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# Essays on Developing Country Vulnerability to External Shocks in Light of the Great Recession

**Dennis Essers**

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# Abstract

This dissertation takes the 2008-2009 global financial and economic crisis or 'Great Recession' as a vantage point to investigate the vulnerability of developing countries to external shocks. It consists of a collection of essays organised around three research questions. One, how was the global crisis transmitted to developing countries, and what do the transmission channels tell us about potential vulnerability-reducing strategies? Two, which factors can explain cross-country heterogeneity in economic growth during the crisis? And three, how did the crisis manifest itself at lower levels in developing countries, beyond its macroeconomic consequences?

First, we document how financial crises and recessions in the US and Europe transformed into a global crisis that hit developing countries as a wave of external shocks, mainly through reduced trade and private capital flows. Vulnerability to such shocks is defined as a combination of the probability and severity of shocks, exposure and resilience, and is shown to be dealt with by strategies of coping, prevention, self-insurance and/or market insurance and hedging. An overview of recent experiences of developing countries and international financial institutions with the above strategies reveals that while important progress has been made, much more remains to be done, especially by and for low-income countries. We zoom in on local currency government bond market development in Sub-Saharan Africa as one example of vulnerability reduction through prevention. Based on a panel data econometric analysis, we find that African local currency government bond market capitalisation relates negatively to fiscal balances and inflation and positively to common law legal origins, institutional quality and democracy. Another strategy we examine in greater detail is that of self-insurance by international reserves accumulation. We formulate and numerically calibrate a representative agent model of a low-income country that has asymmetric access to international capital markets and is faced with terms-of-trade shocks. Our baseline model confirms intuitions about optimal reserves levels being a positive function of shock probability, duration and severity and of the interest benefits (costs) of reserves (market borrowing). An extended model formalises the partial substitution between reserves accumulation and market insurance through a stylised shock-contingent credit line mechanism.

As regards the second theme, we investigate the effect of democracy, a potential factor of resilience, on developing country growth during the crisis. Simple OLS estimations suggest a negative correlation between democracy and crisis growth, seemingly robust to changes in control variables and the country sample as well as alternative democracy or growth measures. However, once endogeneity is accounted for using instrumental variable estimators the negative correlation disappears and gives way to a positive effect of democracy on crisis growth.

Third, we study South African labour market mobility and the determinants of individual-level transitions in and out of employment during the height and aftermath of the global crisis, using two longitudinal datasets. We find large gross flows between different labour market statuses underlying the net increase in South African unemployment rates over 2008-2012 and uncover that the latter should be ascribed more to reduced inflows into employment than to increased outflows. A probit analysis indicates that, above and beyond the influence of other skill-related variables, higher (matric or post-matric) education significantly increased men and women's chances of remaining in or finding regular wage/formal sector jobs. It furthermore appears that higher education's buffer against job loss gradually diminished over the first post-crisis years.

The final chapter of the dissertation distils a number of policy lessons from our findings and sets out avenues for further research.

# Abstract (Nederlandstalig)

Dit proefschrift neemt de globale financiële en economische crisis van 2008-2009, ook wel 'Grote Recessie' genoemd, als uitgangspunt om de kwetsbaarheid van ontwikkelingslanden voor externe schokken te onderzoeken. De essays waaruit het proefschrift bestaat, zijn gebundeld rond drie vragen. Eén, hoe kwam de globale crisis tot uiting in ontwikkelingslanden en wat leren de onderliggende transmissiekanalen ons over mogelijke strategieën om de kwetsbaarheid van dergelijke landen terug te dringen? Twee, welke factoren kunnen verschillen in economische groei tussen ontwikkelingslanden ten tijde van de crisis verklaren? Drie, hoe kwam de crisis tot uiting in ontwikkelingslanden als we verder kijken dan puur macro-economische impact?

Eerst en vooral brengen we in kaart hoe de financiële crisissen en recessies in de Verenigde Staten en Europa uitmondden in een globale crisis die ontwikkelingslanden trof als een golf van externe schokken, vooral via verminderde handels- en private kapitaalstromen. De kwetsbaarheid (*vulnerability*) voor dergelijke schokken wordt gedefinieerd als zijnde een combinatie van de kans op en de ernst van de respectievelijke schokken (*shock probability and severity*), de blootstelling aan schokken (*exposure*) en economische weerbaarheid (*resilience*). We tonen ook aan dat er verschillende strategieën bestaan om deze kwetsbaarheid aan te pakken, met name: beheersing (*coping*), preventie (*prevention*), zelfstandige verzekering (*self-insurance*), en marktverzekering en -afdekking (*market insurance and hedging*). Een overzicht van recente ervaringen van ontwikkelingslanden en internationale financiële instellingen met bovengenoemde strategieën leert dat er, niettegenstaande belangrijke vorderingen, nog heel wat meer kan gedaan worden, in het bijzonder door en voor lage-inkomenslanden. Zo bekijken we in het bijzonder de ontwikkeling van overheidsobligatiemarkten in lokale munt in Sub-Sahara-Afrika, als één specifiek voorbeeld van een preventiestrategie. Op basis van een econometrische analyse van paneldata besluiten we dat de kapitalisatie van Afrikaanse overheidsobligatiemarkten in lokale munt negatief gerelateerd is aan het begrotingssaldo en de inflatie en positief aan een traditie van *common law*, de algemene kwaliteit van instituties en democratie. Een andere strategie die we meer in detail beschouwen, is zelfstandige verzekering door middel van de opbouw van internationale reserves. We formuleren en kalibreren een theoretisch model met een representatieve agent voor een lage-inkomensland dat asymmetrische toegang heeft tot de internationale kapitaalmarkten en onderhevig is aan externe ruilvoetschokken. Ons basismodel bevestigt de intuïtie dat de optimale voorraad reserves een positieve functie is van de kans op, tijdsduur van en ernst van schokken, alsook van de interestopbrengsten (-kosten) verbonden aan reserves (marktleningen). Een uitgebreid model formaliseert de gedeeltelijke substitutie tussen reserveopbouw en marktverzekering bestaande uit een gestileerd mechanisme van schok-afhankelijke kredietlijnen.

Wat betreft het tweede thema onderzoeken we het effect van democratie, een mogelijke factor van weerbaarheid, op de economische groei van ontwikkelingslanden tijdens de crisis. Eenvoudige *OLS* schattingen suggereren een negatieve correlatie tussen democratie en crisisgroei die schijnbaar robuust is voor wijzigingen in controlevariabelen en de bestudeerde landen en ook geldt voor alternatieve maatstaven van democratie of groei. Wanneer er echter gecorrigeerd wordt voor endogeniteit met behulp van instrumentele variabele schatters, verdwijnt dit negatieve verband en maakt het plaats voor een positief effect van democratie op crisisgroei.

Ten derde bestuderen we de Zuid-Afrikaanse arbeidsmarktmobiliteit en de determinanten van bewegingen in en uit tewerkstelling op het individuele niveau tijdens het hoogtepunt en in de

nasleep van de globale crisis, daarbij gebruikmakende van twee longitudinale datasets. We ontdekken dat er achter de nettotoename in de Zuid-Afrikaanse werkloosheidsgraad van 2008 tot 2012 grote (bruto)stromen schuilgaan tussen de verschillende posities die individuen kunnen innemen op (en buiten) de arbeidsmarkt. De werkloosheidstoename over die periode dient bovendien meer toegeschreven te worden aan een terugval in de totale instroom in tewerkstelling dan aan een grotere uitstroom. Een probit analyse geeft aan dat een kwalificatie hoger onderwijs (op het *matric* of *post-matric* niveau) de kansen van zowel mannen als vrouwen om vast werk in loondienst/jobs in de formele sector te behouden of te vinden, significant vergrootte; en dit bovenop de invloed van andere competentie-gerelateerde variabelen. Verder blijkt er, tijdens de eerste jaren volgend op de crisis, een geleidelijke afzwakking te zijn geweest van de buffer die hoger onderwijs biedt tegen jobverlies.

In het laatste hoofdstuk van dit proefschrift vertalen we onze bevindingen naar een aantal beleidsadviezen en zetten we krijtlijnen uit voor verder onderzoek.

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*Vibrations of tremors that shook long ago*
*Tear holes in the fabric of all that we know*

SOHN - 'Tremors', from the homonymous album (2014)

Similarly to the Great Recession itself, which originated from initially small 'tremors' in a poorly understood subsegment of US financial markets, this dissertation started out as a rather vaguely formulated 400-word note (long ago indeed). And, with the risk of sounding too dramatic, like the global financial and economic crisis that turned out to be a highly disruptive force, my PhD research has certainly 'torn holes' in some of the preconceived ideas I myself had about developing countries' integration into the world economy and has changed the way I think about economics and economic policy more generally.

A fascinating study by Paola Giuliano and Antonio Spilimbergo, titled *Growing up in a recession*, finds that individuals who experienced large macroeconomic shocks during their 'impressionable' years, defined as between ages 18 and 25, tend to have significantly and persistently different beliefs and economic and political preferences than those who lived through more stable economic times.[1] I was a little snot of 23 when Lehman brothers collapsed (25 when I embarked on my PhD) and while I was lucky enough to be spared from any direct, material losses from the ensuing global crisis, I do believe this turbulent episode has affected and will continue to shape my worldviews.

Even though I take final responsibility for the content of the current dissertation (including its flaws), starting my PhD, writing it up, and everything in between would have been simply impossible without the support of many. Therefore, I would like to take this opportunity to express my immense gratitude to those who brought me here, just before the finish line.

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[1] Giuliano, P., and Spilimbergo, A. (2014). Growing up in a recession. *Review of Economic Studies*, 81(2), 787-817.

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respect, I am also thankful to your horses Wikke and Fay for keeping you busy when I could not. Martine, you were there to listen to my nerdy research stories, and whereas I am quite convinced your own interests lie elsewhere, I have always felt heard and understood. Finally, you have almost single-handedly taken care of our household and made sure I was (more than) fully fed and clothed (phew!) during the final stages of dissertation writing. Although I must say your cooking skills have undeniably benefited from my PhD and strongly encourage you to progress further along this road, I promise to also spend more time with pots and pans myself and to be a better hubby overall. Because you deserve it, sjoe. I dedicate this volume to you.

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# Chapter 1

# Introduction

*I'm glad that this time we did not cause it*

Guillermo Ortiz, Governor of the Central Bank of Mexico
World Economic Forum Annual Meeting at Davos, January 25th, 2008

## 1. Context and motivation

The now almost seven years since the collapse of Lehman Brothers have seen a long chain of remarkable events, including massive fiscal stimulus packages, bailouts of some of the world's largest financial institutions, previously unthinkable monetary experiments and the first IMF-supported adjustment programmes in advanced economies since the 1980s; as well as a whole alphabet soup to go with it: from MBS, CDO, CDS, ABCP, SIV and TBTF to TARP, LTRO, ZIRP, QE, OMT and ESM. The legacies of the global financial and economic crisis are still clearly visible today and many uncertainties remain, particularly in Europe. Whereas recent economic performance has been more robust in developing countries, this should not detract from the fact that many of them, too, were strongly affected by a crisis which, in retrospect, has been labelled the 'Great Recession'. In 2008 and especially 2009, economic growth slowed down markedly in the large majority of developing countries, prompting (mostly expansionary) changes in fiscal and monetary policies. Likewise, several emerging market and low-income countries needed to turn to the IMF for financial assistance.

Unsurprisingly, the Great Recession has spawned a multitude of debates and an enormous literature, mainly focused on the advanced economies that were at its centre stage, but also on the future growth and development paths of developing countries. One recurrent argument in these debates, alluded to by many commentators (not only country officials like Guillermo Ortiz but also academics and international organisation staff), is that developing countries were, by and large, 'innocent bystanders' during the Great Recession, unlike in most previous financial and economic crises with global implications. Indeed, as we will argue in this dissertation, financial sector troubles and the resulting recessions in the US and Europe spread to the developing world under the form of external shocks, including steep declines in the demand for developing country exports and sudden stops in private capital inflows. The vulnerability of developing countries to such external shocks is certainly not a new phenomenon, but the global crisis has revived attention to it. Devising sensible strategies to deal with vulnerability to future external shocks is expected to move higher up policymakers' agendas as developing countries, and low-income countries in particular, continue to integrate into the global economy.

## 2. Research objectives, design and limitations

This dissertation takes the Great Recession as a vantage point to investigate the vulnerability of developing countries to external shocks. Our research is grounded in the following three questions:

(1) What were the main transmission channels of the 2008-2009 global financial and economic crisis from its epicentre in the US and Europe to developing countries? And how could developing countries and international financial institutions (have) reduce(d) vulnerability to such external shocks?

(2) Which factors explain the observed cross-country heterogeneity in the economic growth of developing countries during the global crisis?

(3) Beyond its macroeconomic consequences, how did the global crisis manifest itself at lower echelons and, ultimately, the individual level in developing countries?

Arguably, one could dedicate a lifetime of research to this broad set of questions. This dissertation is therefore very selective in its treatment of the mentioned themes. We attempt to identify and fill a number of gaps in the existing literature on developing countries' experiences of the crisis and on their vulnerability to external shocks more generally. Or, to put it more graphically, we aim at plugging a few holes in a giant Swiss cheese; which is perhaps not that unusual an objective for a PhD project. As such, and as its title suggests, the dissertation should be read as a collection of interconnected but relatively self-contained essays rather than as a monograph with a single, overarching and progressively elaborated line of argument. The first essay (Chapter 2), which has a much wider scope than the rest of the dissertation, contains a number of pointers to the other essays or chapters, so as to help the reader situate them in the broader context of the global crisis and developing countries' vulnerability to external shocks.

In view of the just-described set-up and throughout the various chapters, the dissertation will draw on different subfields of economics and apply different research methodologies to different samples of developing countries. First, whereas the general topic and most of the content of the dissertation fall under the umbrella of international economics and finance, we bring in perspectives from political economy (Chapter 5) and labour economics (Chapter 6) too, where we feel these dimensions have been relatively neglected in the literature. Second, we mix a more narrative, descriptive approach (Chapter 2) with econometrics (Chapters 3, 5 and 6) and some theoretical modelling (Chapter 4). And third, similarly driven by our goal of contributing to the literature as well as by data availability, we vary our sample from all 'non-advanced', developing countries, including large emerging market economies, (Chapters 2 and 5) over the subset of low-income countries (Chapter 4) and Sub-Saharan Africa (Chapter 3), to a case study of a single emerging market economy, i.e., South Africa (Chapter 6).[1]

A number of further limitations and important caveats are worth mentioning in advance. First of all, this dissertation does not engage in a fully comprehensive overview of or larger critical debates about the deeper roots and underlying forces of the crisis. We feel there is already an

[1] Our classification of developing countries into low-income and emerging market (or middle-income) economies is not uniformly applied across the chapters of the dissertation, but mainly depends on the sources of data used and the time at which each of the individual chapters was written. For example, in Chapter 2 we follow the IMF's new 2014 'low-income developing country' classification to group countries, whereas in Chapter 4 low-income countries are defined as 'IDA-only', in line with World Bank classifications. In Chapter 5 we start from the IMF's WEO 'emerging and developing countries' aggregate to construct our sample, but then combine it with the World Bank's income-level cut-offs.

overload of books and other materials available that endeavour to do just that.[2] We limit ourselves to a short and highly stylised description of how the crisis unfolded, from the first symptoms of systemic problems in US housing and mortgage markets in the summer of 2007 up to the Lehman bankruptcy in the fall of 2008 and ensuing advanced country recessions (see Chapter 2). We believe this is sufficient to make our point that developing countries experienced the global crisis as a wave of shocks that was largely exogenous to them.[3] Second, our focus will be on the most acute phase of the crisis, the years 2008-2009, which is commonly referred to as the 'Great Recession'; a term which will be used interchangeably with 'global financial and economic crisis' (or simply 'global crisis') throughout the dissertation.[4] It is this particular period that was marked by a globally synchronised collapse in output, much more so than the crisis offshoots in Europe (see Abiad *et al.*, 2013). An in-depth analysis of post-crisis recovery and the consequences of the (ongoing) Eurozone crisis for developing countries falls outside the scope of the dissertation. Lastly, the essays bundled in this dissertation will provide only partial answers, even to the better-delineated research questions we put forward in the various chapters. Some of our answers also generate new questions and hypotheses to test. We will set out avenues for further study at the end of each individual essay and in the closing chapter.

## 3. Overall structure

The remainder of this dissertation is organised into six chapters: five essays and a general conclusion.

**Chapter 2** deals with research question (1) and introduces the conceptual framework around which the dissertation is largely built. We first show how the 2008-2009 global crisis epitomises developing countries' vulnerability to external shocks, by describing the origins and different transmission channels of the crisis. Next, we offer improved definitions of such (output) vulnerability and its main building blocks, i.e., the *probability and severity of shocks*, *exposure* and *resilience*. This conceptualisation allows us to better understand and comment on existing vulnerability measurement efforts by the IMF and others and, after connecting it to the work of Perry (2009), can be used to classify and evaluate different strategies of dealing with output vulnerability: *coping*, *prevention*, *self-insurance*, and *market insurance and hedging*. We argue that these four strategies all have particular advantages as well as important drawbacks and plea for a multi-layered approach

[2] Financial analyst Gary Katz maintains a website that keeps track of academic and popular books on the origins and drivers of the global financial and economic crisis. He lists nearly 400 books published between June 2007 and June 2015. See http://investorhome.com/crisisbooks.htm. Books that have been influential in shaping our own conceptualisation of the crisis include Rajan (2010), Roubini and Mihm (2010), Stiglitz (2010), Johnson and Kwak (2011) and Blinder (2013); as well as the historical accounts by Ferguson (2009) and Reinhart and Rogoff (2009). Two very insightful (and entertaining) 'insider' stories are Tett (2009) and Lewis (2010).

[3] Hard-headed supporters of the 'global savings glut' view might disagree (see Bernanke, 2005).

[4] The term 'Great Recession' is not defined unambiguously in the literature; its meaning and exact dating depend on the (output and other) measures considered for identification and on one's geographical scope. We use it here to refer to the years 2008-2009 for a number of reasons. First, although global GDP did not decline over 2008 as a whole, the last two quarters of 2008 saw many advanced and emerging market economies (that report quarterly GDP data) experience negative growth. Second, 2008 was also the year when the transmission of the financial and economic crises in the US and Europe to most developing countries became visible, through various channels (see Chapter 2). Third, 2009 has been identified by the IMF (2009, pp. 11-14) as the first year of 'global recession' since 1991 and, by far, the deepest and most synchronised in post-war history, based on the decline in world real GDP per capita and corroborated by various other measures of global activity.

that combines different vulnerability-reducing strategies, pays attention to the short and longer term, is mindful of country specifics, and involves both developing countries themselves and international financial institutions. The chapter then provides a bird's-eye overview of how vulnerability to external shocks has been dealt with in practice, concentrating on the years leading up to and of the global crisis. This first, non-exhaustive exploration of developing countries' and international financial institutions' experiences with different interventions and instruments suggests that important progress has been made in a number of areas, notably in coping and self-insurance, but also that much more remains to be done, especially by and for low-income countries.

**Chapter 3** also addresses part of question (1), by zooming in on one key preventive strategy that reduces developing countries' exposure to external shocks, i.e., the development of local currency bond markets (cf. Chapter 2). Our focus is on Sub-Saharan Africa, a region whose progress in the development of such markets has been largely ignored in the literature. Based on detailed information hand-collected from various sources, we construct a cross-country comparable picture of the current state of local currency bond markets in Sub-Saharan Africa. This exercise reveals that quite a number of African governments are now able to issue fixed-rate bonds with tenors of ten years and more and that the local non-bank institutional investor base is growing. Conversely, we also find that African bond markets are generally marked by low liquidity, very few corporate bonds and, still, a dominance of local commercial bank investors. We then perform an econometric analysis of a novel OECD-collected panel dataset on local currency government bond market capitalisation in selected African countries. The results indicate that this capitalisation relates negatively to governments' fiscal balance and inflation, and positively to common law legal origins, overall institutional quality and democracy.

In **Chapter 4** we turn to international reserves hoarding, which, as a strategy of self-insurance, increases developing countries' resilience against the external shocks they are exposed to (cf. Chapter 2). We extend the work of Barnichon (2009) in building a dynamic, two-good, small open economy model to evaluate the optimal level of reserves in a low-income country faced with terms-of-trade shocks. First, we relax Barnichon's assumption that the low-income country in question always has a positive net foreign assets position and instead assume a differentiated interest rate, low on positive net foreign assets (reserves) and high on negative net foreign assets (market borrowing). Numerical calibrations using value function iteration techniques demonstrate that our baseline model generates optimal net foreign assets that are smaller than in Barnichon (2009) but generally still positive (under most parameterisations). Intuitions about the optimal level of reserves being a positive function of the probability, duration and severity of shocks, and of the interest benefits (costs) of positive (negative) net foreign assets, are also confirmed. Second, we complement the baseline model with a stylised contingent credit line mechanism, one of the market insurance-like instruments discussed in Chapter 2. We assume that a subsidised loan, proportional in size to the balance-of-payments impact of terms-of-trade shocks, is automatically disbursed to the low-income country when hit by a shock. Additional calibrations suggest a partial substitution between optimal reserves and such shock-contingent loans, whose strength increases with larger coverage of the shock impact by the contingent loans, lower interest rates on the loans, and longer repayment periods.

**Chapter 5** connects to research question (2). It contributes to a recent body of empirical cross-country studies that have sought to explain economic growth heterogeneity during the global crisis. In particular, we attempt to evaluate the effect of democracy on developing countries' 'unexpected crisis growth', i.e., the difference between observed real GDP per capita growth in crisis

year 2009 and the IMF's pre-crisis forecast of 2009 growth. Political institutions have been overlooked by the existing literature on the global crisis as a potential factor of resilience. In theory, democracy could be either growth-retarding or -enhancing in times of economic turbulence. But most previous empirical research on the role of political institutions in the management of external shocks and crises (of different kinds), seems to suggest that democracy is helpful in overcoming shocks and keeping up growth. Based on a large sample of developing countries and controlling for macroeconomic, financial and standard institutional factors and pre-crisis trends, we find that democracy is *negatively* correlated with crisis growth, a result that is surprisingly robust to changes in the set of control variables, country sample and measures of crisis growth or democracy. However, once we control for endogeneity using instrumental variable estimators, the negative correlation between democracy and crisis growth disappears and, in our preferred specifications, turns *positive*. Strict causality remains hard to establish and additional research is needed to identify the mechanisms underlying our results.

In **Chapter 6** we look beyond growth and other macroeconomic consequences, at the lower-tier manifestations of the global crisis, in line with research question (3). The case study we select is that of South African labour markets, where unemployment rates, which were already structurally high before the crisis, further increased between 2008 and 2012. Two nationally representative longitudinal datasets are used to examine individual-level labour market transitions since the start of the global crisis. We do not attempt, however, to assess the *impact* of the crisis on South African labour markets and its participants; attribution would be very difficult with the data at hand. Based on transition matrices we uncover considerable mobility in South African labour markets, with large gross flows in and out of employment and between different forms of employment and non-employment, both in the short and medium run. The evidence further shows that overall labour market mobility decreased from 2008 up to 2012, and that the observed increase in South African unemployment rates should be ascribed more to reduced inflows into employment than to increased outflows. An econometric analysis of the determinants of transitions in and out of regular wage and formal sector jobs suggests that both deliberate individual and household choices and external circumstances played a role. The latter is evidenced by the significant impact of several skill-related variables on the likelihood of an individual remaining in or finding employment. Above all, we find that higher educational attainment, i.e., a matric or post-matric level qualification, reduced the chances of job loss and increased job finding prospects in South Africa. Comparing the economic significance of labour market transition correlates over time, it seems that higher education's buffering effects gradually diminished over the first post-crisis years.

**Chapter 7**, the concluding chapter of this dissertation, rounds up the most important findings of the PhD project, suggests avenues for future research and formulates a number of policy recommendations.

## References

Abiad, A., Furceri, D., Kalemli-Ozcan, S., and Pescatori, A. (2013). Dancing together? Spillovers, common shocks, and the role of financial and trade linkages. In: IMF (Ed.), *World Economic Outlook October 2013: Transitions and tensions* (pp. 81-111). Washington, DC: IMF.

Barnichon, R. (2009). The optimal level of reserves for low-income countries: Self-insurance against external shocks. *IMF Staff Papers*, 56(4), 852-875.

Bernanke, B. (2005). The global savings glut and the U.S. current account deficit. Speech delivered at the Sandridge Lecture, Virginia Association of Economics, Richmond, VA, 10 March.

Blinder, A. S. (2013). *After the music stopped: The financial crisis, the response, and the work ahead*. New York, NY: Penguin Press.

Ferguson, N. (2009). *The ascent of money: A financial history of the world*. London: Penguin Books.

IMF. (2009). *World Economic Outlook April 2009: Crisis and recovery*. Washington, DC: IMF.

Johnson, S., and Kwak, J. (2011). *13 bankers: The Wall Street takeover and the next financial meltdown*. New York, NY: Vintage Books.

Lewis, M. (2010). *The big short: Inside the doomsday machine*. London: Allen Lane.

Perry, G. (2009). *Beyond lending: How multilateral banks can help developing countries manage volatility*. Washington, DC: Center for Global Development.

Rajan, R. G. (2010). *Fault lines: How hidden fractures still threaten the world economy*. Princeton, NJ: Princeton University Press.

Reinhart, C. M., and Rogoff, K. S. (2009). *This time is different: Eight centuries of financial folly*. Princeton, NJ: Princeton University Press.

Roubini, N., and Mihm, S. (2010). *Crisis economics: A crash course in the future of finance*. London: Allen Lane.

Stiglitz, J. E. (2010). *Freefall: America, free markets, and the sinking of the world economy*. New York, NY: W.W. Norton & Company.

Tett, G. (2009). *Fool's gold: How unrestrained greed corrupted a dream, shattered global markets and unleashed a catastrophe*. London: Little, Brown.

# Chapter 2

# Developing country vulnerability to external shocks


## Abstract

This paper adopts a vulnerability perspective to look into some of the key issues for developing countries raised by the global financial and economic crisis of 2008-2009. We contend that developing countries' output vulnerability to external shocks, which is a function of the *probability and severity of shocks*, *exposure* and *resilience*, matters for future growth and development paths. However, different ways of dealing with such vulnerability all have their particular advantages as well as downsides. First, *coping* with the aftermath of shocks can be painful and is inherently backward-looking. Second, *prevention* by reducing exposure is typically a longer-term process. Third, increasing resilience through *self-insurance* often carries high opportunity costs. And fourth, *market insurance and hedging* may suffer from political economy problems and is largely unavailable to countries that would benefit most. Hence we argue for a multi-layered approach, combining different vulnerability-reducing strategies with attention to the short and longer term, mindful of country specifics and with roles to play for both developing countries themselves and international financial institutions. A tentative exploration of how vulnerability has been dealt with before and during the crisis suggests that, in some areas, important progress has been made. Nevertheless, and particularly for low-income countries, there is still a long way to go.



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## 1. Introduction

The world economy has taken a rough ride over the past years, with 2009 seeing the deepest decline of global GDP in post-war history (IMF, 2009d). Not only advanced economies, which were at the crisis epicentre, but also developing countries have borne the brunt of the so-called 'Great Recession', in terms of lower economic growth and welfare. Back-of-the-envelope calculations by the World Bank (2010), for example, suggest that the crisis had added as much as 64 million to the number of people living on less than US$1.25 a day by the end of 2010, relative to a no-crisis scenario. Economic recovery was initially relatively quick in the developing world but later stalled as weak growth in advanced countries dragged on.

A huge and still growing volume of academic and policy work is testimony to the diversity and complexity of debates the crisis has spawned, also with respect to future growth and development paths. This paper seeks to systemise some of the key issues for developing countries raised by the crisis. We will argue that the global crisis epitomises developing countries' vulnerability to external shocks. Such vulnerability is certainly not a new phenomenon, but is likely to gain further importance for developing countries as they continue to integrate into the global economy.

We believe the paper's contribution is twofold. First, we propose an improved conceptualisation of developing country output vulnerability to shocks which, we believe, is helpful for understanding (and refining) existing vulnerability measurement efforts and for classifying and evaluating different strategies of dealing with such vulnerability. Second, we provide a broad overview of the progress made (before and during the crisis), as well as remaining problems, with respect to a number of vulnerability-reducing interventions and instruments. Most of these interventions and instruments have received renewed attention in the wake of the crisis, but have been studied largely in isolation. We demonstrate, however, that the fight against vulnerability is one on multiple fronts and with roles for both developing countries themselves and international financial institutions.

The structure of the paper is as follows. Section 2 sets the scene by looking into the origins, evolution and multi-dimensional character of the global financial and economic crisis. Special attention is given to the main transmission channels of the crisis from the US and other advanced economies to developing countries. Section 3 constitutes the core of the paper. It starts by clarifying the concept of output vulnerability and its different building blocks: the probability and severity of shocks, exposure and resilience. In a second subsection we briefly dwell on the efforts that have been made in measuring vulnerability, and where such efforts could be enhanced. Third, we explain why output vulnerability to external shocks matters for future growth and development. A fourth subsection connects our concept of vulnerability to the work of Perry (2009) to come up with a four-category classification of possible strategies to deal with vulnerability: coping, prevention, self-insurance, and market insurance and hedging. We contend that each of these four strategies has advantages as well as downsides and that a multi-layered approach is warranted. Section 4 illustrates the practical use of the proposed framework by exploring, in a non-exhaustive manner, how vulnerability has been dealt with in practice prior to and during the crisis, first by developing countries themselves and second by multilateral development banks and the IMF. Our overview suggests that, in some areas, important progress has been made. Nevertheless, and particularly for low-income countries, there is still a long way to go. Section 5 concludes and proposes a tentative agenda for moving forward.

## 2. A global crisis: Origins and transmission

To many observers the global financial and ensuing economic crisis was a 'black swan'; a rare, extreme-impact event that was predictable in retrospect but not, or unlikely, in advance (Taleb, 2010). Indeed, only a few Cassandras saw some sort of storm coming and, when things got underway, almost no one expected them to turn out as fiercely as they did.[1] With answers to the 'how' and 'why' of the crisis not readily available, a seemingly endless number of books, papers, articles and op-eds have dissected the chain of events that led up to the collapse of Lehman Brothers and far beyond, in an attempt to identify the origins and key causes of the global crisis. Often analysts have come to very different or even outright conflicting conclusions. Most would probably agree, however, that the global crisis reflected a 'remarkable confluence of factors', some akin to those in previous periods of financial upheaval but other largely unseen before (Claessens *et al.*, 2010, p. 4). We will not attempt to make a detailed list or give a judgment on the importance of different contributing factors, involved parties and deeper roots. As Stiglitz (2009) aptly notes, every crime has its principals, accomplices and accessories. Picking out the main villains is a tedious, if not impossible task. Rather, the following two sections present a brief (and inevitably, incomplete and simplified) overview of how problems in the US housing market contaminated the wider financial sector and real economy and eventually impacted on developing countries through various channels of transmission.

### 2.1. Where did it all start?[2]

Virtually all accounts of the global financial crisis point to the bursting of the US housing bubble and the subsequent increase in subprime mortgage loan default rates as the triggering event. In the years before the crisis, housing prices were rising rapidly in the US (and several other advanced economies), causing and fuelled by an equally fast expansion of lending to subprime borrowers, people with no reliable source of income or solid loan repayment history. Mortgage brokers, banks and other financial institutions engaged in a process of pooling these subprime mortgages, sometimes together with other loans and assets, into packages (such as collateralised debt obligations (CDOs) or other, more complex structured financial products) and selling securities backed by those packages, or typically tranches thereof, to various interested financial investors. Rating agencies generally awarded the securities backed by the most senior of such tranches (that would continue to yield income until all other tranches had been wiped out by non-performance of the underlying mortgages) with triple-A ratings. This meant a wide range of investors could be tapped, including for example foreign pension funds. Buyers of asset-backed securities were moreover able to insure themselves by purchasing credit default swaps (CDSs) that would compensate them in the event of default of a particular tranche. All in all, highly rated asset-backed securities seemed liked a good investment, especially in the low-interest rate environment at the time. Meanwhile, a 'shadow' banking system emerged, in which off-balance-sheet investment vehicles of commercial banks borrowed short-term in the money market to finance the purchase of longer-term assets, such as mortgages. These off-balance-sheet structures allowed banks to invest in

[1] Of course, Caballero (2010, p. 85) also has a point in arguing that '[it] is almost tautological that severe crises are essentially unpredictable, for otherwise they would not cause such a high degree of distress'.

[2] This section draws liberally from Baily *et al.* (2008), Brunnermeier (2009), Acharya and Richardson (2009), Claessens *et al.* (2010), Gorton (2012) and Blinder (2013).

mortgages and other assets (which they could hold on to, sell to other parties, or process into structured products), while circumventing minimum capital regulations. Ultimately, however, the commercial banks themselves, which provided guarantees to these structures, remained exposed to the maturity risk. Similarly, investment banks increasingly turned to short-term (often overnight) repurchase agreements (so-called repos), collateralised by all sorts of assets, to fund their balance sheets. These developments were accompanied by a huge increase in leverage in the financial sector.

The 'originate-to-distribute' banking model was initially thought to help off-loading risk to those who were willing and best-placed to bear it. However, banks were among the most active buyers of the structured products they and others created, in part because of the low capital requirements and relatively high premiums attached to them. Securitisation practices, which had already existed for a long time but changed dramatically in scope and complexity, exacerbated agency problems by further delinking borrowers and lenders and increased the opaqueness of the financial system by masking the risks faced by different market participants. Moreover, the growing popularity of the securitisation of subprime mortgage loans increased the origination of such mortgages and pushed up the price of the underlying real estate. This in turn led to more and cheaper credit (and therefore rising household debts) and deteriorating lending standards, feeding back into ever-appreciating housing prices and a growing supply of new mortgages.

This positive, self-reinforcing loop came to a halt early 2007 when subprime mortgage default rates started to increase noticeably; it turned into a vicious cycle soon thereafter. In July 2007, US investment bank Bearn Stearns disclosed that two of its hedge funds had lost almost their entire value because of the fast-declining market for subprime mortgages and German bank IKB announced similar problems with one of its conduits. In August 2007, BNP Paribas, a large French bank, suspended redemptions for three of its investment funds due to subprime-related losses. Events like these undermined the confidence of financial institutions in counterparties and led to a drying up of liquidity in interbank, commercial paper and repo markets. 'Shadow' banks, which had relied on these markets to fund themselves, started to experience what increasingly looked like bank runs. Mid September 2007 UK bank Northern Rock asked for liquidity support from the Bank of England and saw worried customers queuing outside its branches to withdraw their money. The US Federal Reserve, European Central Bank and other major central banks reacted by making available increasingly large and flexible credit lines to commercial banks, but this calmed markets only temporarily. There continued to be serious questions about the viability of internationally active banks and other financial institutions, such as monoline insurers and CDS providers. The end of 2007 and beginning of 2008 saw a long series of large write-downs by banks in an attempt to clean their books. In March 2008, Bear Stearns, the smallest but most leveraged of Wall Street's top-five investment banks (and heavily concentrated in mortgage finance), was absorbed by JP Morgan Chase for a fire-sale price; a deal brokered by the Federal Reserve and supported by an additional US$30 billion loan through its New York division. This operation, together with further interest rate cuts by the Federal Reserve, brought some relief to interbank and stock markets. On the other hand, the problems with declining housing prices, rising foreclosure and mortgage delinquencies worsened, driving the two main US government-sponsored enterprises for mortgage securitisation, Fannie Mae and Freddie Mac, into government conservatorship.

In the fall of 2008 the crisis entered a new, critical phase. Lehman Brothers, the fourth largest US investment bank, had heavily invested in derivatives linked to (commercial) real estate, and in the months following the Bear Stearns takeover it grabbed the attention of investors as well as speculators who seriously doubted its chances of survival. On September 15$^{th}$, after a failed attempt

to marry it to UK bank Barclays and after the US Treasury and Federal Reserve refused to step in with taxpayer money, Lehman Brothers filed for bankruptcy. The collapse of Lehman, and perhaps even more so the US government decision not to save it, shocked market confidence and rippled throughout a highly interconnected and leveraged global financial system. The day after the Lehman bankruptcy, the Federal Reserve bailed out the insurance company AIG, a major player in the CDS market with numerous counterparties, and established a new liquidity facility to stop a run on money market funds. Liquidity problems had transformed into greater solvency concerns about systemically important financial institutions, and over the following weeks a record number of bailouts and guarantees were staged in the US and much of Europe.

As is usually the case with severe financial crises, the problems did not stop at the borders of the financial sector; there were also severe macroeconomic repercussions. In the US, and soon thereafter in other advanced countries experiencing financial crises, economic activity and employment plummeted in the aftermath of the Lehman debacle. The massive declines in housing prices, destruction of financial wealth and huge debts induced consumers to cut back on their spending. At the same time, with commercial banks struggling to survive or nationalised, credit dried up or, where still available, became much more expensive. The credit crunch and reduced consumer demand forced (non-financial) firms to postpone their investments, downscale their activities or, in many cases, shut down completely. This led to more layoffs and less hiring. Greater unemployment translated into even lower consumption levels and output, which further depressed the demand for labour. According to the National Bureau of Economic Research (NBER), US economic activity peaked in December 2007. The largest decline in output was however observed in 2008Q4, when real GDP dropped by an annualised rate of almost 9%. Only in 2009Q2 the US economy bottomed out and began its slow recovery. Also US net (payroll) employment losses, which started in February 2008 according to the US Bureau of Labor Statistics, peaked between 2008Q4 and 2009Q2. However, it took until January 2010 before total employment started to grow again in the US and only in April 2014 it surpassed its January 2008 peak. Similar negative loops between consumption, output and employment operated in many other advanced economies in Europe, often with equally dire (or worse) outcomes. A global economic crisis, later termed the 'Great Recession', was born.

### 2.2. How was the crisis transmitted to developing countries?

Developing countries, especially low-income countries, were long thought to be more or less decoupled from the US and Western European economies (see e.g., the discussion in IMF, 2007). Even more than a year after the onset of US financial sector troubles it was commonly believed that 'some of the same (undesirable) factors that have kept a significant share of the developing world's population in deep and persistent poverty...[would] protect them to some degree from the crisis' (Development Research Group, 2008, p. 2).[3] These hopes turned out to be overly optimistic, especially after the collapse of Lehman Brothers, as witnessed by the IMF and World Bank's stepwise downward revisions of developing country growth (Naudé, 2009a).

Figure 1 presents the post-2000 evolution of average and median annual real GDP growth for developing country groups and different regions, calculated from the IMF World Economic Outlook (WEO) database. We classify as low-income developing countries the 60 countries that are

[3] Expressions such as 'Lagos is not Lehman', quoted in te Velde (2008), are exemplary of such beliefs.

designated as such according to the IMF's 2014 standardised definition.[4] Emerging markets are the remaining 94 countries found in the WEO's 'emerging market and developing countries' aggregate. Average growth rates are weighted using countries' share of world GDP in purchasing power parity (PPP) terms. Panel (a) of Figure 1 indicates that average emerging market country growth dropped significantly during the crisis: from 8.7% in 2007, over 5.8% in 2008, to 2.9% in 2009; a decline comparable to that of average advanced economy growth (which fell from 2.8% to -3.4% over 2007-2009).[5] Average low-income country growth was indeed much less affected, but nonetheless declined from 7.5% in 2007 to 6% in 2009 and reached new lows in 2011 and 2012 as the world economy continued to be sluggish. These (changes in) weighted averages are, however, skewed upwards by the relatively good performance of larger economies (such as emerging markets China, India and Indonesia; and Nigeria, Bangladesh and Vietnam in the low-income group) and hide substantial between-country variation. Panels (b) and (c) show that the 2007-2009 declines in median real GDP growth of low-income and emerging market economies were steeper than the drops in average growth. The variety of economic trajectories is evident from the interquartile ranges of real GDP growth, plotted as grey bands in Figure 1. From Panel (c), for example, we observe that a quarter of all emerging market countries saw their economy shrink by 4% or more in 2009.

Panels (d) to (i) of Figure 1 exhibit large regional differences in developing country growth during the crisis.[6] Clearly, the impact on growth was largest in Emerging and Developing Europe (EMDE), which consists of countries located in Central, Eastern and South Eastern Europe, and for Commonwealth of Independent States (CIS) countries, all former Soviet republics. In the EMDE cluster declines in average and median GDP growth were 9 and 11 percentage points, respectively, between 2007 and 2009. The collapse in average growth rates was even more spectacular in the CIS group: more than 15 percentage points, largely driven by Russia. But even within these regional clusters the growth impact of the crisis varied strongly from country to country. Lithuania (EMDE) saw its GDP growth drop from 9.8% in 2007 to -14.8% in 2009, whereas in Albania (also EMDE) economic growth budged far less, from 5.9% to 3.4%. Armenia, whose growth rate plunged almost 28 percentage points over 2007-2009, does not compare to Uzbekistan (both CIS). Looking at growth in the other regions, Latin America and Caribbean (LAC) countries also seem to have been relatively much affected; Venezuela and Paraguay were among the hardest hit in the region, but also Brazilian, Mexican and Argentinean growth suffered significantly. In the Middle East and North Africa (MENA), Sub-Saharan Africa (SSA) and, especially, Emerging and Developing Asia (EMDA) growth was relatively spared. This general trend should however not detract from the fact that countries such as Kuwait, Pakistan (MENA), Angola, Botswana, the Seychelles (SSA), Mongolia, Malaysia and Cambodia (EMDA) did experience large swings in growth rates (and often negative growth) during the crisis years.

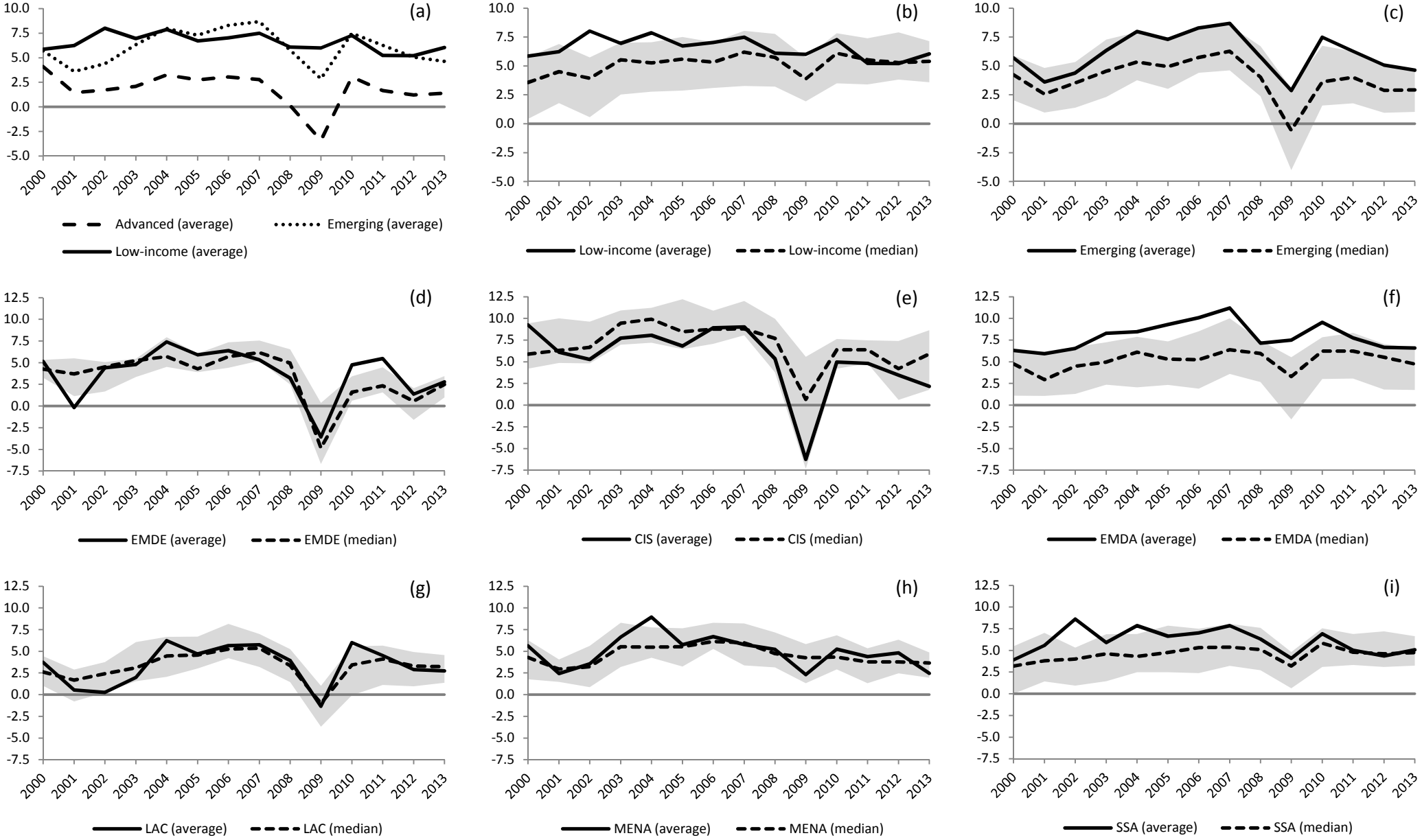
[4] This definition is based on eligibility for the IMF's concessional Poverty Reduction and Growth Trust (PRGT) and per capita GNI levels. For more details, see IMF (2014b). It should be noted that this IMF classification of countries differs in some respects from that of the World Bank.

[5] 2007 may not necessarily be the best comparator (counterfactual) for crisis years 2008 and 2009, as some countries experienced exceptional booms in 2007, driven by high commodity prices and abundant international and domestic credit. Alternative comparisons could be made by looking at trend growth (or pre-crisis growth forecasts). As can be seen from the different panels of Figure 1, (average/median) growth in 2009 was generally well below (average/median) growth over 2000-2007.

[6] Our regional classification is based on that of the October 2014 edition of the IMF WEO.

*Figure 1. Weighted average and median real GDP growth by country group and region, 2000-2013: y-o-y change (%)*

Source: Calculated from IMF WEO.



In spite of the differences between low-income and emerging market country groups and the regional and country-level diversity in growth we have just documented, the overall picture that emerges from Figure 1 is one of sharply slowing growth in the developing world during the crisis and a fairly modest recovery thereafter, which seems to dispel the decoupling myth. Thus the question that arises logically: how did the tide turn so virulently on developing countries?

The transmission of the crisis from its epicentre in the US and Europe to the rest of the globe is again the subject of a vast literature.[7] One obvious way the crisis could possibly spread to the developing world was through the holding by developing country banks of the same impaired assets that troubled Western banks' balance sheets, or through close ties with foreign financial institutions that held such assets (Naudé, 2009b). Direct contagion was however very limited; due to low domestic financial sector complexity and modest foreign bank penetration in most developing countries, with the exception of a number of SSA, EMDE and CIS countries where the presence of foreign banks was large and had been growing rapidly prior to the crisis (Claessens and Van Horen, 2014). Laeven and Valencia (2013) count only six systemic banking crises (based on criteria of financial distress and policy interventions in the banking sector) in developing countries between 2007 and 2011: Russia, Kazakhstan, Ukraine, Hungary, Mongolia and Nigeria; compared to 19 banking crises in the much smaller group of advanced economies. Moreover, at first glance, only in Hungary was the domestic banking crisis directly related to links with Western European banks (Banai *et al.*, 2010). As a result, developing countries were largely insulated from the crisis for some months, in part explaining initial optimism about decoupling (Dooley and Hutchison, 2009).

The far-reaching consequences of the crisis for these countries only became noticeable with a lag, from September 2008 onwards, after the Lehman bankruptcy and when both the US and large parts of Europe were already mired in severe economic recessions. The literature seems to identify four broad, more indirect channels of crisis transmission as most important for developing countries: trade, private capital flows, remittances and bilateral aid. In the remainder of this section we briefly discuss each of these channels in turn.

### *2.2.1. Trade*

An important driver of growth in developing countries, trade is overall considered as the number one channel of crisis transmission for many of them (see e.g., the case studies in ODI, 2010). As global demand slumped because of postponed consumption and investment in advanced economies, international trade did so too, before abruptly collapsing late 2008. According to various sources, the fall in world trade between 2008Q3 and 2009Q2 was the steepest in recorded history (and deepest since world war II), which earned it the label of the 'Great Trade Collapse' (Baldwin, 2009). The World Bank (2010) reports that the US$ value of world trade dropped about 31% between August 2008 and March 2009. In spite of the rapid recovery thereafter, the decline in trade over the whole of 2009 was much greater than that of world GDP. Freund (2009) shows that the elasticity of global trade to income has steadily increased over time and is typically larger during global downturns than in normal times. Baldwin (2009) explains that part of the divergence between evolutions in GDP and

[7] Early accounts include, among many others, Lin (2008), te Velde (2008), IDS (2008) and Naudé (2009b). For more comprehensive studies, often with ample empirical evidence, see e.g., ODI (2009), ODI (2010), IMF (2009b), World Bank (2009b), Mold *et al.* (2009) and Griffith-Jones and Ocampo (2009); and for regional perspectives, see e.g., Goldstein and Xie (2009), Caparas *et al.* (2008), Swiston (2010), Kasekende *et al.* (2009), EUI (2009) and Allen and Giovannetti (2011).

trade is due to the fact that postponable goods such as consumer durables and investment goods, which suffered especially hard from growing risk aversion and deleveraging in the West, account for a much larger share of world trade than of world GDP (which includes non-tradables).[8] Moreover, because of the highly fragmented nature of modern global production chains, the same drop in value-added now implies a much larger and more synchronised reduction in gross cross-border exchanges than a few decades back (see also Cheung and Guichard, 2009). Because of the financial sector origins of the Great Recession one could also expect a freeze in trade financing (such as letters of credit or export insurance) to have contributed to the global trade collapse (Dorsey, 2009). In line with this (supply-side) hypothesis, Chor and Manova (2012) find that countries with tighter domestic credit conditions exported less to the US during the peak of the crisis, especially if their exports were concentrated in financially vulnerable sectors. Other studies, however, seem to downplay the importance of trade financing constraints (ODI, 2010; Asmundson *et al.*, 2011). Also, in sharp contrast to the Great Depression of the 1930s, an increase in protectionism, by means of increased tariffs or other trade barriers, was largely avoided during the Great Recession (Eaton *et al.*, 2011; Kee *et al.*, 2013).

Haddad *et al.* (2010) decompose the fall in product- and trading partner-level import values from the US, the European Union, Brazil and Indonesia during the global crisis into changes at the intensive margin (i.e., price and quantity changes in existing bilateral trade relations) and changes at the extensive margin (i.e., changes in the bilateral trade relations themselves, through product entry or exit). They find that the effects of the crisis at the intensive margin greatly outweighed those at the extensive margin for all four import markets. Further examination of the intensive margin dimension indicates that the relative effect of price and quantity changes varied significantly among product groups. The decline in commodity trade, and especially minerals, was largely due to a fall in prices, much more so than reduced quantities. The value reduction in manufactured imports, on the other hand, is almost exclusively explained by smaller imported quantities. These findings are conform with the observed collapse of the commodity boom that started to inflate around 2003. Oil, mineral and other commodity prices began to dwindle in July 2008 and plummeted to pre-boom levels in the months thereafter, not only because of lower contemporary demand but also due to revised expectations about future growth (World Bank, 2009a). Copper prices, for example, dropped from almost US$9000 per metric tonne in June 2008 to less than US$3000 in December 2008[9], adversely impacting on the export earnings of major exporters such as Mongolia, Zambia and the DR Congo (Kabuya Kalala and Cassimon, 2010).

Of course, the rapid reversal of commodity price trends had positive impacts on the import bills of other developing countries, some of which were experiencing severe fuel and food crises at the time (IMF, 2008a). However, while international food prices did come down from their mid-2008 peaks during the crisis, they turned out to be rather 'sticky' and remained high by historical standards. Figure 2 shows the overall impact the crisis had on emerging market and low-income countries' exports and imports, based on data from the World Bank's World Development Indicators (WDI).[10] We find that total emerging market export value decreased about US$1.4 trillion between

[8] See e.g., Levchenko *et al.* (2010) and Bems *et al.* (2010) on the importance of falling US and European demand for durable goods (and their inputs) in global trade spill-overs during the crisis.

[9] These figures are for copper grade A contracts traded on the London Metal Exchange. See http://www.lme.com.

[10] We use the same IMF definition as in Figure 1 to distinguish between emerging market and low-income countries (different from the World Bank's own classification).

2008 and 2009, with China (US$249 billion), Russia (US$178 billion) and Saudi Arabia (US$120 billion) accounting for the largest losses in absolute terms. At the same time, imports fell by roughly US$1 trillion, again dominated by China (US$120 billion) and Russia (US$116 billion). Total net exports by emerging markets therefore shrank by close to US$400 billion, from US$750 billion to US$350 billion. Panel (b) of Figure 2 suggests a similar evolution for low-income countries but with two important differences: first, the order of magnitude and, second, the fact that the low-income group as a whole was a net importer, even before the crisis. Between 2008 and 2009 the joint trade balance of low-income countries worsened by US$30 billion, driven to a large extent by the slump in Nigerian (oil) exports.

### *2.2.2. Private capital flows*

Changes in private capital flows were a second key channel of crisis transmission, especially (but not exclusively) in emerging market economies. Again, both volume and price (cost) effects appeared to be at play (Griffith-Jones and Ocampo, 2009). First, faced with high uncertainty, investors redirected their money to safe haven assets such as US government bonds and bills. This may seem ironic in view of the origins of the crisis, but increased investments in US Treasuries have been observed time and time again during episodes of (global) financial turmoil (Prasad, 2014).[11] Second, the global credit crunch also made the available financing more costly, as investors became more risk averse and started to worry about the possible consequences for developing countries of a fall-out of the crisis (in terms of debt servicing capacity, for example).

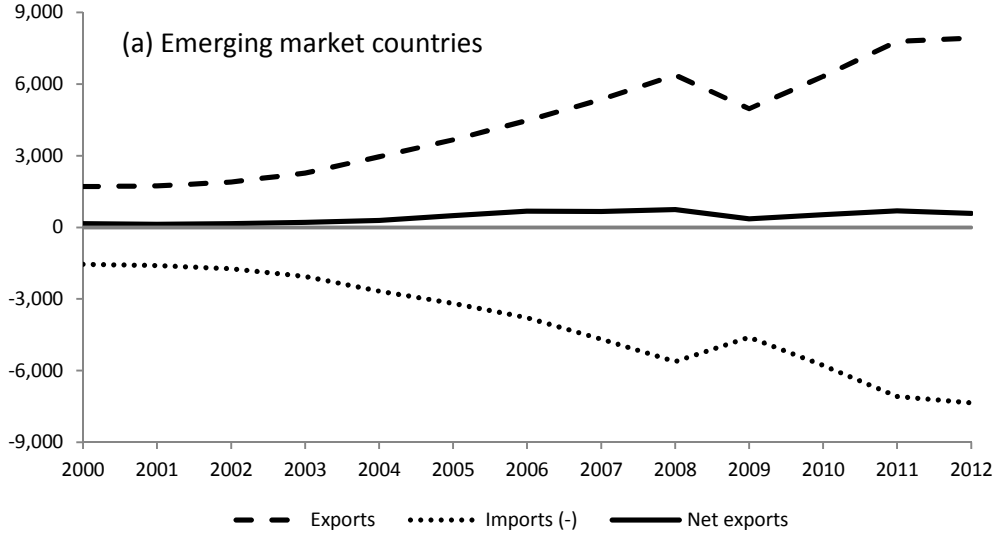
Figure 3 plots the evolution of different sorts of net private capital inflows (from non-residents) into emerging market and low-income countries, together with other net resource flows (remittances and bilateral aid; see next sections). Our data comes from the World Bank's WDI and International Debt Statistics (IDS).[12] Altogether, net private capital inflows to developing countries declined from a record-high US$953 billion in 2007 to US$667 billion in 2008. 2009 saw a further drop to US$581 billion. In emerging market countries, where net private capital inflows in 2007 were more than a factor 20 larger than in low-income countries, inflows in 2009 were about 40% below their 2007 peak. The absolute and percentage drop in low-income countries was much more modest but still significant; net private capital inflows decreased more than 13% over 2007-2009. Private capital flows once again turned out highly procyclical (Kaminsky *et al.*, 2005).

[11] This recurrent pattern of capital flows can be explained by the (hitherto) unmatched depth and liquidity of the financial markets of the US as well as its historical 'exorbitant privilege' of being the world's reserve currency issuer (Eichengreen, 2011). As Krugman (2008, pp. 171-172) puts it: 'US government debt is as safe as anything on the planet, not because the United States is the most responsible nation on earth but because a world in which the US government collapses would be one in which pretty much everything else collapses too'.

[12] The sample of countries underlying Figure 3 is smaller than that of Figures 1 and 2 as not all emerging market and low-income countries participate in the World Bank's Debtor Reporting System (DRS) (from which the IDS are sourced). Apart from a number of small island state economies also Russia, Chile, Poland, and large oil exporters are not included in the IDS. Therefore, the figures we report here are likely to be underestimates of the true net private capital inflows into developing countries.

*Figure 2. Total exports, imports and net exports by country group, 2000-2012: current US$ billions*

Source: Calculated from World Bank WDI.



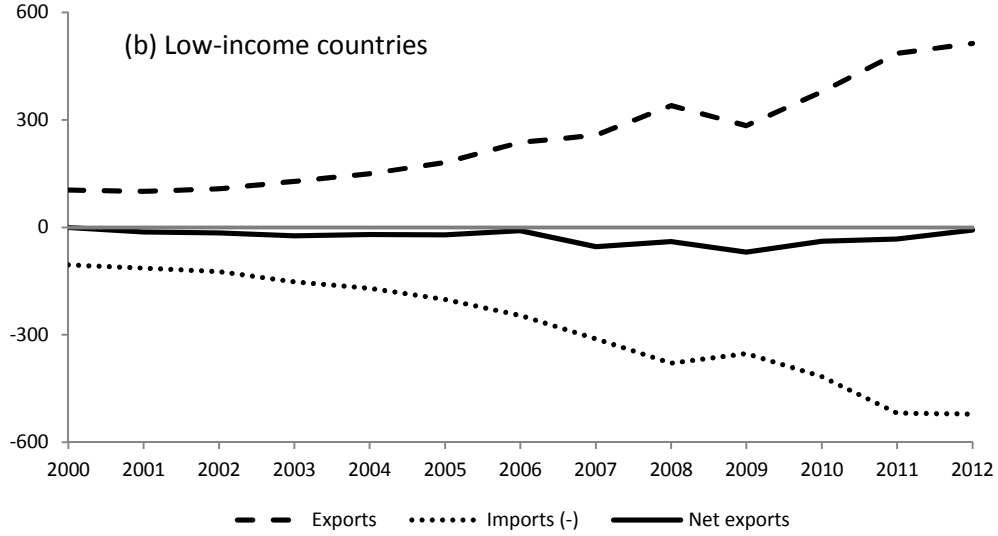
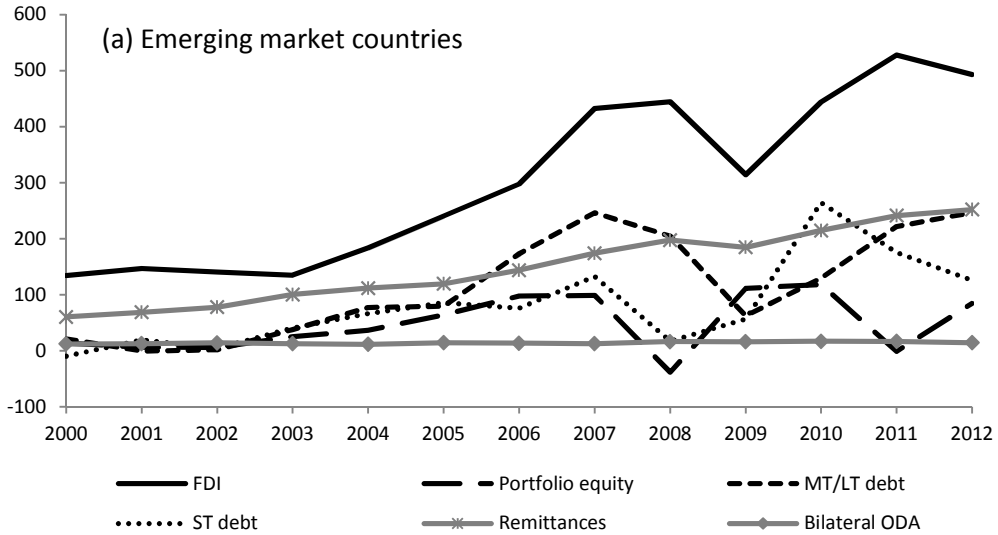
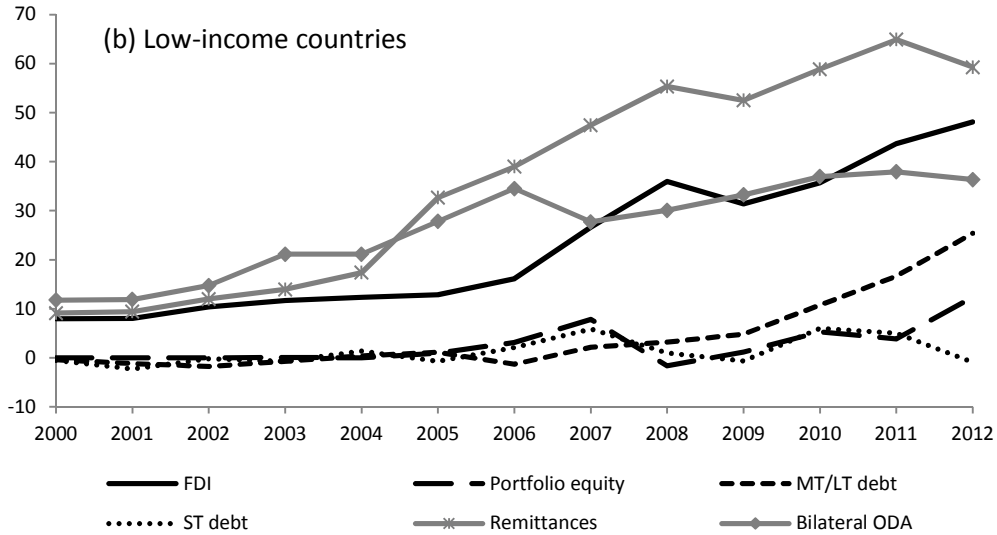




*Figure 3. Selected net resource flows by country group, 2000-2012: current US$ billions*

Source: Calculated from World Bank WDI/IDS and OECD-DAC Table 2a.



Differentiating by type of capital flow provides additional insights (see World Bank, 2011). As can be seen in Figure 3, net portfolio equity investment was affected most severely in 2008. Both emerging and low-income economies experienced *negative* net inflows of portfolio equity, to the tune of US$38 billion and US$1.6 billion, respectively. Stock market prices fell dramatically in many developing countries, reflecting a decline in corporate valuations, particularly of companies active in export sectors (IMF, 2009b). The Merrill Lynch Africa Lions Index, for example, keeping track of some 15 African countries, declined almost 70% over the period March-December 2008. Didier *et al.* (2012) find that co-movements between US and other (mostly emerging country) stock market returns during June 2007-April 2009 were mainly driven by financial linkages, such as the presence of US investors in stock markets and higher degrees of liquidity. They also observe a wake-up call effect in the first, 'pre-Lehman' stage of the crisis, when the stock markets of countries with weaker banking and corporate sector fundamentals displayed greater co-movement with US markets.

According to Figure 3, also short-term debt inflows (i.e., debt with an original maturity of one year or less) took a hit in 2008, especially in emerging market countries where these flows are again much larger than in low-income countries, and remained volatile thereafter. Net medium- and long-term debt inflows into emerging market economies declined somewhat in 2008, mostly due to lower bond inflows, but much more so in 2009, driven by a collapse in net commercial bank lending (World Bank, 2011). The importance of global banks in transmitting the crisis from advanced to emerging market economies is documented by Cetorelli and Goldberg (2011), who present evidence for three different channels: first, a reduction in direct cross-border lending by advanced country banks; second, reduced internal lending to emerging market affiliates by those foreign banks; and third, reduced access to interbank markets by stand-alone emerging market banks. De Haas and Van Lelyveld (2014) furthermore show that subsidiaries of multinational banks slowed down their lending about three times as fast as comparable domestic banks during the crisis, and that the credit reduction was largest for subsidiaries whose parent banks relied heavily on wholesale funding. Figure 3 suggests that, in contrast to emerging market countries, low-income countries did not see large declines in net medium- and long-term debt inflows. That said, sovereign bond spreads for low-income countries with access to international markets increased dramatically in the immediate aftermath of the Lehman collapse; this led others, including Kenya, Uganda, Tanzania and Zambia to postpone their planned (maiden) international bond issuance (IMF, 2009b; Kasekende *et al.*, 2009).

Foreign direct investment (FDI) constituted the largest private capital inflow into our sample of developing countries, before, during and after the crisis. Hailed in the past as a more stable and less crisis-elastic source of financing (e.g., Levchenko and Mauro, 2007; Kose *et al.*, 2009)[13], overall net FDI was still growing in 2008, albeit at a much slower pace than in pre-crisis years. In 2009 however, total net FDI inflows shrunk to US$345 billion or almost 30% below 2008 levels, prompting a serious questioning of their supposedly acyclical (or less procyclical) nature. The difference with past crises (where FDI was more of a stabilising force) may be that the Great Recession hit FDI source countries equally hard as (or harder than) host countries and left potential buyers of developing country firms credit-constrained (Poulsen and Hufbauer, 2011). Another (partial) explanation that has been put forward is that much of the FDI going to developing countries before 2008 existed of intra-company loans, which are typically more volatile than new equity capital; although equity capital investment declined too. Anecdotal evidence from low-income countries indicates that new

[13] This proposition is based on arguments related to the typically longer-term perspective of multinational enterprise investors and possibilities for M&A deals at bargain prices (so-called 'fire-sale FDI') in times of crisis (see Aguiar and Gopinath, 2005).

investment projects were cancelled or postponed and that existing projects were scaled back in sectors such as mining, energy and heavy industry (linked to lower commodity prices), as well as construction and tourism (Bhinda and Martin, 2009).

Largely as a result of the flight-to-safety pattern of capital flows towards US fixed-income instruments, virtually all advanced and emerging market country currencies depreciated against the US dollar from the intensification of the crisis in the summer of 2008 onwards, but particularly in the weeks following the Lehman bankruptcy. As Fratzscher (2009) demonstrates, countries with larger portfolio liabilities vis-à-vis US investors, lower foreign exchange reserves and weaker current account positions experienced more severe currency depreciations. The South African rand, for example, lost no less than 35% of its value between mid September and mid October 2008 (IDS, 2008).

### *2.2.3. Remittances*

In the years leading up to the crisis, remittances were reported to be growing steadily at double-digit rates (see World Bank, 2011). This is evident from Figure 3, where we have plotted net personal transfers and compensation of employees working abroad (i.e., remittances received minus remittances paid) for emerging market and low-income countries from WDI data. In the latter group net remittances rose fastest and trumped all categories of private capital inflows, including FDI. Countries such as India, Mexico and the Philippines, and low-income Nigeria, Bangladesh and Vietnam accounted for the largest net remittance flows.

Ever since the global crisis gained steam, its potential impact on remittances to developing countries has been a matter of debate. On the one hand, faced with adverse economic conditions in their host countries and considering the sectors (for example, construction) and conditions (for example, under temporary contracts) they typically work in, migrants may be less likely to send money abroad. Barajas *et al.* (2012), for example, argue that remittances are an often overlooked channel of business cycle synchronisation and uncover that economic downturns are more effectively transmitted between remittance-sending and -receiving countries than economic upswings. On the other hand, migrants may try to respond to the worsened situation of remittance recipients in their countries of origin, which were also affected by the crisis, by increasing transfers. Based on a large bilateral dataset pre-dating the crisis, Frankel (2011) presents empirical evidence in support of the two above hypotheses; remittances tend to be countercyclical with respect to income in the migrant's source country and procyclical with respect to income in the host country. To circumvent the potential reverse causality from large remittance inflows to higher output growth in the receiving country, Bettin *et al.* (2014) look into bilateral remittances from different Italian provinces to developing countries (which are unlikely to have significant effects on these countries' output). In line with Frankel (2011) and others, they find that between 2005 and 2011 remittances originating from Italy were inversely related with recipient country business cycles and positively with economic conditions in the sending Italian provinces. Moreover, remittances were found to respond countercyclically to adverse exogenous events in receiving countries, such as natural disasters or large terms-of-trade declines. The global nature of the 2008-2009 crisis, however, made it hard to predict *ex ante* the net effect on remittance flows.

Figure 3 suggests that net remittances continued to grow during 2008 but dropped by US$12.7 billion (-5%) and US$2.7 billion (-4%) for emerging market and low-income countries, respectively, in 2009. Compared to other flows, especially shorter-term private capital, remittances

thus seemed a more reliable source of finance over the course of the crisis. Sirkeci *et al.* (2012) advance several possible (but partial) explanations: first, remittances are mainly sent by the cumulative stock of migrants abroad rather than by new arrivals, which aids persistence over time; second, there was little return migration during the crisis and those that did return took their savings with them; and third, the depreciation of most currencies against the US dollar (see previous section) increased the purchasing power of migrants in the US and other destinations in terms of source country goods and assets, leading to a surge in remittance-financed investments in several countries. Relatively positive global figures however mask the underlying regional (and country) disparities in remittance trends. Eastern Europe and Central Asia experienced the largest percentage declines in remittances between 2008 and 2009, followed by Latin America and the Caribbean region. In South Asia, growth in remittance inflows slowed down but remained positive. According to Ratha *et al.* (2010), the more diversified a source country's migration destinations were, the less strong the impact of the crisis on remittances.

Although the order of magnitude of remittances before and during the crisis appears to be robust across different data sources, important measuring problems remain. Because of the relative paucity of data on informal, non-official transfers (which are likely to vary across countries), remittance statistics and trends could well be seriously understated (Freund and Spatafora, 2008). Conversely, increased attention to money transfers together with improvements in (formal channel) data recording may have artificially inflated pre-crisis remittance growth rates in the first place (Ruiz and Vargas-Silva, 2010).

Moreover, one should be careful in juxtaposing remittances to other financial flows. The mainstream research literature indeed seems to treat remittances as windfall income to the recipient country that can be directed to specific development uses, much like development aid (see next section). However, Clemens and Ogden (2014) forcefully argue that it makes much more sense to view international migration as a (costly) household investment strategy and remittances as (part of) the return on that investment, accruing directly to the migrant's relatives and friends in the source country. They also highlight the current lack of knowledge on how remittances affect economies at the meso- and macro-level. Surely, remittances can have a multiplier effect if they are consumed, or even better, invested locally, but little is known about the size of such multipliers. It could well be that the share of remittances that is productively invested remains low exactly because sending out migrants for overseas work is most attractive to those households that face few profitable investment opportunities at home. Together with the earlier-mentioned measurement problems and the fact that rising remittances often go together with rising migration (which, *ceteris paribus*, reduces the GDP of the origin economy), this makes that identifying the growth effect of remittances in cross-country regressions is very difficult, if not elusive (see Clemens and McKenzie, 2014).

### *2.2.4. International bilateral aid*

International bilateral aid is the fourth transmission channel which has featured in many reports on the crisis. One could indeed expect that when traditional donor countries experience severe growth contractions and have spent billions on bailing out financial institutions, they may be less willing to disburse aid to developing countries. As noted by Mold *et al.* (2009), maintaining aid budgets, the beneficiaries of which are not part of donor countries' political constituency, may not be an important vote-winner, especially not in the midst of an economic recession at home. History does not bode well. Roodman (2008), for example, illustrates how in the wake of systemic banking crises

in the 1990s, Finland, Norway, Sweden and Japan all cut back substantially on their aid disbursements. Econometric analysis by Frot (2009), Gravier-Rymaszewska (2012) and Dang *et al.* (2013) confirms the hypothesis that donor country banking crises tend to lead to marked and long-lasting declines in bilateral aid flows, reflecting, besides direct income-related effects, the costs of dealing with post-crisis public debt overhangs. More generally, Faini (2006) finds proof of a positive link between healthy fiscal positions of donors and larger aid budgets. On the recipient side, Pallage and Robe (2001) demonstrate that in many developing countries, and especially in Sub-Saharan Africa, the cyclical components of both aid receipts and domestic output are strongly positively correlated. Their results are in line with Svensson (2000), which shows analytically that donors with limited monitoring abilities tend to tie their aid disbursements to observed positive macroeconomic performance in recipient countries, since they cannot distinguish between external circumstances and recipient government efforts. Rand and Tarp (2002), however, challenge the findings of Pallage and Robe (2001) using different business cycle filters. A more extensive study by Dabla-Norris *et al.* (2015) presents evidence in support of aid procyclicality with respect to both donors' and recipients' business cycles but in addition shows that aid turns countercyclical when recipients experience unusually large terms-of-trade declines, climatic disasters or growth collapses. They also demonstrate that, confronted with large economic downturns, donors have traditionally curbed aid flows to low-income countries more than to middle-income countries.

At first sight, overall bilateral aid levels seem not to have been notably impacted by the Great Recession. Figure 3 indicates that total net Official Development Assistance (ODA) (grants plus net concessional loans) to low-income countries by Development Assistance Committee (DAC) bilateral donors continued to grow in absolute terms in 2009 and 2010, reaching unprecedented levels comparable to net FDI inflows in those years.[14] Net bilateral ODA to low-income countries did decline substantially before the crisis, between 2006 and 2007, but this can be ascribed to a large debt relief deal with Nigeria that inflated ODA figures in 2006. The relative stability of total net ODA during the first crisis years again hides differences between recipients, but also between donors.[15] According to official OECD-DAC statistics, in 2009 the largest relative (percentage) increases in net ODA disbursements were recorded for Norway, France, the UK, South Korea, Finland, Switzerland and Belgium (all +10% or more in real US$ terms); the UK, Korea and Belgium were again among the best-performing donors in 2010.[16] At the same time, because of austerity measures and other budgetary pressures, net ODA provided by Ireland, Italy, Portugal and Greece contracted sharply in 2009. In 2010 new cuts in ODA were most visible for Greece, Ireland and Spain. Overall, it appears that the reduced aid budgets of a few smaller donors were (over)compensated by stable or rising aid from larger donors over 2009-2010. The pledge of EU members of the DAC to reach a minimum ODA target of 0.51% of their GNI by 2010, and other promises made at the 2005 G8 summit in Gleneagles, may have played a role here. In 2011 and 2012 total net ODA by DAC bilaterals declined in real terms (by -2% and -4%, respectively), due to a combination of continued and new fiscal tightening (mostly in Spain, Italy, Greece and Portugal but also in Belgium and the Netherlands), less debt relief, and a normalisation against 2010 ODA to GNI targets. 2013 saw a recovery in net ODA, with a real increase of 6%.

[14] To facilitate comparison with the other resource flows in Figure 3, total net ODA is calculated for the same sample of countries that is included in the IDS database (i.e., DRS-reporting developing countries).
[15] The following information was obtained from OECD-DAC media reports.
[16] It should be noted, however, that some of the increased net ODA of individual donors was again due to large debt forgiveness grants, such as for example Belgian's debt relief to the DR Congo in 2010.

In view of the just-described transmission channels and the noticeable impact of the crisis on developing country growth (apparent from Figure 1), many commentators have invoked, in some way or another, the notion of 'vulnerability' (see e.g., Mold *et al.*, 2009; IMF, 2010b). Developing countries have been labelled vulnerable to the global crisis (mostly in retrospect) and vulnerable to future turbulence in the world economy. The use of the term 'vulnerability', while increasingly common, is however seldom meticulous and often confusing, not at the least because of the various meanings attached to it by different researchers. Yet, we believe the concept of vulnerability itself, if sufficiently specified, provides a useful perspective from which to examine jointly a number of development issues raised by the crisis and by developing countries' volatile external environment more generally. In the following section we therefore attempt to offer some conceptual clarification: first, we define vulnerability and its different building blocks; second, we look into the measurement of the different concepts; third, we explain why vulnerability matters for development; and fourth, we classify different ways of dealing with vulnerability and outline their respective advantages and disadvantages.

## 3. Developing country vulnerability

### 3.1. Defining vulnerability and its components

The idea of vulnerability has a long history and applications in a wide range of social and natural sciences (for an extensive overview, see Villagrán de León, 2006). Within development economics, vulnerability research has traditionally been situated on the level of households or individuals (e.g., Chambers, 1989; Dercon, 2001; or more recently, Naudé, Santos-Paulino*, et al.*, 2009b). In more recent years however, particularly in the aftermath of the East Asian crisis, a growing body of literature on country-level vulnerability has emerged (Briguglio, 1995; Committee for Development Policy, 1999; Atkins *et al.*, 2000; Guillaumont, 2001; Teunissen and Akkerman, 2005; Briguglio *et al.*, 2009; Guillaumont and Guillaumont Jeanney, 2009; Dabla-Norris and Bal Gündüz, 2014; Angeon and Bates, 2015).[17] It is this macroeconomic vulnerability of emerging and low-income developing countries that will be the subject of the remainder of the paper.

In very general terms, vulnerability can be defined as the likelihood of a system being negatively affected by some sort of perturbation or sudden 'shock' that goes beyond the normal range of variability (see Gallopín, 2006).[18] Here we assign the system to be an individual developing country's economy and the perturbation to be a number of macroeconomic and financial shocks such as those transmitted during the global crisis (see Section 2.2). This brings us close to Guillaumont (2009, p. 197)'s dynamic definition of country-level vulnerability as 'the risk that economic growth is markedly and extensively reduced by shocks'. In line with most of the literature our main focus will be on the vulnerability of *output* (or output growth) to shocks; we will make the link with *consumption* vulnerability when discussing development implications (see Section 3.3).

[17] There is of course a link between the different echelons of study, as the vulnerability of households is often (although not always) a consequence of that on the macro-level (Guillaumont, 2009; see Section 3.3). For a rare study on sub-national (regional) vulnerability, see Naudé, McGillivray*, et al.* (2009).

[18] Gallopín (2006) also considers the possibility of the perturbation to be a continuous or slowly increasing 'stress' (commonly *within* the range of normal variability). For the purpose of this paper we make abstraction of such stresses.

Vulnerability to shocks, in the sense we use it here, can be seen to have at least three distinguishable building blocks: the likelihood and severity of the *shocks* in question; the *exposure* of a country to these shocks; and the country's capacity to react appropriately to shocks, or its *resilience* (cf. Guillaumont, 2001, 2009). We now discuss these three main vulnerability components in turn.

First, a *shock* can be conceptualised as an event which impacts unexpectedly on a country's economy, and which is exogenous or beyond the control of that country's government (or other decision makers) to prevent, making it discernible from 'non-shocks' such as predictable and/or recurrent trends and policy-induced, endogenous events (Martin and Bargawi, 2005). Similarly, such shocks can be seen as instances of extreme input volatility, to be distinguished from output volatility such as the deviations from trend economic growth they may cause (Varangis *et al.*, 2004; see also Section 3.3). What constitutes 'extreme' is, of course, a matter of judgement and has implications for measurement (see Section 3.2). Two important features of shocks are their (estimated) likelihood of occurring and their severity. Attaching a rough order of probability to particular shocks does not imply that one knows the exact timing of shock events beforehand; indeed, if one did, those events would not constitute shocks in the first place. Shock severity is usually expressed in terms of the relative size of (output) losses due to shocks (see further).

From the perspective of developing countries, the global financial and economic crisis clearly satisfies the unexpectedness and exogeneity criteria of a shock. As outlined in Section 2, the crisis originated in a relatively small segment of the US financial system, far away from developing countries' locus of control, before spreading rapidly around the globe. It seems fair to say that developing countries were innocent bystanders during the Great Recession, unlike in many other previous crises with global implications. The 2008-2009 crisis represented a wave of successive external shocks (Naudé, 2009a), with multiple and interacting dimensions: financial shocks under the form of declining private capital inflows (FDI, portfolio equity and debt) and, to a lesser extent, reduced remittances and aid; and real sector trade shocks in terms of both volumes and prices.[19]

Shock events can take the form of so-called 'common shocks' that affect multiple countries simultaneously (though not necessarily to the same extent); a steep drop of international commodity prices or a global collapse in investor confidence, for example. Alternatively, it is possible that shocks are the result of 'contagion', i.e., economic troubles spilling over from one country to another (and then to the next), say, the drying up of export demand by an important trade partner or a reduction in cross-border lending. Observationally however, common shocks and contagion, especially of the 'fast and furious' type (Kaminsky *et al.*, 2003), may be very similar and difficult to distinguish.[20]

The second component of vulnerability is *exposure*, which is typically referred to as the degree to which a country is open to outside shocks and relates to the size and configuration of a country's economy (Guillaumont, 2009). Most economists would now concede that as countries

[19] Shocks need not be negative of course, with sharply rising commodity prices or capital flow surges being obvious examples. Much of the framework we develop in this section can, in principle, also be used to study the likelihood of countries' economies benefitting from positive shocks. However, since the current paper and the rest of the dissertation are framed in the context of the global crisis (and in keeping with the majority part of the literature on vulnerability to external shocks), we confine our analysis to negative shocks only.

[20] For a discussion of the common shock and contagion dimensions of the global crisis, see e.g., Reinhart and Rogoff (2009, pp. 240-247). For (complementary) empirical applications, see Rose and Spiegel (2012) and Rose and Spiegel (2010), respectively, and Abiad *et al.* (2013). It is indeed very likely (although not straightforward to formally test) that some developing countries were affected by the crisis not through their direct links with the US and European epicentres, but mainly because of other economies' (Russia or China, for example) links with the US and Europe.

integrate into the global economy, opening up their economy to international trade and finance, they increase their exposure to shocks and, *ceteris paribus*, the risk of marked, negative impacts on their economic growth (i.e., output vulnerability). One way to understand exposure to a shock is as the maximum potential loss resulting from that shock; in other words, the total amount of resources that is at stake. Exposure is, although perhaps often structural (meaning quasi-permanent), at least partly a policy choice and thus amendable, be it in the longer run.[21]

The third major building block of vulnerability is *resilience*, interpreted here as a country's capacity to counteract shocks appropriately, or more specifically, its ability to withstand or adjust quickly from the shocks it is exposed to (see Briguglio *et al.*, 2009; Angeon and Bates, 2015).[22] This ability will largely depend on the financial and institutional resources a country has at its disposal to fight shocks, but also on its policy space to effectively deploy those resources (which is influenced by both national and interational factors; see Mayer, 2008). Counter to exposure, country resilience is largely self-inflicted. However, and in sharp contrast with Briguglio *et al.* (2009) and others, we choose to incorporate resilience into the concept of vulnerability, next to the shocks and exposure components, rather than to see it as the policy-induced flip side or antonym of 'structural vulnerability' (or exposure). Indeed, resilience can be seen as sort of a buffer or potentially moderating factor between shocks and exposure on the one hand, and their consequences for economic output on the other. Like Angeon and Bates (2015), we feel the dichotomy between structural and policy-induced determinants of vulnerability is somewhat artificial and does not fit with our understanding of exposure and resilience (and how to change them, see Section 3.4).

In order to synopsise the above discussion, we have attempted to find a suitable formula or measure of vulnerability of output to external shocks that expresses vulnerability as a combination of its main components. That said, clear analytical work seems to be largely lacking from the vulnerability literature; the studies we mentioned earlier are all primarily empirical in their approach.[23] One can however draw inspiration from the credit risk literature, which uses concepts that are in many ways similar to the ones we described above. Indeed, credit risk, or the 'risk of an economic loss from the failure of a counterparty to fulfil its contractual obligations' (Jorion, 2009, p. 431), is seen as driven mainly by the *probability of default*, *loss given default*, and *credit exposure*. One standard measure of portfolio credit risk is the so-called 'expected credit loss', which in its simplest form is just the product of the three foregoing elements aggregated over the different assets in the portfolio. Similarly, we could propose the 'expected output loss' as a basic measure of countries' output vulnerability to (different) shocks:

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[21] Here we beg to differ from Briguglio *et al.* (2009), who argue that country exposure is inherently structural. Their point of view is understandable as it is grounded in research on small (island) developing states (see Briguglio, 1995). Indeed, small states have (quasi-)permanent features such as small domestic markets and limited natural resource endowments which drive them automatically towards greater economic openness and therefore more exposure. Nevertheless, we are inclined to agree with Abousleiman *et al.* (2007, p. 3), which note that '...in the long run, the exogeneity of any measure of exposure [to shocks], with perhaps the exception of certain natural disasters, is highly questionable'.

[22] This definition corresponds well with how resilience is described in the Oxford English Dictionary: 'the quality or fact of being able to recover quickly or easily from, or resist being affected by, a misfortune, shock, illness, etc.'.

[23] te Velde (2009) and ODI (2010, p. 32) put forward that 'vulnerability equals exposure minus resilience', thereby ignoring the shock component of vulnerability. It may seem tautological but has often been ignored (or insufficiently emphasised) in the literature that the extent to which developing countries are at risk of having their output negatively impacted by an external shock, crucially depends on the probability of such a shock occurring in the first place.

$$Expected\ output\ loss = (1 - resilience) \times \sum_i probability\ of\ shock_i \times loss\ given\ shock_i \times exposure\ to\ shock_i \quad (1)$$

The part of Equation (1) under the summation operator could be called the 'expected shock loss' and is completely analogous to the standard 'expected credit loss' in the credit risk literature; it is interacted with moderating variable resilience to obtain the expected output loss. If exposure to a shock is expressed as a percentage of GDP (like most trade or financial openness measures); loss given shock (or, alternatively, shock severity) is expressed as a percentage of exposure; the probability of a shock is simply a percentage; and resilience is a factor between zero and 100%, it follows that the resulting expected output loss is again a percentage of GDP. Our formula contains the *probability* of shocks, rather than shocks per se, to accentuate the stochastic nature of vulnerability. As we (and others) have defined it, vulnerability embodies a risk *ex ante*, not a deterministic state of affairs (see e.g., Naudé, Santos-Paulino*, et al.*, 2009a; Montalbano, 2011).

Of course, in reality not only the occurrence of the shock is a random variable. As acknowledged in the credit risk literature, also the loss given shock and exposure are likely to have certain distributions; the same arguably goes for resilience. This implies that the realised output loss may well differ from its expected value (for reasons other than just uncertain shock incidence). Furthermore, whereas the expected output loss is perhaps the simplest, it is not the only (and probably not the best) proxy of output vulnerability. Again in line with the credit risk literature, one may construct other measures too that summarise the distribution of output losses due to shocks. Often these measures require making additional assumptions about the interrelation of different shocks. In the Appendix we describe a very simple, fictive example of a country that is vulnerable to several shocks, to illustrate the concept of shock loss distributions, to introduce a number of other possible shock loss measures, and to show the role played by correlations between shocks. Lastly, we should note that the proposed formula is only a first step towards a better conceptualisation of vulnerability. For example, resilience is treated in Equation (1) as a very general scale factor, whereby a greater overall ability to counteract shocks (reflected in a higher resilience score) translates into lower expected output losses given particular expected shock losses. A more realistic assumption would be that distinct aspects of resilience, such as certain institutional arrangements or the availability of certain financial resources, bear differently on the expected impact of different shocks. Likewise, the way in which aspects of resilience moderate shock impacts will need to be made more explicit in future analytical work.

In spite of its limitations, we believe the proposed decomposition allows one to better grasp the efforts that have been made in measuring vulnerability empirically and to suggest some possibilities for improvement (Section 3.2). Also, and perhaps more importantly, Equation (1) helps to better structure discussions about different vulnerability-reducing strategies and the interventions and instruments associated with such strategies (Section 3.4).

### 3.2. Measuring vulnerability

Attempts to quantify developing countries' vulnerability to shocks go back a long time. Early efforts include UN-commissioned research on indicators for assessing the vulnerability of small island developing states (SIDS) and the group of least developed countries (LDCs). Briguglio (1995), for example, constructs a composite vulnerability index for SIDS, comprising measures of exposure such

as overall trade openness (i.e., the ratio of exports plus imports to GDP). In follow-up work, variables capturing export concentration and dependence on strategic imports were added to SIDS indices (see also Atkins *et al.*, 2000). Likewise, in 1999 the UN introduced an economic vulnerability index (EVI) as one of the criteria for the identification of LDCs, next to per capita income and human capital measures (Committee for Development Policy, 1999). The EVI combines exposure (e.g., merchandise export concentration) with shock indicators (e.g., the instability of exports) by simple arithmetic averaging with equal weights; a method that may unduly complicate interpretation. Guillaumont (2009) acknowledges the problems with the old EVI and proposes a number of alternative aggregation methodologies, including geometric averaging of shock and exposure indices to account explicitly for multiplicative effects. Such suggestions are much in line with our proposed vulnerability formula, but leave out the resilience component. Conversely, Briguglio *et al.* (2009) bring together an index of exposure with one of economic resilience; the latter consists of variables on the macroeconomic and fiscal outlook of countries, market efficiency, good governance and social development. In light of the crisis, Naudé (2010) has updated the exposure and resilience indices of Briguglio *et al.* (2009) for Sub-Saharan Africa, supplementing them with measures of external indebtedness, private sector credit and cross-border banking liabilities. Angeon and Bates (2015) employ a graph theory-inspired algorithm to construct a broad hierarchical vulnerability index that contains the maximum of information with a minimum set of exposure and resilience variables and use it to rank and classify countries into different groups. None of latter papers however take into account the probability of shocks in their empirical analysis.

Measuring vulnerability has not been limited to SIDS and LDCs. The end of the 1990s and early 2000s, a period marked by several financial crises in emerging market economies, also saw increased interest in early warning models, designed to identify the indicators that best predict crisis incidence. To the extent that such crisis incidence is defined in terms of output drops (see e.g., Ghosh and Ghosh, 2003), early warning models could be seen as estimating vulnerability (in the sense we have defined it above) on the basis of indicators of country exposure and resilience. Much of the early warning literature, however, has focused rather narrowly on sudden stops of capital inflows into emerging market economies, leaving aside trade and other current account shocks.[24]

The most comprehensive and systematic approach to measuring and monitoring developing country vulnerability today is embodied by the IMF's Vulnerability Exercises for low-income countries (VE-LIC, operational since 2011) and emerging market economies (VEE, since 2001), respectively (see Robinson, 2014).[25] The VE-LIC in particular gives attention to all three vulnerability building blocks we identified (although it does not always use the exact same wording). It does so through two complementary modules. In the first module a so-called Growth Decline Vulnerability Index (GDVI) is constructed for each low-income country (see Dabla-Norris and Bal Gündüz, 2014). A negative shock event is identified as an annual percentage point change in one or more of the relevant variables, i.e., external demand, terms-of-trade, FDI, aid or remittances (all expressed as ratios to GDP), that falls in the bottom decile of the historical country-specific distribution of such changes.[26] Out of this

[24] Frankel and Saravelos (2012) provide an extensive review of the early warning literature and test the predictive power of its leading indicators for the cross-country incidence of the 2008-2009 global crisis.

[25] Together with the Vulnerability Exercise for advanced economies (VEA, since 2009), these exercises are now part of the much broader IMF and Financial Stability Board's (FSB) joint Early Warning Exercise (EWE), the development of which started late 2008, just when the crisis had entered a new, global phase. See IMF (2010c) for a detailed overview of the EWE.

[26] We make abstraction of large natural disasters, which are formally also part of the current VE-LIC. The use of country-specific deciles to identify shocks implies that shock probability is fixed at 10% for each country.

sample of shock events, the episodes in which countries experience negative real GDP per capita growth in the shock year *and* have a below-trend level of real GDP per capita in the two years following the shock are marked as growth crises. The focus is thus on shocks that have a marked and extensive (persistent) impact on economic output growth (cf. Section 3.1). The VE-LIC then determines for a list of potential exposure, resilience and shock severity indicators individual threshold values that minimise Type I (false alarm) and Type II (missed call) errors in separating crisis from non-crisis episodes. Indicator values are mapped into binary scores according to these thresholds and aggregated to three (real/external/fiscal sector) cluster indices and the overall GDVI, with weights based on indicators' relative goodness-of-fit in the crisis signalling specification. Using cut-off values for the GDVI, countries are classified into categories of high, medium and low vulnerability.[27] One disadvantage of the just-described signalling approach is that it does not explicitly take into account possible interaction effects between different exposure and resilience variables. For example, the extent to which large external debt levels contribute to vulnerability may well depend on the amount of foreign reserves held, or on institutional quality (insofar as the latter proxies debt management capacity). Also, we observe a great number of resilience-related measures in the VE-LIC (including variables on reserves, institutional quality and fiscal balances) but relatively few exposure measures.[28] In this respect, there are perhaps lessons to be learned from the research on SIDS and LDCs.

The second module of the VE-LIC (and VEE) focuses on the shocks component of vulnerability in using an elaborate set of scenario analysis and spill-over modelling techniques to identify global tail risks and approximate their potential impact on developing countries, in terms of GDP growth, fiscal balances and financing needs (IMF, 2011b). The specific scenarios that are studied are informed by the IMF's research contained in its WEO and Global Financial Stability Reports (GFSRs) and vary between different rounds of the exercises. In the first VE-LIC, concluded late 2011, one of the scenarios involved simulating the effect of bank recapitalisation on global growth and associated changes in global commodity prices making use of advanced DSGE and VAR models. Combining these simulated effects with information on trading patterns enabled translation into country-level terms-of-trade projections. More recently, the VE-LIC has analysed scenarios of protracted slower growth in advanced and emerging economies, energy price shocks, and the normalisation of monetary policy in key advanced economies (IMF, 2014a). We believe that by paying attention to global risks and shock scenarios the IMF's Vulnerability Exercises constitute an important improvement over other empirical vulnerability research. But perhaps there is still room to better integrate the two modules, for example by combining forward-looking scenario analysis with scenario-specific vulnerability indices (constructed in a similar way as the GVDI).

Now that the initial conceptual framework and associated measurement efforts have been laid out, it is important to understand why and how vulnerability to external shocks matters for developing countries.

[27] The VEE follows a similar methodology, but differs from the VE-LIC in estimating countries' vulnerability to balance-of-payment crises rather than growth slowdowns per se, and in considering different shock, exposure and resilience indicators.

[28] Similar concerns were voiced by ODI's Isabella Massa in a joint ODI-IMF roundtable discussion of the VE-LIC in October 2011 (see http://www.odi.org.uk/events/docs/4874.pdf).

### 3.3. Vulnerability to shocks as a development concern

It is well-established in the literature that, historically, output volatility has been considerably higher in developing than in advanced economies. At least part of the explanation lies in the fact that developing countries are subject to more frequent and severe external shocks (Koren and Tenreyo, 2007). Perry (2009), for example, estimates that over 1970-2005 about 44% of the 'excess' output volatility of developing countries, calculated as deviations of GDP per capita from its trend and measured against the benchmark of advanced country output volatility, was due to external shocks in capital flows and terms of trade. Raddatz (2007) on the contrary argues that external shocks accounted for no more than 11% of the overall variance of real GDP per capita in low-income countries over 1965-1997. The same author however finds that in Sub-Saharan Africa the relative importance of external shocks as a source of output volatility has increased in the post-1990 period, mainly because of greater internal stability and a larger sensitivity of output growth to external shocks (Raddatz, 2008). Becker and Mauro (2006) show that the majority of severe output drops over 1971-2001 coincide with at least one shock, often sudden stops of capital flows (in emerging market economies) or terms-of-trade shocks (in low-income countries).

Output volatility (and by extension output drops) has been found to have significant and often asymmetric welfare effects in developing countries, through direct and indirect channels. First of all and most importantly, output volatility typically translates into even higher consumption volatility (Aguiar and Gopinath, 2007; Loayza *et al.*, 2007; Perry, 2009), which runs counter to standard hypotheses of consumption smoothing. The risk of marked declines in consumption arguably matters more to developing country citizens than simply the risk of lower output.

Several reasons have been advanced for the disproportionate consumption volatility in developing countries. Kodama (2013) constructs a model where external shocks, to terms of trade for example, bypass income and have a direct effect on the consumption of import goods, and through imports' complementarity with non-traded domestic goods on the latter too. Developing countries' economies may also not be adequately described by standard representative agent models in which international financial markets are used to insure against output risk. External borrowing constraints, for example due to commitment problems or higher output vulnerability to shocks in developing countries, and other financial frictions could explain why consumption smoothing is limited. If capital inflows are indeed procyclical (Kaminsky *et al.*, 2005), access to external finance will decrease exactly when it is needed most to prop up consumption. Levchenko (2005) demonstrates that greater financial integration may even *increase* overall consumption volatility when an economy's agents are heterogeneous in their sources of income and access to international financial markets, and when domestic financial markets are underdeveloped (which implies incomplete risk-sharing between domestic agents).[29]

Furthermore, as shown in a seminal paper by Ramey and Ramey (1995), countries with higher output volatility on average also have lower trend growth, which again reduces (future) consumption. Hnatkovska and Loayza (2003) uncover that the negative relation between volatility

[29] In principle, one could also construct decomposable measures of consumption vulnerability, such as the 'expected consumption loss'. A very simple extension of Equation (1) would be: *expected consumption loss* = *frictions* × *expected output loss*. Frictions, which could include international borrowing constraints, are here considered a scale factor (possibly exceeding 100%) which regulates the transmission of output losses to consumption losses. Again, more analytical work is needed to disentangle the mechanisms through which different sorts of frictions operate.

and long-run growth is causal and find that it is primarily 'crisis volatility', negative fluctuations beyond a certain threshold, that harms long-run growth (see also Kharroubi, 2007).

Importantly, however, the effect of external shocks on output (and, in second instance, consumption) is conditioned by variables that proxy the other two main components of countries' vulnerability, i.e., exposure and resilience. Loayza and Raddatz (2007), for example, find that the cumulative output impact of standardised terms-of-trade shocks rises with trade openness and declines with labour market flexibility and, to a lesser extent, (*de jure*) financial openness. Calderón *et al.* (2008) present evidence suggesting that trade openness magnifies the effects of terms-of-trade, external demand and international interest rate shocks on growth volatility, while larger financial openness dampens it. Crispolti *et al.* (2013) apply the same country-specific definition of shocks as in the IMF's VE-LIC to 1980-2007 data and use an event analysis to demonstrate that the impacts of negative terms-of-trade, external demand, FDI or aid shocks on GDP growth and real per capita consumption growth crucially depend on country characteristics such as the flexibility of the exchange rate regime, the level of reserves, overall indebtedness, the importance of commodities in countries' exports and imports, and whether or not countries are island states.

As argued in the previous sections, the 2008-2009 Great Recession is another prime example of how (a wave of) exogenous shocks can affect developing countries' output. Again there are indications that the impact of the global crisis on economic growth varied with different dimensions of developing countries' vulnerability. Indeed, there is now a considerable body of empirical studies that have linked, with reasonable success, cross-country differences in growth during the crisis to variables which could be interpreted as capturing exposure and resilience.[30] Moreover, Dabla-Norris and Bal Gündüz (2014) show that the GVDI of the VE-LIC (described in Section 3.2) has relatively good out-of-sample predictive power for the incidence of growth crises in 2009; it flags nine out of 13 low-income countries that experienced an actual growth crisis as highly vulnerable and another one as moderately vulnerable, while false alarms remain limited to 28% of the non-crisis cases.

Another strand of the literature has illustrated how the Great Recession, beyond its macroeconomic consequences, translated (or was projected to translate) into welfare impacts on the level of households and individuals in developing countries, using a variety of methodologies, including microsimulations based on pre-crisis micro-level data and macroeconomic projections, rapid (quantitative and/or qualitative) monitoring exercises, and panel data analysis of pre- and post-crisis household surveys (see among numerous others, Friedman and Schady, 2009; Heltberg *et al.*, 2012; Narayan and Sanchez-Paramo, 2012; Reyes *et al.*, 2013).[31] This large and growing literature provides a wealth of evidence of the (largely negative) effects the crisis has had on the incomes, consumption patterns and labour market participation of developing country citizens, albeit with great heterogeneity across countries, livelihoods and demographic groups.[32]

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[30] In Chapter 5 of the dissertation we review this recent literature and contribute to it by examining in greater detail the effect of political institutions, the strength of democracy in particular, on growth during the crisis. We will argue that democracy has a theoretically ambiguous effect on countries' resilience to external shocks.

[31] Harper *et al.* (2011) and Heltberg *et al.* (2013) offer short, schematic overviews of the possible second-tier channels through which shocks, such as those underlying the global crisis, affect household and individual well-being.

[32] We present a case study of how South African labour markets fared during and in the aftermath of the Great Recession in Chapter 6 of this dissertation. More particularly, we employ two different longitudinal datasets to study transitions in and out of employment (and individual, household-level and job-specific determinants of such transitions) in South Africa since 2008. Whereas this is not strictly a crisis 'impact' study, it does exhibit the same heterogeneity in the experiences of different groups of people during difficult economic times.

All of the foregoing suggests that, if we are serious about development, output vulnerability to external shocks needs to be addressed. The next subsection contains a structured discussion of the different conceivable options to do so.

### 3.4. Classifying and evaluating ways of dealing with vulnerability

From the simple formula proposed in Section 3.1 (i.e., Equation (1)), we can logically infer that in order to bring down developing country vulnerability (proxied by expected output losses), external shock probability and severity would have to be diminished, exposure to shocks would have to be reduced, and/or resilience would need to be built. First, without shocks occurring (zero shock probability), no developing country can be considered vulnerable, of course. Second, a country which is closed off from all external shocks (zero exposure) is also non-vulnerable. And third, countries which are greatly exposed to frequent and severe shocks need not be highly vulnerable; an equally great resilience would counter the negative effect of exposure on output vulnerability.[33]

Reducing the probability and severity of shocks is one of the (implicitly) intended outcomes of proposals for a more stable and robust global financial and monetary system. For example, a report by the Palais-Royal Initiative (2011), an informal group composed of former government officials, central bankers and international organisation staffers, lays out an extensive and very ambitious reform agenda to progress towards such a system; including adjustments to global current account imbalances, limiting speculative capital flows and excessive exchange rate fluctuations, and stronger multilateral surveillance of national macroeconomic and financial policies. If achieved, this would certainly go a long way in reducing the occurrence of large financial shocks and/or containing shocks before they spread out.

Many of the proposed reforms require close cooperation and concerted action at the global level, whether through existing organisations and platforms, such as the IMF, G20, FSB and WTO, or new configurations. Developing countries will need greater voice if the reformed global financial and monetary system is to be made more inclusive and development-friendly (Ocampo, 2011). As the ongoing quota and governance changes at the IMF suggest, enhancing the voice of developing countries is a slow-moving and highly political process. Further exploration of these issues, while of utmost importance, is well beyond the scope of this paper. Rather, in what follows, we will zoom in on the two building blocks of output vulnerability over which developing countries have arguably more direct control, i.e., exposure and resilience.

Table 1, adapted from Perry (2009), provides a particularly useful framework to classify different ways of dealing with vulnerability to external shocks.[34] We will restrict our analysis to trade shocks, both in external demand and terms of trade, and shocks in external private capital flows, the

[33] Briguglio *et al.* (2009) refer to this as the 'Singapore paradox', citing Singapore as an example of a country highly exposed to external shocks but with steady GDP growth (presumably due to high-performant macroeconomic management capacity, a factor of resilience).

[34] Perry (2009)'s framework, inspired by Ehrlich and Becker (1972) and the broader insurance literature, was originally developed to classify different strategies of managing output volatility, rather than the vulnerability of output to external shocks as such, and with a strong focus on the potential role of multilateral development banks. This paper instead links the different categories of interventions to developing country vulnerability and pays attention to the roles of both countries themselves and international financial institutions (multilateral development banks *and* the IMF) (see Section 4). Also, we provide a thorough update of Perry's work (a first draft of which was finished *before* the Lehman bankruptcy) and include a number of additional instruments, such as capital controls and sovereign wealth funds. See Cassimon and Verbeke (2009) for an application of the framework to the DR Congo.

two best-documented and, arguably, most important transmission channels of the global crisis (cf. Section 2.2). While Table 1 is by no means exhaustive, it does present a wide and interesting pallet of interventions and instruments.[35]

Broadly speaking, one can identify four possible strategies. First, as the default option, countries may decide not to address the vulnerability of their output to shocks beforehand; neither do they reduce exposure, nor do they strengthen their resilience. Overall output vulnerability thus remains unchanged. Countries just wait for the shock(s) to occur and then cope with the aftermath. Such *coping* typically involves balance-of-payments adjustments, such as reducing imports or using up international reserves, and procyclical fiscal (and monetary) policy behaviour in developing countries (Kaminsky *et al.*, 2005; Ilzetzki and Végh, 2008). In the case of large shocks, this may well result in a destruction of income and wealth and an increase in poverty. Procyclicality could moreover amplify the impact of shocks and stall the recovery process.[36] Of course, international actors such as the IMF, World Bank, regional development banks and bilateral donors can help softening a country's adjustment process by providing exceptional financing, under the form of additional (ad hoc) loans and/or grants.[37] Coping with shocks like those observed during the global crisis is often painful in both financial and human terms and, as a strategy of wait-and-see, it is inherently backward-looking. Nevertheless, for some low-income countries it represents the only possible way of dealing with their vulnerability (see further).

*Table 1. Dealing with developing country vulnerability to external shocks*

| **Type of shock** | **Strategy** | | | |
|---|---|---|---|---|
| | *Coping* | *Prevention* | *Self-insurance* | *Market insurance/hedging* |
| *External demand/ terms-of-trade* | Balance-of-payments and fiscal adjustments; Exceptional loans/grants | Export diversification | Reserves hoarding; Stabilisation funds; Other sovereign wealth funds | Commodity price derivatives; Commodity price-indexed debt; Contingent credit lines |
| *Private capital flows* | Balance-of-payments and fiscal adjustments; Exceptional loans/grants | Capital portfolio diversification; Domestic capital market development; Capital controls | Reserves hoarding | Currency/interest rate derivatives; GDP-indexed debt; Local currency credit lines; Contingent credit lines |

Source: Adapted from Perry (2009, p. 16).

[35] For example, we do not discuss moves towards more flexible exchange rate regimes as a potential vulnerability-reducing strategy (see Edwards and Levy Yeyati, 2005).

[36] Whereas we do not explicitly incorporate coping policy in Equation (1), its role can be thought of as affecting the difference between expected and actual output (and consumption) losses.

[37] The provision of such exceptional financing arguably reduces the financial frictions that influence the degree to which output declines translate into lower consumption (see footnote 29). As noted by Cassimon and Verbeke (2009), the burden-sharing between the country itself and the international community then becomes a key issue.

Second, countries may attempt to work on *prevention*, i.e., impeding external shocks from reaching and contaminating their economies. Linking back to our proposed output vulnerability measure (Equation (1)), prevention can be seen as a strategy of bringing down vulnerability by reducing exposure to shocks. With respect to trade shocks, probably the most prescribed prevention tactic is the diversification of exports. Expanding the range of export products, and to a lesser extent of export partners/markets, has been found to moderate (and possibly even overrule) the growth volatility-increasing effect of trade openness in developing countries, by shielding them from adverse external shocks (Haddad *et al.*, 2013; see also IMF, 2014d).

In a similar vein, capital portfolio diversification, in terms of seeking access to external finance of different types (debt versus equity), currencies, maturities and providers, is assumed to lower countries' exposure to severe capital flow shocks. Caner *et al.* (2009), for example, show that in emerging market countries liability dollarization has typically increased the probability of a sudden stop in capital inflows, while higher FDI inflows have tended to decrease it.[38] However, due to financial market imperfections, developing countries are typically not able to borrow externally in their own currency; neither can they access long-term financing domestically, at least not at favourable interest rates. This is what Eichengreen and Hausmann (1999) have famously dubbed the 'original sin' dilemma and leaves developing countries the choice between currency and maturity mismatches on government (and corporate) balance sheets. Eichengreen *et al.* (2005) show that various measures of original sin are strongly correlated with higher capital flow and output volatility and a lower willingness to accept exchange rate flexibility (another potential shock absorber). Clearly, the development of deep and long-term local currency bond markets is one potential path towards overcoming original sin.[39] A more drastic preventive measure against capital flow shocks is that of imposing capital controls, i.e., regulating more directly the in- and outflow of foreign money. The effectiveness and desirability of capital controls is the subject of an ongoing, animated debate (see e.g., Ostry *et al.*, 2010). Nevertheless, in studying 195 currency crisis episodes in 91 developing countries over 1970-2000, Gupta *et al.* (2007) do find that declines in output were significantly lower if capital controls existed prior to the currency crisis.

Prevention through diversification, rather than disengagement from external finance and trade (which also narrows exposure), would arguably classify as the first-best strategy to reduce the output vulnerability of developing countries, were it not that this is a gradual, longer-term process which can take decades to bear fruits. Countries may need quicker solutions too.

A third strategy is *self-insurance* against external shocks, i.e., saving up surpluses in good times, especially during positive shocks such as commodity booms or capital flow surges, and then employing the accumulated resources when a negative shock hits. Within our theoretical framework such an approach is to be seen as increasing a country's ability to withstand or adjust quickly from negative shocks, i.e., a strategy of building resilience. The hoarding (and deployment) of foreign exchange reserves could well prove helpful as a buffer against external shocks, by attenuating a decrease in vital imports, enabling the implementation of countercyclical fiscal policies, and/or

[38] The latter effect is however insignificant. The robustness of FDI has also been partly discredited by the global crisis (see discussion in Section 2.2.2).

[39] To be sure, the development and deepening of local currency bond markets may have advantages other than 'washing away' original sin or reducing countries' exposure to external shocks, as well as some inherent risks. A more elaborate discussion of the pros and cons of local currency bond markets can be found in Chapter 3 of this dissertation, where we analyse in detail the development of such markets in Sub-Saharan Africa.

supporting the exchange rate in case of a sudden stop in capital inflows.[40] Reserves have traditionally been invested in liquid, low-yielding and low-risk foreign currency assets such as US Treasury bills. Sometimes they are devoted to sovereign wealth funds, entities that are typically managed outside central banks and can take many different shapes (see e.g., IMF, 2008b). One form is that of a stabilisation fund designed to smooth out, in the medium-term, export earnings accumulated during periods of high commodity prices. Alternatively, countries may establish sovereign wealth funds that invest part of (excess) reserves in a wider spectrum of higher-yielding but riskier assets, in view of enhancing returns over longer periods (but at the expense of liquidity).

Self-insurance however comes at a (potentially large) opportunity cost under the form of foregone investment in economic growth and long-term development or a 'cost of carry', generally expressed as the spread between the return on (liquid) reserves assets and the cost of external borrowing. Rodrik (2006), however, finds that reserves accumulation, even if it involves a significant insurance premium, is not irrational for developing countries that face the risk of costly financial crises. Levy Yeyati (2008) adds that, for emerging market countries at least, the cost of self-insurance may be overstated, taking into consideration that an increase in reserves decreases the spread to be paid on the full sovereign debt stock.[41]

Fourth and last, countries may rely on *market insurance* and/or *hedging* mechanisms.[42] The former refers to market-based instruments that allow a country to keep the upside potential of favourable changes in prices or other variables, while reducing the downside risk at the cost of an up-front paid premium; the latter concerns instruments that eliminate downside risk at the expense of losing the upside potential (Abousleiman *et al.*, 2007, pp. 38-39). This fourth category of possible interventions, market-based alternatives to self-insurance, can also be understood as building resilience. Market insurance against external shocks is typically related to the use of options. A developing country whose growth and budget depend heavily on the export of a certain commodity could buy put options that would give it the right (but not the obligation) to sell that commodity at a set minimum price. If the commodity price evolves favourably and exceeds the strike price of the put, the option contact would not be executed and countries would simply enjoy the higher export earnings. In a similar fashion, call options can be used to insure countries against unfavourable price hikes of strategic imports (such as oil or food).[43] The same logic also applies to currency and interest rate options. Typical hedging instruments, on the other hand, are future or forward contracts whereby buyer and seller agree (and are obliged) to exchange an asset at some specified future point

[40] Besides these precautionary motives there are other factors that may explain reserves accumulation in emerging market and low-income countries. We refer to the literature review in Chapter 4 of the dissertation, where we build a model of optimal reserves for a low-income country faced with terms-of-trade shocks.

[41] Others contend that while amassing reserves reduces the vulnerability to shocks for an individual country, if practised on a greater scale (by systemically important emerging market economies), reserves accumulation may well increase global instability, at least under the current global reserves system (see e.g., Stiglitz, 2006). The underlying argument, which invokes the Triffin dilemma under the Bretton-Woods system, is that the reserve currency issuer (nowadays still predominantly the US) will get increasingly into debt by growing demand for safe assets, up to a point where confidence in the reserve currency falters. This of course poses a serious threat to those countries holding the reserves. However, as the crisis has shown, such fears may have been exaggerated (Prasad, 2014).

[42] We limit ourselves to only a few examples out of a wide variety of theoretically possible market insurance and hedging instruments.

[43] Lu and Neftci (2008) show that countries can cut the cost of standard commodity put options by simultaneously selling call options on that commodity (a so-called 'risk reversal' approach), or by adopting 'barrier' option structures, in which options automatically cease to exist if the price of the underlying asset (commodity) hits a pre-determined barrier value.

in time at a price that is fixed today (Hull, 2012).[44] The use of futures and forwards could thus reduce countries' balance-of-payments and budget uncertainty (Abousleiman *et al.*, 2007). Again, hedging can be applied to commodities, currencies or interest rates.

Arguably, indexed debt also falls within the category of market insurance and hedging instruments, having comparable risk-sharing features. GDP-indexed bond issuance would help countries to keep their debt-to-GDP ratios within a narrower range, by automatically reducing debt payments when GDP growth turns out to be lower than projected and increasing those payments when GDP growth develops positively. This could in turn lower the likelihood of debt overhang and debt crises in the country and lessen the need for procyclical (fiscal) policies (Borensztein and Mauro, 2004; Griffith-Jones and Sharma, 2006). Debt indexed to the prices of commodities on which developing countries depend for foreign exchange, or more generally to their terms of trade, are deemed to have similar benefits (Atta-Mensah, 2004). International financial institutions from their side could possibly help countries in insuring/hedging risks by offering (possibly inflation-indexed) local currency-denominated credit (Missale and Bacchiocchi, 2012), or by making their financing contingent on the occurrence of external shocks, for example by means of pre-set trigger values (Martin and Bargawi, 2005).[45]

Once more, it is important to take note of a number of challenges inherent to strategies of market insurance and hedging. Option contracts require the upfront payment of a (possibly sizeable) premium, which may be hard to sell politically, since it is very possible that shocks do not materialise or turn out to be not as severe as expected. Likewise, futures and forwards can offer protection from volatility in export prices but in doing so may exclude countries from enjoying potential (commodity) price booms (Abousleiman *et al.*, 2007). Indexed debt and other contingent financing may suffer from moral hazard (a typical insurance problem) as countries would seem to have an incentive to disregard growth-oriented policies or misrepresent their (GDP growth) statistics; although such behaviour could have reputational costs too (Borensztein and Mauro, 2004). With regards to contingent credit provision, the IMF (2011a) stresses the trade-off between predictability (removing uncertainty about how much financing will become available in case of a shock) and specificity (tailoring that financing to the needs stemming from a shock). Most notably perhaps, the creation of markets for new financial instruments entails considerable first-mover costs and coordination problems, while the management of such instruments also has certain institutional and technical capacity requirements (see Claessens, 2005; Perry, 2009).[46] As a result, many of the derivatives mentioned here are currently not or only restrictedly available for developing (especially low-income) countries, often those that would benefit most from such instruments because of their large exposure to particular shocks.

As is clear from the above, all four approaches to deal with output vulnerability to shocks have their advantages as well as downsides. The different categories and interventions listed should

[44] Futures differ from forwards in that they are typically exchange-traded (rather than over-the-counter), take a more standardised form, and require collateral to be deposited in advance (see Hull, 2012).

[45] As explained by Abousleiman *et al.* (2007), such contingent credit lines are no perfect substitute for purely market-based insurance since they distribute income losses from shocks over time, rather than making income streams independent of shocks. Also, contingent loans need to be repaid *after* a shock has taken place, whereas the cost of insurance is incurred *beforehand*.

[46] Some of the costs derive from the fact that investors may demand large risk premia for instruments that they are unfamiliar with and that are difficult to price. Risk premia on instruments such as GDP-indexed bonds are also greater if investors cannot diversify across countries (preferably with distinct expected growth trajectories) (see Borensztein and Mauro, 2004).

however not be seen as standing in isolation from each other. Important substitution effects and complementarities are not to be overlooked. For example, market insurance, by reducing vulnerability to shocks, may well lead a country government to favour 'enhancing' reforms aimed at productivity growth (such as increased openness) over 'buffering' reforms (such as implementing capital controls or reserves accumulation) (Cordella and Levy Yeyati, 2005).[47] On the other hand, engaging in preventive measures such as export or capital portfolio diversification can help bring down the costs of market insurance for a country (Perry, 2009).

The aptness of different strategies to deal with vulnerability, or a mix thereof, depends to a large extent on three factors: the nature of shocks, the country's unique characteristics, and the envisioned time horizon. First, coping may dominate other strategies in case of rare and mild shocks, while high-frequency, severe shock events would probably be best addressed by prevention. If shocks are relatively rare but costly, as those associated with the global crisis arguably were, the balance of optimal responses tilts more towards market insurance and hedging, according to Perry (2009). Second, what works for one country is not necessarily helpful for another. Indeed, academics and development professionals have come a long way to denounce the one-size-fits-all logic underlying the structural adjustment programmes (SAPs) advocated by the IMF and the World Bank in the 1980s and early 1990s. Countries differ in their resource endowments, economic and institutional structures, technical capabilities and political configurations, which all have implications for the desirability and feasibility of certain interventions. Third, the best choice of strategy is not fixed but evolves over time. In the very short run, coping with the aftermath of a shock may be the only possible strategy. Self- and market-based insurance (and hedging) become available and potentially more attractive options in the medium term. Only over a longer period of time, (first-best) preventive measures such as diversification and local capital market development may pay off.

Taking the foregoing into consideration, we argue for a multi-layered approach, combining the different vulnerability-reducing strategies in a dynamic manner and with attention to country specifics. As our analysis has indicated, there are roles to play for both developing countries themselves and international financial institutions. In the next section, we provide (largely illustrative) evidence on the course followed by developing countries and multilateral development banks and the IMF, respectively, in dealing with output vulnerability to external shocks, structured along Perry (2009)'s four-category taxonomy of strategies. Our focus will be on the years leading up to and of the global crisis. We do not attempt to give a comprehensive overview of each and every possible intervention and acknowledge that much more in-depth research is needed beyond what we present here.[48] Rather, our short exposition will try to highlight a number of notable achievements as well as locate some existing sore points in national and international attempts to reduce the vulnerability of developing countries' output to shocks.

[47] This is because the former type of reforms pays off relatively more in good times and relatively less in bad times, while the latter type of reforms does precisely the opposite (Cordella and Levy Yeyati, 2005).

[48] Chapters 3 and 4 of this dissertation will look deeper into issues surrounding local currency bond market development and self-insurance through reserves accumulation.

## 4. How vulnerability has been dealt with...

### 4.1. …by countries themselves

#### *4.1.1. Prevention*

Developing countries' overall success with respect to prevention, i.e., reducing vulnerability through limiting exposure to external shocks of various kinds, has been limited, as witnessed by the rapid transmission of the crisis through channels of trade and private capital flows (Section 2.2). Many, especially low-income, developing countries still depend for their exports on a small, undiversified basket of commodities and/or low value-added manufactures, most of which are very sensitive to overall market sentiment (Papageorgiou and Spatafora, 2012). Between 2000 and 2008, Herfindahl export concentration indices only slightly improved in a number of South and South-East Asian economies and even worsened in most Central African and South American countries (UNCTAD, 2009, pp. 200-207). Of course, there have been some laudable exceptions to these general trends. Countries like Kenya and Chile have gradually developed successful non-traditional export (NTE) sectors, such as the cut flower and seafood industry, respectively (ODI, 2010). Focusing on Latin America, da Costa Neto and Romeu (2011) find that export product diversification, more so than export partner diversification, attenuated the 2008Q3-2009Q1 collapse of export values.

Diversification of trade partners has also been a moderately slow process, although there have been some noticeable shifts. In 2008, 46.7% of total developing country export value was destined for traditional developed economies, compared to 50.9% in 2005 and 54.1% in 1995, primarily because of declining export shares to the US and Japan. Concurrently, between 1995 and 2008 developing country exports to China increased from 5.8% to 9.2% of total export value. African export shares to China (Asia) grew much faster, from 0.9% to 9.3% (10.8% to 19.9%) (UNCTAD, 2009, pp. 80-85). Some claim that trade links with fast-growing China and India helped low-income African countries such as Zambia, the DR Congo and Sudan in avoiding worst-case scenarios during the crisis (ODI, 2010). It could however be argued that while China's (and other emerging market economies') thirst for raw materials may have benefited poor developing countries in diversifying their export markets, it has not supported the latter in moving up the global value chain, thus potentially locking in their dependence on volatile and crisis-prone commodity exports (The Economist, 2010).

Prevention through capital portfolio diversification has been a more promising, but insufficient and uneven process thus far. *De facto* international financial integration, as measured by the ratio of the sum of all foreign financial assets and liabilities to GDP, has gradually increased for developing countries since the 1970s, but remains well below the financial integration of advanced economies (see Lane and Milesi-Ferretti, 2007). On the liability side, the available figures indicate that the share of FDI in developing countries' total stock of external liabilities has grown tremendously since the 1990s, more so even in low-income countries (from about 11% in 1990 to 50% in 2011) than in emerging market economies (from 16% to 47%). The mirror image of this has been a sharp decline in the share of debt in total liabilities, whereas the share of portfolio equity has somewhat increased (from a very low base) but with strong fluctuations over time.[49] The growing diversification of liabilities in developing countries towards FDI (which is also evident from the flows

[49] Our observations and calculations are based on the extended and updated version of the External Wealth of Nations (EWN) Mark II database (1970-2011) by Lane and Milesi-Ferretti (2007). The classification of low-income and emerging market countries is the same as in Figure 1.

in Figure 3) seems a positive evolution from a vulnerability perspective, but is certainly no magic bullet (see Section 2.2.2). ODI (2010) again suggests that emerging market FDI may have served as a more crisis-robust alternative to Western sources of investment in a number of low-income countries.

From World Bank (2011) figures, which provide greater detail on outstanding external debt, one can observe that short-term debt had been gaining relative importance within total external debt stocks of developing countries in the years leading up to the crisis (from about 13% in 2000 to 23% in 2007). Also, the lion share (about 90%) of developing countries' public and publicly guaranteed external debt is shown to remain denominated in one of three main currencies, primarily US dollar (around 66% in 2009) and to a lesser extent euro (15%) and yen (10%).

To reduce the maturity and currency risks on their balance sheets, developing countries, emerging market economies in particular, have undertaken efforts to develop long-term domestic capital markets where they can borrow in local currency (Perry, 2009). In fact, a report by the BIS (2007) finds that in large emerging market economies, and in emerging Asia specifically, net domestic issuance of bonds and notes (mostly denominated in local currency) greatly exceeded that of international (foreign currency) securities in the decade prior to the global crisis.[50] This important development is acknowledged by Hausmann and Panizza (2011), who further show that the majority of these domestic bonds is fixed-rate, rather than floating-rate, inflation-indexed or exchange rate-indexed and that the average original maturity of bonds is increasing. Making abstraction of regional disparities, this points to an overall reduction in the domestic aspect of original sin. Hausmann and Panizza (2011) are, however, less sanguine about international original sin. They register a rather modest increase between 2001 and 2008 in the value share of local currency bonds issued internationally by a sample of 65 developing countries. A lack of data prohibits a comprehensive analysis of the importance of foreign investment in domestic bond markets, an alternative course to reducing original sin on the international front. Nevertheless, using US Treasury survey data, Hausmann and Panizza (2011) estimate that in 2007 no more than 10% of the total US$1.6 trillion in bonds issued by developing countries (domestically *and* internationally) and held by US investors was denominated in the issuer's currency.

Several other qualifications apply to the observed development of local currency bond markets. First and most importantly, local currency bond markets are still predominantly an emerging market country matter. Although small steps are being made, very few low-income countries have developed deep and liquid domestic capital markets of any significance.[51] Second, in their study of emerging economies' domestic bond markets, Didier and Schmukler (2014) find limited secondary market liquidity and an underdevelopment of the corporate segment relative to public sector bonds. Third, despite their potential to operate as a 'spare tyre' to sudden stops in external capital flows, some local currency bond markets, including in Brazil, Indonesia, Mexico, Russia and Turkey, did run into problems during the global crisis (albeit only temporarily), as witnessed by fast-rising yields. Turner (2012) ascribes this to a flight of foreign investors and local subsidiaries of foreign banks for which these local currency bonds, as a relatively new asset class, had insufficient international 'collateral capacity' during the crisis (see also Jaramillo and Weber, 2013).

[50] One remarkable initiative, aimed at broadening the investor base and overcoming other impediments to local and regional capital market development in Asia, is the Asian Bond Fund, conceived in 2005 by a number of East Asian and Pacific central banks (see Packer and Remolona, 2012).

[51] See Chapter 3 of this dissertation for a detailed overview of the state of Sub-Saharan African local currency bond markets.

Diversification of the domestic investor base away from banks, which are now the dominant class of local currency bond holders in most developing countries, could further reduce exposure to external shocks.

The use of capital controls, another preventive strategy, has had some success in altering the maturity structure and composition of capital portfolios, often without significantly affecting the overall volume of inflows however. Two oft-cited 'success' cases are the implementation of an unremunerated reserve requirement in Chile from 1991 to 1998 and the Malaysian capital controls in the wake of the East Asian crisis (de Gregorio *et al.*, 2000; Goh, 2005). An overview study by Binici *et al.* (2010) indicates that countries applying capital controls are usually better in stemming capital outflows than in preventing inflows, and that the effectiveness of controls differs across asset categories and country income levels.

General *de jure* measures of financial openness, such as the KAOPEN index constructed by Chinn and Ito (2006) and updated to 2012, demonstrate that while the long-term trend towards greater capital account openness continued, several countries, mostly in Latin America, did increase restrictions on cross-border financial transactions between 2008 and 2010. Ostry *et al.* (2010) suggest that the presence of capital controls on debt inflows was associated with avoiding the worst output drops during the global crisis, although the evidence does not allow making causal claims. Blundell-Wignall and Roulet (2013) argue that these results are indeed not robust and find instead that controls on debt inflows were useful before the crisis, to resist exchange rate appreciation, but harmed GDP growth during the crisis.

#### *4.1.2. Market insurance and hedging*

While global derivative markets for insurance and hedging instruments have grown exponentially in recent years (before the crisis at least), the participation of developing countries is believed to be marginal but increasing (Perry, 2009). Based on data from the BIS Triennial Central Bank Survey and commercial sources, Ehlers and Packer (2013) estimate that, as of April 2013 and across 32 emerging market economies, net average daily turnover of foreign exchange, interest rate and equity-linked derivatives in emerging markets' own jurisdictions amounted to US$1.1 trillion or about 4% of those countries' GDP, compared to US$10.3 trillion in advanced economies (24% of their GDP). Their results indicate that over-the-counter derivatives trading is growing while exchange-based trading is in decline, and that the former is dominated by foreign exchange derivatives. The 'emerging markets' sample of Ehlers and Packer (2013) however includes high-income Korea and financial centres such as Hong Kong and Singapore (which the IMF and we, in this paper, classify as 'advanced' rather than as 'developing'), that account for large shares in turnover totals. Detailed statistics for a larger group of developing countries are, to our knowledge, not available.

Similarly, there is little data (publicly) available on developing countries' use of commodity derivatives. In fact, large markets exist for insurance or hedging against price movements of many different commodities, both in the form of centralised exchanges and over-the-counter contracts. But, as pointed out by the IMF (2011a), major exchanges are not required to disclose the identity and individual positions of investors. Neither do sovereigns typically report on their insurance or hedging activities, out of market sensitivity concerns. Known examples of developing country experience with commodity derivatives include Panama's hedging of fuel oil import prices, Mexico's hedging of oil export prices and Ghana's hedging of oil imports and cocoa exports. Overall, however, the IMF (2011a) asserts that market insurance and hedging of commodity risks is limited in developing, and

especially low-income, countries. As noted before, political economy problems associated with paying high upfront insurance fees or foregoing the upside potential from favourable price evolutions have surely been a restraining factor here. Beyond oil and some agricultural derivatives (like for maize), most existing commodity-related financial products also have relatively short maturities and/or high costs (Abousleiman *et al.*, 2007; Perry, 2009). Furthermore, local commodity prices in developing countries are often only imperfectly correlated with the prices of exchange-traded commodities or indices (due to differences in commodity varieties or grades). This 'basis risk' again reduces the attractiveness of existing derivative products (IMF, 2011a).

Although, as far as we know, no aggregate numbers exist on debt indexed to GDP or commodity prices in developing countries, there are a few earlier instances that have been documented. Most indexed debt issuances took place in the wake of debt restructuring processes that followed financial crises and sovereign defaults in emerging market economies. Borensztein and Mauro (2004) and Griffith-Jones and Sharma (2006) report on the Argentinean experience with GDP warrants in 2005 and a number of Brady bonds with 'value recovery rights' linked to GDP (Bulgaria, Bosnia and Herzegovina, and Costa Rica) or oil prices (Mexico, Venezuela and Nigeria) in the 1990s. The design of these instruments was often severely flawed, with complex and inappropriate indexation formulas, which hampered liquidity (in addition to small market sizes). The IMF (2011a) adds that low-income countries may have insufficiently timely and credible GDP data to support the issuance of GDP-indexed bonds. Arguably the problem of basis risk also applies to commodity price-indexed debt, at least if the indexing would be based on internationally determined commodity prices.

### *4.1.3. Self-insurance*

Unlike prevention or market insurance and hedging, the strategy of self-insurance through reserves hoarding has proven popular with developing countries, especially from the 1990s onwards. After a series of major financial crises, East Asian, Latin American and a number of oil-exporting countries began amassing war chests of foreign exchange reserves as a buffer against possible future shocks, by running current account surpluses or by international borrowing. According to WDI figures on around 160 countries, the total stock of reserves (excluding gold holdings) stood at almost US$11 trillion in 2012, a thirteen-fold increase (in nominal terms) from 1990. Most of this enormous increase can be ascribed to reserves accumulation by emerging market economies. China has over time become the undisputed champion, accounting for US$3.3 trillion or roughly 30% of global reserves in 2012. Relative to their GDP, both emerging market and low-income countries hold much more reserves, on average, than advanced economies, and these differences have grown larger over time.[52]

Several studies have examined the use of reserves by developing countries during the global crisis and its impacts on economic performance. Aizenman and Sun (2012) and Aizenman and Hutchison (2012) find that only a limited number of emerging market countries significantly depleted their international reserves as part of their crisis adjustment, and that even among those countries the pace of depletion tailed off after a few months. They argue that, uncertain about the duration and depth of the crisis, emerging market economies exhibited a 'fear of losing reserves' and

[52] These trends in reserves accumulation, as well as the underlying factors, are examined more in detail in Chapter 4 of the dissertation. Again and as Chapter 4 explains, there are other, non-precautionary (non-self-insurance) motives too that explain the remarkable surge in global reserves.

preferred to adjust by exchange rate depreciation instead. Dominguez (2012) and Dominguez *et al.* (2012) use finer-grained data of countries subscribing to the IMF's Special Data Dissemination (SDDS) to construct measures of actively managed reserves, net of interest income and valuation changes. They show that many emerging market countries *did* actively draw down their reserves during the crisis and that doing so was positively associated with post-crisis recovery in GDP growth, as was the overall pre-crisis level of reserves. Likewise, for a much larger sample including many low-income countries, Bussière *et al.* (2015) present evidence suggesting a positive, causal link between pre-crisis reserves levels and GDP growth during the crisis (see also Crispolti *et al.*, 2013), especially in countries with a relatively closed capital account. In addition, they document that depleted reserves stocks were quickly rebuilt after the crisis.

Since the holding of reserves carries significant opportunity costs, a growing part has been channelled into sovereign wealth funds, stand-alone government investment vehicles that hold more diversified global portfolios of higher-yielding assets. As of January 2015, total assets under management of developing country sovereign wealth funds are estimated by the Sovereign Wealth Institute at around US$4.9 trillion, of which about two thirds originate from oil or gas revenues.[53] Sovereign wealth funds are very heterogeneous in terms of their sources of finance, governance structure and overall objectives, which in turn influences their investment behaviour. Of course, the extent to which they can perform a self-insurance function similar to traditional reserves largely depends on the liquidity and risk profile of assets. Kunzel *et al.* (2011) show that sovereign wealth funds themselves were affected by the crisis and that this has sparked debates about their strategic asset allocations. Whereas before the crisis, advanced economies, and the US in particular, were the main recipients of sovereign wealth funds' investments, attention may now gradually turn towards other developing countries' assets (Curto, 2010). Gelb *et al.* (2014) note a trend towards including domestic investment as part of the mandate of sovereign wealth funds, which could pose problems of governance and may not be advisable if macroeconomic stabilisation is the main objective.

Another notable evolution has been the increasing regional cooperation in reserves management. One example is the Chiang Mai Initiative (CMI), an arrangement of reserves pooling and bilateral liquidity swaps initiated in 2000 by the ASEAN+3 (see Sussangkarn, 2011). In 2007 the CMI was converted to the Chiang Mai Initiative Multilateralization (CMIM), which more closely resembles a regional safety net (but requires countries to have an active IMF programme to be eligible for larger tranches of balance-of-payments support). However, when the global crisis hit, the CMIM was quickly discarded and member countries instead used their own reserves and/or resorted to bilateral central bank swap lines with the US, Japan, China and Australia. A second initiative are the efforts by the Latin American Reserves Fund (FLAR) to improve the return on investments made with the pooled and individual reserves of its member states Bolivia, Colombia, Costa Rica, Ecuador, Peru, Uruguay and Venezuela (Rosero, 2014).

The important role reserves of most developing countries have played in countering the global crisis, and in self-insuring against shocks more generally, does not mean that this instrument has been available to all. Indeed, some low-income countries have not been able to translate high export prices into significant stocks of reserves. In the DR Congo, for example, despite favourable

[53] This estimate is based on data from 29 emerging market economies and seven low-income countries (Ghana, Kiribati, Mauritania, Mongolia, Nigeria, Senegal and Vietnam) and excludes traditional reserves holdings by central banks. It is however only a very rough approximation, since several sovereign wealth funds do not report publicly on the size of their assets and market values of assets fluctuate daily. For individual sovereign wealth fund asset holdings, see http://www.swfinstitute.org/fund-rankings.

prices for its main commodity exports (copper, cobalt, gold, diamond and oil) in the years prior to the crisis, the level of reserves had always been structurally low, averaging out at the equivalent of one week of imports in September 2008. When the global crisis gained momentum, reserves evaporated to less than a day (literally just a few hours) of import coverage, leaving the country no choice but to reduce vital imports and seek external assistance (Cassimon and Verbeke, 2009; Kabuya Kalala and Cassimon, 2010). This example, while certainly extreme, is not an isolated case (see e.g., ODI, 2010). Reserves accumulation and management as a self-insurance strategy for low-income countries, which have typically limited access to international capital markets but are often very vulnerable to current account shocks, therefore deserves more attention in future research.

#### *4.1.4. Coping*

On the whole, developing countries entered the global crisis with relatively strong positions. In the years prior to the crisis they enjoyed favourable market conditions and major debt relief (low-income countries in particular), improved their macroeconomic management and policies, and implemented structural reforms (IMF, 2010b, 2010a; van Doorn *et al.*, 2010). As such, most developing countries, including low-income countries, were able to pursue countercyclical fiscal and monetary policies, similar to the stimulus packages and related measures implemented by advanced economies (see e.g., te Velde, 2009; ILO and World Bank, 2012).[54] In Sub-Saharan Africa, Kenya, Tanzania and Uganda, among others, expanded government spending and eased monetary policy to aid crisis recovery (Kasekende *et al.*, 2010). In Cambodia, Bangladesh and Bolivia, for example, public works and other social transfer programmes were initiated (ODI, 2010). The countercyclicality of developing countries' policy responses to the global crisis signifies somewhat of a break with the past (Kaminsky *et al.*, 2005; Ilzetzki and Végh, 2008), especially for Sub-Saharan Africa where government expenditures have on average been more procyclical than in other developing regions (Lledó *et al.*, 2011).

Nevertheless, not all developing countries have been equally able to react countercyclically to the global crisis. Fiscal space was already heavily constrained before the crisis in low-income countries such as (again) the DR Congo, Zambia and Ghana, ruling out expansionary policies (Kasekende *et al.*, 2010; ODI, 2010). These countries were forced to resort to adverse fiscal and balance-of-payments adjustments, slowing down recovery and impacting their citizens. Facing a shrinking tax base, the Congolese government imposed new taxes on the private sector and public enterprises over the course of 2009. Meanwhile, pro-poor expenditures on health, education and social protection were reduced as a percentage of total government spending (Cassimon and Verbeke, 2009). This example reinforces the message that, in coping with a crisis, policymakers often face a tension between 'offsetting adverse short-term impacts and preserving incentives for economic recovery and future growth' (Paci *et al.*, 2012, p. 107). Moreover, in the countries that did respond aggressively to the crisis, macroeconomic space to cope with further shocks diminished (van Doorn *et al.*, 2010). The IMF (2014a) asserted that, as of end 2014, low-income countries were less well-prepared to handle new shocks than prior to the global crisis, largely due to weaker fiscal positions (itself in part a legacy of the crisis).

[54] Frankel *et al.* (2013), for example, argue that improvements in overall institutional quality enabled many developing countries to shift from a procyclical to a countercyclical fiscal policy stance between 2000 and 2009.

Having dwelled on each of the different approaches to deal with vulnerability to external shocks from the perspective of developing countries themselves, we now turn to an examination of the progress made by multilateral development banks and the IMF in this area.

### 4.2. ...by multilateral development banks and the IMF

#### *4.2.1. Prevention*

Recent years have seen laudable efforts by the IMF, World Bank and regional development banks in assisting countries with their own preventive measures. Of particular interest is the Global Emerging Markets Local Currency Bond (GEMLOC) programme, a World Bank-sponsored facility created in May 2008 to increase the investability of local currency bonds issued by emerging market governments.[55] Under the initiative the World Bank offers a range of advisory services to bond issuers; manages (together with Markit, a financial information services provider) the GEMX index, a benchmark tool for local currency bonds; and assists in promoting domestic and foreign investment in bonds (through private investment management firm PIMCO). Initially only about 20 major emerging market economies were considered for the initiative, all of which already had relatively developed local currency bond markets (Perry, 2009). At the moment of writing there are 34 countries eligible for GEMLOC's advisory services, including low-income Kenya, Nigeria and Vietnam. Because eligibility for these services requires local currency bond markets with a total market capitalisation of at least US$3 billion and five bonds with a minimum outstanding size of US$100 million, they may not become available to many other low-income countries anytime soon. GEMLOC is supplemented by the Efficient Securities Markets Institutional Development (ESMID) programme, which the World Bank operates since 2007 together with its private sector lending arm, the International Finance Corporation (IFC).[56] This programme, with a focus on corporate bond markets, aims primarily at providing financial, legal and regulatory advice and capacity building and training of market participants. So far, ESMID has targeted five low-income countries in Africa (Kenya, Tanzania, Uganda, Rwanda and Nigeria) and two emerging market economies in Latin America (Colombia and Peru); it seeks to expand its activities to other countries and different regions.

Since 2002, the IFC has also issued its own (triple A-rated) bonds denominated in developing country currencies around the world, including in Peru (2004 'Inca' bond), Armenia (2013 'Sevan' bond), and Rwanda (2014 'Umuganda' bond). Often the IFC has been the first non-resident issuer in the respective domestic bond markets, which could serve as an example for other corporate issues. The International Bank for Reconstruction and Development (IBRD), the non-concessional window of the World Bank that lends to emerging market and creditworthy low-income country governments, has moreover engaged in selling bonds in so-called 'non-core' currencies.[57] While most of these bonds have been in key emerging market currencies such as South African rand or Turkish lira, since 2011 some have been denominated in the currencies of low-income countries, including Nigerian naira, Zambian kwacha, Ugandan shilling and Ghanaian cedi.

[55] For more details, see http://www.gemloc.org.
[56] For more details, see http://www.ifc.org/esmid.
[57] These IBRD local currency bonds are typically Eurobonds, listed in Luxembourg and governed by New York State or English law, rather than domestic or global bonds (i.e., bonds offered on both domestic and international markets). See http://treasury.worldbank.org/cmd/htm/worldbank_bonds.html.

World Bank efforts to promote local currency bond market development complement the various initiatives that have been taken by regional development banks, such as, for example, the Asian Development Bank's support to the Asian Bond Fund; the Inter-American Development Bank's involvement in local currency bond issuances of a number of countries in the region; and the African Development Bank's offshore bond issuance programme and African Financial Markets Initiative (AFMI) (which includes a database, bond fund and benchmark index). Most of these programmes had been operational well before the global crisis (see Wolff-Hamacher, 2007). Nevertheless, it seems as if the crisis has spurred international financial institutions to step up their efforts.[58]

Another point worth noting is the altered position of the IMF on the use of capital controls. Whereas capital controls were long outlawed in the IMF's promotion of free trade and capital movements in developing countries, a 2010 IMF Staff Position Note, prompted by the global crisis, acknowledged that '[f]or both macroeconomic and prudential reasons ...there may be circumstances in which capital controls are a legitimate component of the policy response to surges in capital inflows' (Ostry *et al.*, 2010, p. 15). This position has been echoed in follow-up work and built upon to form the IMF's institutional view, endorsed by its Executive Board (see IMF, 2012). Although cautiously worded, the more accommodating stance of the IMF towards controls is important as it arguably broadens developing countries' future policy space in dealing with their vulnerability to shocks.

#### *4.2.2. Market insurance and hedging*

Progress on the provision by international financial institutions of instruments to assist developing countries with insurance and hedging against external shocks has so far been slow and biased towards larger emerging market economies. We look at three types of interventions in more detail: local currency lending, derivative products, and contingent credit facilities.

First of all, direct local currency lending to developing countries, to help the latter eliminate part of their currency mismatches, has constituted only a very small percentage of total loans disbursed by international financial institutions (see Perry, 2009). With respect to the World Bank, Abousleiman *et al.* (2007) note that this is a legacy of the past, when the Bank was operating in a world system of fixed exchange rates, and reflects institutional inertia. The International Bank of Reconstruction and Development (IBRD)'s articles of agreement prohibit it from holding open currency positions on its balance sheet. Therefore, if it chooses to make local currency loans, these need to be fully backed by borrowings in the same currency or hedged using currency swaps. So some of the bond issuances mentioned before (Section 4.2.1) may have more to do with the IBRD's own (currency) risk management and with raising funds in a cost-effective way (given the dominance of certain non-core currencies) than with helping to establish local currency bond markets (Wolff-Hamacher, 2007). The prohibition of retaining currency risk reduces the appeal of local currency lending for the IBRD, and essentially excludes countries which have not yet relatively deep local currency bond markets (where IBRD bond issuance is more cumbersome) or whose currencies cannot be swapped easily; these are likely to be the countries that would benefit most from local

[58] In November 2011, the G20 issued its *Action Plan to Support the Development of Local Currency Bond Markets*, in which ample reference was made to the global crisis. Annex 5 of the Action Plan provides a detailed overview of the initiatives taken by the international financial institutions listed here and others (BIS, OECD and European Bank for Reconstruction and Development). See http://www.g20.utoronto.ca/2011/2011-finance-action-plan-currency-111015-en.pdf.

currency lending (Perry, 2009).[59] Restrictions on Inter-American Development Bank, Asian Development Bank and African Development Bank local currency lending are very similar, in spite of some local currency lending initiatives recently initiated by these organisations.[60] The IMF, for its part, does not engage in local currency lending.

Second, multilateral development banks do offer possibilities for country insurance and hedging with derivatives. Through its Flexible Loan products, the IBRD allows countries to tailor their repayment terms, such as grace period, maturity and amortisation schedule, beforehand and to use risk management tools such as currency and interest rate conversion options (which can be executed at a certain transaction fee) embedded in these loans.[61] Currency (and interest rate) swaps can also be accessed on a stand-alone basis by signing a master derivatives agreement with the IBRD.[62] Again, however, the availability of these instruments is largely conditional on the existence of an already sufficiently liquid swap market in the desired local currency.

A promising development is that of currency risk diversification through global pooling as practiced, for example, through The Currency Exchange Fund (TCX), an initiative launched by the Netherlands Development Finance Company (FMO) and fully operational since February 2008.[63] TCX is a special-purpose fund that provides flexible, medium- to long-term cross-currency swaps. Rather than perfectly matching its own currency exposures, TCX retains the currency risk on its balance sheet and attempts to achieve risk diversification by holding a wide, global basket of currencies. According to its annual reports, TCX lost a significant part of its shareholder value following the Lehman collapse, when most developing country currencies depreciated against the US dollar, but recovered relatively quickly. As of end December 2014, TCX had a total outstanding portfolio of US$1.3 billion in 48 currencies, many of them pertaining to low-income countries. Participating as shareholders in TCX (or similar global pooling arrangements), as the African Development Bank, Inter-American Development Bank and IFC already do, development banks can offload some of the currency risk which they are not permitted to retain themselves. It is, however, not clear to what extent different organisations have made use of this possibility.

Third, there has been some reluctance from international financial institutions to provide contingent financing facilities under the form of credits (let alone grants) that would be automatically disbursed in the event of a shock, without any additional conditionality. The IMF, which arguably qualifies as the natural candidate for such international safety net-type support because of its mandate and large capital base (Fischer, 1999; Cordella and Levy Yeyati, 2006), attempted a first step in this direction when it established the Contingent Credit Line (CCL) in the spring of 1999. Due to a

[59] One could of course argue that, because of the triple-A credit rating of international financial institutions, financial intermediation (i.e., onlending of bond proceeds) by an organisation like the IBRD may be beneficial (cheaper) even for developing countries that can already borrow directly in local currency in domestic or international markets. Abousleiman *et al.* (2007) however find that the pricing advantage of international financial institutions may be limited for local currency bonds (where credit risk is typically perceived to be less important than for foreign currency bonds).

[60] More details about these restrictions can be found on the respective institutions' websites (typically under the 'risk management' sections).

[61] More details are available from the World Bank Treasury's website; see http://treasury.worldbank.org/bdm/htm/financing.html. The major regional development banks offer similar financial products.

[62] Since 1999, the IBRD also offers commodity swaps on a case-by case basis. Abousleiman *et al.* (2007) report that these had not yet been used by IBRD clients. We do not know of any recent experiences with IBRD-provided commodity swaps.

[63] See http://www.tcxfund.com.

lack of automaticity and other design flaws, the CCL remained unused for years until it was abandoned in November 2003 (Abousleiman *et al.*, 2007). Only in March 2009, in response to the crisis, the IMF set up a new Flexible Credit Line (FCL), with the intention of giving countries with strong economic fundamentals and a proven track record upfront access to credit on which they can draw unconditionally and at their own discretion.[64] The FCL requires that countries do not yet experience balance-of-payments problems and have sound public finances at the moment of application. So far only Mexico, Poland and Colombia have entered into FCL arrangements and none of them have drawn upon the available resources. In August 2010 the IMF also introduced the Precautionary Credit Line, which was later broadened and rebaptised the Precautionary and Liquidity Line (PLL). The PLL applies less stringent *ex ante* qualification criteria than the FCL, but requires commitment of the recipient country to policies aimed at addressing problems identified during qualification; it has been used by Macedonia (which actually drew down part of it) and Morocco. Other IMF facilities that arguably incorporate some elements of contingent financing are the Rapid Financing Instrument (RFI) and Rapid Credit Facility (RCF) for low-income (PRGT-eligible) countries introduced in 2010, which both provide low-access, rapid financial assistance to countries facing urgent balance-of-payments needs (including those arising as the result of an external shock) without the requirement of a full-fledged IMF programme.

It should be noted, however, that all of the above IMF instruments fall short of genuine shock-contingent financing, which would be certain, involve automatic/immediate disbursements, and come without any *ex post* conditionality (cf. Cordella and Levy Yeyati, 2006). Access to the RFI and RCF is rather limited (in terms of size of the support) and determined on a case-by-case basis, taking into account the specific balance-of-payments needs and strength of macroeconomic policies. Also, whereas conditionality is reduced, countries are still expected to cooperate with the IMF in attempting to solve their balance-of-payments difficulties and to propose a general policy plan when requesting RFI/RCF support. Similarly, the PLL involves (targeted) *ex post* conditionality. Even the FCL, which bans *ex post* conditionality completely and probably comes closest to true contingent financing, is not available on a permanent basis but requires periodic reviewing of countries' qualification subject to IMF Executive Board approval. This introduces uncertainty, especially since not all *ex ante* qualification criteria (of the FCL and PLL) are equally transparent (see IMF, 2014c). Moreover, because of the stringency of the qualification criteria, the FCL is only available for the very best performers in terms of fundamentals and previous policy implementation, i.e., the most established of emerging market economies. The limited take up of these instruments further suggests problems associated with the (political and economic) stigma of requesting IMF financing; something which has been confirmed in a survey among country authorities (IMF, 2014c).[65] As proposed by Cordella and Levy Yeyati (2006), 'signalling' problems like these may be avoided by rendering eligibility for an instrument like the FCL or PLL automatic, i.e., without the need for the country in question to make the first move and demand to be considered for the facility.

Within the World Bank, the Deferred Drawdown Option (DDO) on the IBRD's Development Policy Loans bears some resemblance with contingent financing. This DDO, instituted in 2001 and revamped in 2008 (because of initial problems related to pricing and slow disbursement) gives the borrowing country the possibility of deferring disbursements of the underlying loan up to three

[64] More information on the different IMF instruments mentioned here is available from http://www.imf.org/external/np/exr/facts/howlend.htm.

[65] For the same and additional reasons, these instruments are also imperfect substitutes for countries' self-accumulated reserves. See the discussion in Chapter 4 of this dissertation.

years, using the credit when most needed. Colombia and Indonesia are two countries that benefitted from the DDO in 2009. Some regional development banks have experimented with or proposed comparable instruments.

Nonetheless, it seems fair to conclude that the principles of contingent financing are not at all mainstreamed into the lending practices of international financial institutions and, more importantly, are practically unavailable for low-income developing countries.

### *4.2.3. Coping*[66]

As in the case of countries themselves, *ex post* coping has traditionally been the most prominent strategy of international financial institutions in handling country vulnerability to external shocks. Unlike in the case of bilateral aid (see Section 2.2.4), one would imagine multilateral support to be distributed countercyclically to recipient countries' output (as multilateral donors are not, or at least less susceptible to business cycles of their own). However, there seems to be serious doubt on whether such expected countercyclicality has always materialised in practice. Calculating correlations between the cyclical components of GDP and multilateral development bank disbursements for sample periods up to 2006, Perry (2009) finds that, aggregated at the regional level, multilateral lending has tended to be procyclical more often than countercyclical, except during subperiods of deep and prolonged crisis (such as the East Asian financial crisis), when development banks are persuaded by the IMF to join in.[67] In line with these last findings, international financial institutions staged a forceful response once the global crisis started to engulf developing countries.

The IMF in particular faced a sharp increase in the demand for its resources.[68] Between May 2008 and May 2009 (FY2009) a record level of 65.8 billion in Special Drawing Rights[69] (SDRs) was approved to 15 member countries through the IMF's non-concessional lending facilities.[70] Access to SDR1.1 billion in new concessional loans and loan augmentations was granted to 25 low-income countries. FY2010 saw another SDR77.6 billion and SDR2.2 billion committed to non-concessional and concessional arrangements, respectively.[71] In April 2009 the G20 further agreed to enhance the IMF's financial capacity, with commitments to triple its non-concessional lending resources, from a pre-crisis US$250 billion to US$750 billion, and double the size of its concessional support to low-income countries. In addition, about US$100 billion worth of SDR allocations, part of a general US$250 billion liquidity injection, went to developing countries (of which US$18 billion to low-income countries) in August 2009.

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[66] Much of the information and all the figures in this section have been extracted from the annual reports and websites of the respective organisations.

[67] Standard IMF lending in itself, which constitutes short-term balance-of-payments support, can safely be considered countercyclical (almost by definition).

[68] Critics have dubbed the IMF 'the great winner of the global crisis' as the strong downward trend in its loan portfolio was suddenly reversed and the organisation was put at the centre stage of crisis response (Van Waeyenberge *et al.*, 2010).

[69] Special Drawing Rights or SDRs serve as the unit of account of the IMF. Their value is determined by a basket of currencies. End April 2009, SDR1 was approximately equal to US$1.5.

[70] This SDR65.8 billion includes an SDR31.5 billion FCL arrangement with Mexico (which it did not draw upon, see Section 4.2.2). The bulk of the rest of the funds went to Ukraine and Hungary.

[71] The SDR77.6 billion of non-concessional support again includes (an extension of) the Mexican FCL as well as (unused) FCLs to Poland (SDR13.7 billion) and Columbia (SDR7 billion). Romania accounted for much of the remainder.

At the same time, the IMF has been in a (ongoing) process of revising the design of its lending facilities, aimed at enhancing flexibility for borrowing countries and reducing conditionality. The Exogenous Shock Facility (ESF), for example, established in 2006 and expanded with a medium-term High Access Component (ESF-HAC) in 2008, was set up with the purpose of giving timely support, without too many burdensome preconditions, to low-income countries facing sudden exogenous shocks. Under the ESF, SDR336 million was directed to six countries that were particularly hard hit by the crisis in FY2009 and SDR815 million to 11 countries in FY2010.[72] The IMF further agreed to charge zero interest on all concessional lending through end 2014.

Multilateral development banks were also quick in assisting developing countries financially in coping with the global crisis, although their core mandates remain to provide longer-term development finance rather than emergency support. First, the World Bank Group committed a total of US$58.8 billion in loans, grants, equity investments and guarantees to public and private sectors in member countries between July 2008 and July 2009 (its FY2009), marking a 54% surge over FY2008 and all-time high for the Group. In FY2010 new commitments grew even higher, to US$72.9 billion. The World Bank's concessional arm, the International Development Association (IDA), alone accounted for about US$14 billion of support to 63 low-income countries in FY2009, of which US$11 billion in concessional credits, US$2.6 billion in grants and the rest in guarantees. A further US$14.5 billion was committed by IDA in FY2010. Part of these concessional funds, about US$2 billion in FY2009, was channelled through a special Financial Crisis Response Fast-Track Facility in order to speed up approval processes. In December 2009 an IDA Crisis Response Window (CRW) was approved, which was expected to disburse US$1.6 billion of frontloaded IDA commitments and voluntary donor contributions during its pilot phase from January 2010 to June 2011.[73] April 2009 also saw the approval of a capital increase totalling US$86.2 billion, to enlarge the IBRD's future lending capacity.

Second, the Asian Development Bank approved US$16.1 billion of financing in 2009 (US$14.3 billion in loans and grants), a 42% increase compared to 2008. This figure includes the activities of the concessional Asian Development Fund, good for US$3.1 billion. One notable initiative taken by the Asian Development Bank is the Countercyclical Support Facility, a short-term, quick-disbursing lending instrument, geared towards sustaining critical expenditures in Asian middle-income countries during the crisis, which was initiated in June 2009 and had already disbursed US$2 billion by the end of the year. A general capital increase (the first one since 1994) further promised to triple the Asian Development Bank's capital base. Third, the Inter-American Development Bank approved US$15.5 billion in loans and guarantees over the course of 2009, 38% up from 2008. Lending through the Fund for Special Operations, the Bank's concessional window, rose to over US$400 million. A year earlier, loans had already been boosted to an all-time high by the creation of a new Liquidity Program for Growth Sustainability. The Board of Governors of the Inter-American Development Bank agreed upon a general capital increase to over US$170 billion. And fourth, the African Development Bank's loan, grant and other endorsements totalled about US$12.6 billion in 2009 (more than double the 2008 level), with its concessionary African Development Fund division accounting for approximately

[72] In January 2010, the ESF and ESF-HAC were supplanted by the Rapid Credit Facility (RCF) (which has some contingency financing elements, see Section 4.4.2) and the Stand-by Credit Facility (SCF).

[73] The CRW was later transformed into a (last-resort) instrument aimed at helping low-income countries cope with severe economic crises and major natural disasters. Despite its explicit link with shocks, the CRW does again not qualify as genuine contingency financing, mainly because final decisions on CRW disbursements are made by the World Bank's Board of Executive Directors based on evidence of crisis severity and absence of alternative support mechanisms. This implies CRW financing is uncertain and far from automatic.

US$3.7 billion. Again, efforts were made to provide more flexibility to borrowers through a high-speed US$1.5 billion Emergency Liquidity Facility and a US$1 billion Trade Finance Initiative, both launched in March 2009. Also the African Development Bank ensured a capital increase that tripled its capital base.

The remarkable surge in funds and new, exceptional initiatives suggests that international financial institutions have been serious about their response to the global crisis. Of course, not only the amounts of resources committed or disbursed count. The way in which resources are being allocated and invested as well as the accompanying adjustment programmes matter a great deal too for economic recovery. Here, the IMF has come under siege for allegedly applying double standards, strongly supporting large fiscal stimulus packages and expansionary monetary policies in most advanced economies while advising procyclical measures in the programmes of developing countries to which they lend. In September 2009 the IMF itself argued that 'the design of [its] recent [low-income country] programs ha[d] shown considerable flexibility, providing expanded policy space in the face of the [food, fuel and financial] crises', accommodating (among other policies) a looser monetary stance and larger fiscal deficits (IMF, 2009a, p. 4). Also with respect to emerging market borrowers, the IMF (2009c) claimed its programme design had learned from the past and applied fewer restrictions on countries' policy choices. These assertions have been contested by, among others, Stiglitz (2010), Van Waeyenberge *et al.* (2010) and Weisbrot *et al.* (2009). The latter argue that 31 out of 41 IMF borrowing agreements with emerging market and low-income countries (active as of October 2009) advocated procyclical fiscal or monetary policies, and that 15 agreements advocated both. Van Waeyenberge *et al.* (2010) argue that the extra policy space granted to borrowing countries, if any, was at best moderate and biased towards the short term, with again tighter fiscal and monetary targets prescribed for 2010.

A more recent and extensive paper by the IMF's Independent Evaluation Office (IEO) on 25 programmes supported by Stand-By Arrangements (SBAs) between 2008 and 2011 is somewhat more nuanced (see Takagi *et al.*, 2014).[74] First, the evaluators find that IMF support was exceptionally large, heavily frontloaded and fast compared to pre-2008 assistance and carried lighter and better-targeted structural conditionalities than similar programmes in the late 1990s. Second, with respect to advocated fiscal policies, it is argued that there was substantial country-specific heterogeneity (so no one-size-fits-all) and that no post-2008 programme aimed to achieve a fiscal surplus in the short term (unlike programmes during the East Asian crisis). On the other hand, only four programmes envisioned a (modest) fiscal stimulus and in the early programmes with Ukraine, Hungary, Latvia, Serbia and Romania fiscal policy was tightened, reportedly to strengthen confidence and stabilise public finances. *Ex post* fiscal deficits were generally larger than targeted, in part because of overtly optimistic growth projections by the IMF early on in the crisis. In most cases this led the IMF to relax its fiscal targets. Nevertheless, the study estimates that in about half of programme countries actual fiscal deficits were smaller than would have been the case without the fiscal measures introduced by the IMF. Many of the structural reform and fiscal consolidation efforts were watered down or even reversed once IMF programmes had ended. Overall, Takagi *et al.* (2014, p. 39) conclude that 'SBA-supported programs likely helped prevent deeper contractions of output', although they admit that attribution remains very difficult in view of the policies enacted by other, especially advanced countries. That notwithstanding, the debate on the flexibility, conditionality and

[74] These SBAs are still the IMF's 'workhorse' vehicle of balance-of-payments support and occupied a central role in the IMF's *ex post* response to the crisis.

effectiveness of programmes accompanying the support of the IMF (and other international financial institutions) to developing countries' own coping efforts continues.

## 5. Concluding remarks

This paper has sought to systemise some of the key issues for developing countries raised by the global financial and economic crisis of 2008-2009. By looking into the origins of the global crisis and its transmission to developing countries, we have shown how the crisis epitomises developing countries' vulnerability to external shocks. Indeed, financial sector problems and the ensuing recessions in the US and Europe spilled over from their epicentres and were transmitted to developing countries under the form of multiple, exogenous shocks: most importantly a steep decline in trade (both prices and volumes) and reduced private capital inflows, but for some (probably) also a slowdown in remittances and/or bilateral aid.

We have argued that developing countries' output vulnerability to these and future shocks essentially depends on three main components: the *probability and severity of* such *shocks*, the *exposure* to shocks, and the *resilience* (or capacity to react appropriately) of countries. We have then used this decomposition to assess existing efforts to measure country vulnerability empirically. The VE-LIC and VEE of the IMF were found to take into account all three components, but leave some room for improvement, especially in more explicitly considering interactions between variables of exposure and resilience and better linking shock scenario analysis with vulnerability indices. Further, the paper has demonstrated that vulnerability to external shocks is of great concern for developing countries, as the output volatility that shocks bring about reduces long-term growth, increases consumption volatility and impacts the welfare of their citizens. Such vulnerability is certainly not a new phenomenon, but is likely to gain further importance as developing (especially low-income) countries continue to integrate into the global economy. Therefore, if one is genuine about development, the probability and severity of shocks will have to be brought down, country exposure to external shocks needs to be diminished, and/or resilience must be built.

In focusing on the latter two approaches we have identified four possible strategies to deal with output vulnerability, thereby borrowing Perry (2009)'s taxonomy; all were found to have specific advantages as well as important drawbacks. First, *coping* with the aftermath of shocks, i.e., leaving vulnerability unchanged, may include painful adjustment and is inherently backward-looking. Second, *prevention* by reducing exposure to shocks typically takes a long time to bear fruits; countries may also need quicker solutions. Third, increasing resilience to shocks by means of *self-insurance* often carries high opportunity costs. And fourth, *market insurance and hedging*, an alternative strategy of building resilience, may be hampered by political economy problems and is largely unavailable to those countries that would benefit most. This paper has thus advocated a multi-layered approach, combining the aforementioned strategies with attention to the short and longer term, mindful of country specifics, and with roles to play for both countries themselves and international financial institutions.

A broad (but non-exhaustive) review of how vulnerability has been dealt with in practice (prior to and during the crisis), by developing countries and by multilateral development banks and the IMF, reveals that considerable progress has been made in a number of areas, but that much more remains to be done. Whereas further, more in-depth and focused research is needed, our review does enable us to suggest some ways forward, be it tentatively.

First, both because of domestic and international factors, most developing countries were better able to cope with the global crisis, in a countercyclical manner, than had been the case during previous shock and crisis episodes. Those countries where fiscal positions have deteriorated (or were already weak before the crisis) should try to (re)build fiscal space by saving up once their economy (and the global economy) allows them to, even if this may be difficult for political economy reasons. Second, self-insurance through reserves accumulation has arguably been the most important and widespread vulnerability-reducing strategy of developing countries, and of emerging market economies in particular. Regional reserves pooling and management initiatives may hold potential as a way of bringing down the opportunity costs of reserves in countries where reserves holdings are deemed excessive, and as a partial substitute for self-insurance in countries where reserves accumulation is currently too limited. Third, although very little is known about developing countries' use of market-based derivative products for insurance or hedging, the available sources suggest it is still a marginal phenomenon. If market insurance and hedging is to be further developed as a vulnerability-reducing strategy, building technical capacity and transparent communication, both with domestic constituents (to overcome political economy problems related to paying upfront premiums, for example) and international investors (to gauge their appetite for new instruments such as indexed debt), would probably be good places to start. Countries could also attempt to cooperate in bringing new financial products to market, in order to divide first-mover costs and increase initial market size. Fourth, in the longer run, developing countries should increase their efforts aimed at export product diversification, where overall progress has been particularly slow, and export partner diversification. Many countries have been successful in attracting more FDI over time, although not all of it has been new equity capital. Another promising preventive strategy has been the gradual development of local currency bond markets in emerging market economies, many of which seem to have overcome domestic original sin. In low-income countries some progress is being made, but domestic capital markets remain small and shallow. Also, international issuance of local currency bonds and international investor participation in domestic markets are still very limited, even in emerging market economies (with a few exceptions). Broadening the investor base towards more non-bank institutions may help to further reduce exposure to external shocks.

Meanwhile, there are also several areas where international financial institutions such as the IMF, World Bank and regional development banks could make a (bigger) difference. First, they should sustain their latest endeavours in making credit disbursements quicker and more flexible, and in lowering and better targeting the attached conditionality; so as to widen the policy space of recipient countries that attempt to cope with shocks. Second, further experimentation with the provision of local currency financing, derivative products and contingent credit lines is warranted. Such instruments still seem to occupy only a very modest place in international financial institutions' armamentarium and are generally unavailable to low-income countries. Moreover, the take-up of existing instruments has been very limited, which suggests there may be problems with how instruments are currently designed or presented. Expanding and improving their offer of insurance and hedging instruments could benefit international financial institutions themselves as they have a financial and reputational stake in better risk management by their vulnerable clients (see Claessens, 2005). These institutions would also do good to revise and adapt to new realities their own risk management policies; they are in much better positions than developing countries to take on additional risks (without impairing their credit rating), especially in view of recent capital injections. Initiatives such as TCX, that allow multilaterals to offload certain risks (which they cannot or do not want to retain on their balance sheets for now), could function as (temporary) alternative

mechanisms. Third, with respect to countries' preventive strategies, international financial institutions should keep up the work they are undertaking with respect to local currency bond market development, as advisors and market developers, and expand it to more (especially low-income) countries. Hopefully the IMF's more accommodative stance towards the use of capital controls will also broaden developing countries' future policy space in dealing with their vulnerability to shocks.

A long and arduous road lies ahead, both for developing countries and those that intend to help them.

## Appendices

In this Appendix we present a simple, illustrative example of shock loss distributions, alternative loss measures and the influence of correlations across different shock events. Our example is loosely based on the exposition by Jorion (2009, pp. 438-441), which deals with credit loss distributions in an investor's assets portfolio.

We consider a fictive country whose main sources of external finance are oil exports (which constitute 20% of its GDP), cotton exports (5% of GDP) and FDI inflows (3% of GDP). Exports and FDI are subject to exogenous shocks, with marginal shock probabilities and losses given shocks as displayed in panel (a) of Table A.1. With a probability of 20% total oil export value declines by 60% (because of an international oil price shock, for example) and the country loses incoming receipts worth 12% of GDP; cotton export shocks and FDI shocks are assumed to occur less frequently and to be less severe. Using Equation (1) of Section 3.1 and making abstraction of resilience, one can easily calculate that expected (output/shock) losses from these three shocks amount to 2.75% of GDP. This does not require any information about the distribution of losses other than shock probabilities. However, to calculate other loss measures, we do need to describe in more detail the loss distribution and make further assumptions about correlations between shocks.

*Table A.1. Descriptives of example shock scenarios*

| | | | | |
|---|---|---|---|---|
| *Panel (a): Main assumptions* | | | | |
| **Shock event** | **Description** | **Exposure** | **Shock probability** | **Loss given shock** |
| A | Oil export shock | 0.2000 | 0.2000 | 0.6000 |
| B | Cotton export shock | 0.0500 | 0.1000 | 0.4000 |
| C | FDI shock | 0.0300 | 0.1000 | 0.5000 |
| *Panel (b): Scenario with independent shocks* | | | | |
| **State** | **Loss given state** | **State probability** | **Cum. probability** | **Expected loss** |
| No shocks | 0.0000 | 0.6480 | 0.6480 | 0.0000 |
| C | 0.0150 | 0.0720 | 0.7200 | 0.0011 |
| B | 0.0200 | 0.0720 | 0.7920 | 0.0014 |
| B, C | 0.0350 | 0.0080 | 0.8000 | 0.0003 |
| A | 0.1200 | 0.1620 | 0.9620 | 0.0194 |
| A, C | 0.1350 | 0.0180 | 0.9800 | 0.0024 |
| A, B | 0.1400 | 0.0180 | 0.9980 | 0.0025 |
| A, B, C | 0.1550 | 0.0020 | 1.0000 | 0.0003 |
| | | | *Total expected loss* | *0.0275* |
| | | | *St. dev. of loss* | *0.0486* |
| *Panel (c): Scenario with A and C correlated (corr(A,C) = 0.6)* | | | | |
| **State** | **Loss given state** | **State probability** | **Cum. probability** | **Expected loss** |
| No shocks | 0.0000 | 0.7128 | 0.7128 | 0.0000 |
| C | 0.0150 | 0.0072 | 0.7200 | 0.0001 |
| B | 0.0200 | 0.0792 | 0.7992 | 0.0016 |
| B, C | 0.0350 | 0.0008 | 0.8000 | 0.0000 |
| A | 0.1200 | 0.0972 | 0.8972 | 0.0117 |
| A, C | 0.1350 | 0.0828 | 0.9800 | 0.0112 |
| A, B | 0.1400 | 0.0108 | 0.9908 | 0.0015 |
| A, B, C | 0.1550 | 0.0092 | 1.0000 | 0.0014 |
| | | | *Total expected loss* | *0.0275* |
| | | | *St. dev. of loss* | *0.0512* |

Note: All numbers are shares of GDP, apart from (cumulative) probabilities and losses given shock (which are shares of exposure).

In the baseline scenario we suppose the three different shock events are independent from each other. Panel (b) of Table A.1 lists all possible states in which our country can find itself, ranked in ascending order of total losses implied by each state. Obviously, in case there are no shocks total losses are zero; if all three shocks take place simultaneously, total losses amount to 15.5% of GDP (calculated as the sum of the products of exposure and losses given shock for each shock event). Given the independence of shocks, the probability of each state is here simply the product of individual shock or non-shock probabilities. For example, the probability of experiencing both an oil export shock and cotton export shock but no FDI shock is given by: $p_A p_B(1 - p_C)$ = 0.2*0.1*(1 – 0.1) = 1.8%. Combining state probabilities with total losses given each state gives us the earlier-mentioned expected shock loss of 2.75% of GDP. More interestingly, with the information on all possible states we can plot the whole (discrete) probability distribution of losses due to shocks (see Figure A.1) and calculate the standard deviation of shock loss as follows:

$$Std.dev.of\ shock\ loss = \sqrt{\sum_{j=1}^{N}(loss\ given\ state_j - expected\ shock\ loss)^2 \times probability\ of\ state_j} \quad (2)$$

where *N* indicates the number of possible states (eight in our example). In the baseline scenario the standard deviation equals 4.86% of GDP. Alternatively, one may construct 'worst-case' shock loss estimates, i.e., the loss that will not be surpassed at a particular level of confidence, say 95%, using quantile measures. From panel (b) of Table A.1 we see that the 95% quantile loss is 12% of GDP, as the cumulative probability of a shock loss lower than or equal to 12% equals 96.2%. Figure A.2 makes this more clearly visible by plotting the cumulative probability distribution of shock losses. In line with the credit risk literature, one may define the 'unexpected' shock loss (at the 95% confidence level) as the deviation of the worst-case loss from the expected loss (cf. Jorion, 2009), which is 12% minus 2.75%, or 9.25% of GDP in our baseline.

To illustrate the impact of correlations between shock events on shock loss measures, we also look at a second scenario. We take the exact same shock parameters as before (those of panel (a) of Table A.1) but now assume a positive correlation of 0.6 between the oil export shock (event *A*) and the FDI shock (event *C*); the cotton export shock (event B) is still considered to be independent from the other two shocks. The assumed shock correlation implies that the probability of the different states can no longer be calculated as the product of individual shock event probabilities. Instead, we make use of the fact that for Bernouilli-distributed variables *A* and *C* the probability of the joint event *A* U *C* is defined as:

$$p_{A \cup C} = p_A\, p_C + corr(A, C)\sqrt{p_A(1 - p_A)}\sqrt{p_C(1 - p_C)} \quad (3)$$

Applying this formula, panel (c) of Table A.1 shows that the states where shocks *A* and *C* are both present or absent are more likely to occur in the second scenario than in the first scenario, whereas the states with either shock *A* or *C* are now less likely. We observe that the expected shock loss is unaffected by the correlation of shocks, but also that the standard deviation of shock loss increases (from 4.86% to 5.12% GDP). Figures A.1 and A.2 compare the distributions and cumulative distributions of shock losses for the two scenarios. As evident from Figure A.2 and panel (c) of Table A.1 the worst-case shock loss at the 95% confidence level is now higher than under independent

shocks (13.5% of GDP), as is the unexpected shock loss (10.75% of GDP). With similar examples it can be shown that when shocks are negatively correlated, the standard deviation of shock loss and worst-case shock losses decline relative to the baseline scenario.

*Figure A.1. Probability distribution of shock losses (% of GDP) for example shock scenarios*

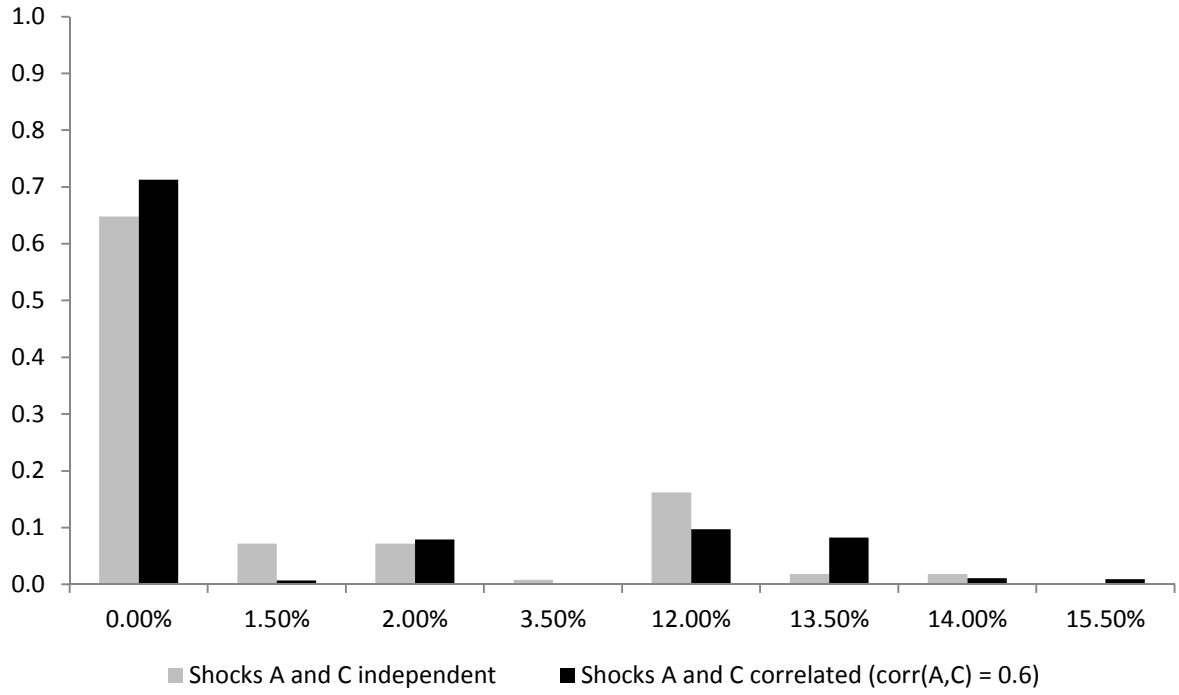
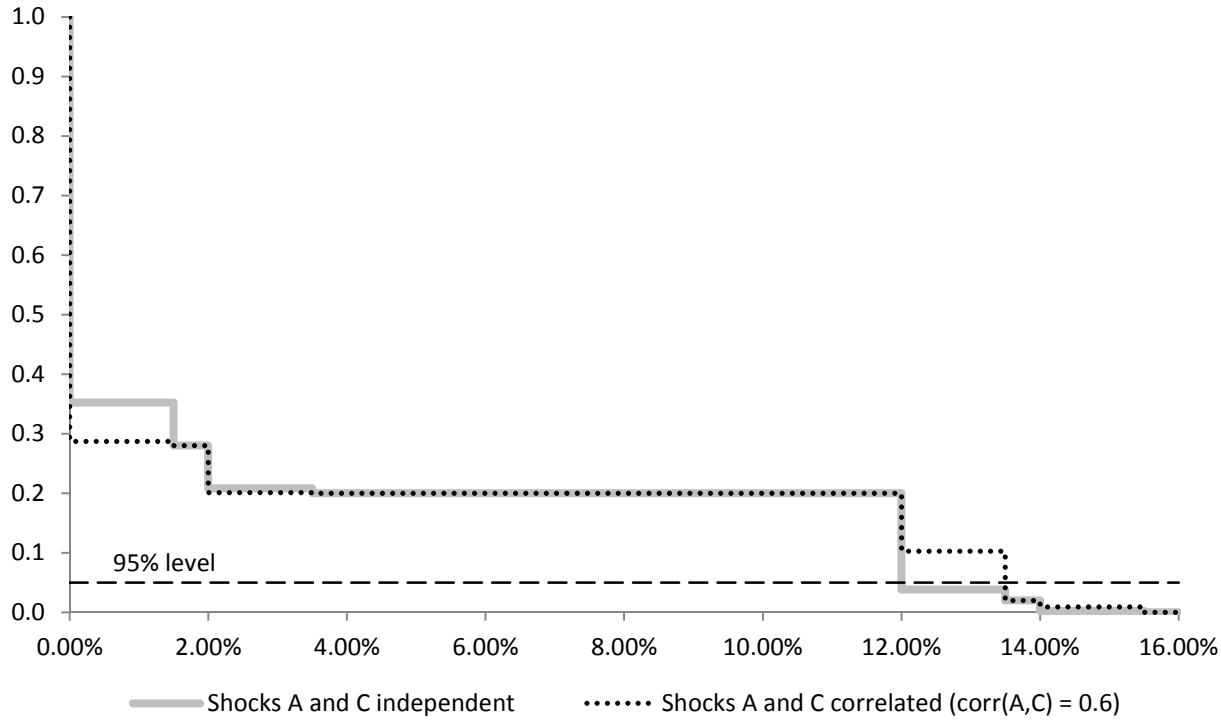



*Figure A.2. Cumulative probability distribution of shock losses (% of GDP) for example shock scenarios*



## References


Abiad, A., Furceri, D., Kalemli-Ozcan, S., and Pescatori, A. (2013). Dancing together? Spillovers, common shocks, and the role of financial and trade linkages. In: IMF (Ed.), *World Economic Outlook October 2013: Transitions and tensions* (pp. 81-111). Washington, DC: IMF.

Abousleiman, I., Calderón, C., Cordella, T., and Levy Yeyati, E. (2007). *Country insurance: Reducing systemic vulnerabilities in LAC*. Washington, DC: World Bank.

Acharya, V. V., and Richardson, M. (2009). Causes of the financial crisis. *Critical Review*, 21(2), 195-210.

Aguiar, M., and Gopinath, G. (2005). Fire-sale foreign direct investment and liquidity crises. *Review of Economics and Statistics*, 87(3), 439-452.

Aguiar, M., and Gopinath, G. (2007). Emerging market business cycles: The cycle is the trend. *Journal of Political Economy*, 115(1), 69-102.

Aizenman, J., and Hutchison, M. M. (2012). Exchange market pressure and absorption by international reserves: Emerging markets and fear of reserve loss during the 2008–2009 crisis. *Journal of International Money and Finance*, 31(5), 1076-1091.

Aizenman, J., and Sun, Y. (2012). The financial crisis and sizable international reserves depletion: From 'fear of floating' to the 'fear of losing international reserves'? *International Review of Economics and Finance*, 24(October 2012), 250-269.

Allen, F., and Giovannetti, G. (2011). The effects of the financial crisis on Sub-Saharan Africa. *Review of Development Finance*, 1(1), 1-27.

Angeon, V., and Bates, S. (2015). Reviewing composite vulnerability and resilience indexes: A sustainable approach and application. *World Development*, 72(August 2015), 140-162.

Asmundson, I., Dorsey, T., Khachatryan, A., Niculcea, I., and Saito, M. (2011). Trade and trade finance in the 2008-09 financial crisis. *IMF Working Paper*, No. 11/16.

Atkins, J. P., Mazzi, S., and Easter, C. D. (2000). A Commonwealth vulnerability index for developing countries: The position of small states. *Commonwealth Secretariat Economic Paper Series*, No. 40.

Atta-Mensah, J. (2004). Commodity-linked bonds: A potential means for less-developed countries to raise foreign capital. *Bank of Canada Working Paper*, No. 2004-20.

Baily, M. N., Litan, R. E., and Johnson, M. S. (2008). The origins of the financial crisis. *Brookings Institution Fixing Finance Series Paper*, No. 3.

Baldwin, R. E. (2009). *The great trade collapse: Causes, consequences and prospects. A VoxEU.org publication*. London: Centre for Economic Policy Research.

Banai, A., Király, J., and Nagy, M. (2010). The demise of the halcyon days in Hungary: 'Foreign' and 'local' banks - before and after the crisis. *BIS Papers*, 54(December 2010), 195-224.

Barajas, A., Chami, R., Ebeke, C., and Tapsoba, S. J. A. (2012). Workers' remittances: An overlooked channel of international business cycle transmission? *IMF Working Paper*, No. 12/251.

Becker, T., and Mauro, P. (2006). Output drops and the shocks that matter. *IMF Working Paper*, No. 06/127.

Bems, R., Johnson, R. C., and Kei-Mu, Y. (2010). Demand spillovers and the collapse of trade in the global recession. *IMF Economic Review*, 58(2), 214-253.

Bettin, G., Presbitero, A. F., and Spatafora, N. (2014). Remittances and vulnerability in developing countries. *IMF Working Paper*, No. 14/13.

Bhinda, N., and Martin, M. (2009). *Private capital flows to low income countries: Dealing with boom and bust*. London: Debt Relief International.

Binici, M., Hutchison, M., and Schindler, M. (2010). Controlling capital? Legal restrictions and the asset composition of international financial flows. *Journal of International Money and Finance*, 29(4), 666-684.

BIS. (2007). Financial stability and local currency bond markets. *Committee on the Global Financial System Publications*, No. 28.

Blinder, A. S. (2013). *After the music stopped: The financial crisis, the response, and the work ahead*. New York, NY: Penguin Press.

Blundell-Wignall, A., and Roulet, C. (2013). Capital controls on inflows, the global financial crisis and economic growth: Evidence for emerging economies. *OECD Journal: Financial Market Trends*, 2013(2), 29-42.

Borensztein, E., and Mauro, P. (2004). The case for GDP-indexed bonds. *Economic Policy*, 19(38), 165-216.

Briguglio, L. (1995). Small island developing states and their economic vulnerabilities. *World Development*, 23(9), 1615-1632.

Briguglio, L., Cordina, G., Farrugia, N., and Vella, S. (2009). Economic vulnerability and resilience. *Oxford Development Studies*, 37(3), 229-247.

Brunnermeier, M. K. (2009). Deciphering the liquidity and credit crunch 2007-08. *Journal of Economic Perspectives*, 23(1), 77-100.

Bussière, M., Cheng, G., Chinn, M. D., and Lisack, N. (2015). For a few dollars more: Reserves and growth in times of crises. *Journal of International Money and Finance*, 52(April 2015), 127-145.

Caballero, R. J. (2010). Macroeconomics after the crisis: Time to deal with the pretense-of-knowledge syndrome. *Journal of Economic Perspectives*, 24(4), 85-102.

Calderón, C., Loayza, N. V., and Schmidt-Hebbel, K. (2008). Does openness imply greater vulnerability? *Central Bank of Chile Working Paper*, No. 485.

Caner, M., Koehler-Geib, F., and Vincelette, G. A. (2009). When do sudden stops really hurt? *World Bank Policy Research Working Paper*, No. 5021.

Caparas, C., Lucich, M., Mellor, D., Rabanal, R., Sugden, C., and Tabanao, R. (2008). *Navigating the global storm: A policy brief on the global financial crisis*. Mandaluyong City: Asian Development Bank.

Cassimon, D., and Verbeke, K. (2009). Case study: Democratic Republic of the Congo. Report prepared for the Development Cooperation Assises on the impact of the financial and economic crisis in low-income African countries, Brussels, 5 May.

Cetorelli, N., and Goldberg, L. S. (2011). Global banks and international shock transmission: Evidence from the crisis. *IMF Economic Review*, 59(1), 41-76.

Chambers, R. (1989). Editorial introduction: Vulnerability, coping and policy. *IDS Bulletin*, 20(2), 1-7.

Cheung, C., and Guichard, S. (2009). Understanding the world trade collapse. *OECD Economics Department Working Paper*, No. 729.

Chinn, M. D., and Ito, H. (2006). What matters for financial development? Capital controls, institutions, and interactions. *Journal of Development Economics*, 81(1), 163-192.

Chor, D., and Manova, K. (2012). Off the cliff and back? Credit conditions and international trade during the global financial crisis. *Journal of International Economics*, 87(1), 117-133.

Claessens, S. (2005). Taking stock of risk management techniques for sovereigns. *World Bank Policy Research Working Paper*, No. 3570.

Claessens, S., Dell'Ariccia, G., Igan, D., and Laeven, L. (2010). Lessons and policy implications from the global financial crisis. *IMF Working Paper*, No. 10/44.

Claessens, S., and Van Horen, N. (2014). Foreign banks: Trends and impact. *Journal of Money, Credit and Banking*, 46(S1), 295–326.

Clemens, M. A., and McKenzie, D. (2014). Why don't remittances appear to affect growth? *Center for Global Development Working Paper*, No. 366.

Clemens, M. A., and Ogden, T. (2014). Migration as a strategy for household finance: A research agenda on remittances, payments, and development. *Center for Global Development Working Paper*, No. 354.

Committee for Development Policy. (1999). Vulnerability and poverty in a global economy. Report of the Committee for Development Policy on the first session, United Nations, New York, NY, 26-30 April.

Cordella, T., and Levy Yeyati, E. (2005). Country insurance. *IMF Staff Papers*, 52(Special Issue), 85-106.

Cordella, T., and Levy Yeyati, E. (2006). A (new) country insurance facility. *International Finance*, 9(1), 1-36.

Crispolti, V., Dabla-Norris, E., Kim, J. I., Shirono, K., and Tsibouris, G. (2013). Assessing reserve adequacy in low-income countries. *IMF Occasional Paper*, No. 276.

Curto, S. (2010). Sovereign wealth funds in the next decade. *World Bank Economic Premise*, No. 8.

da Costa Neto, N. C., and Romeu, R. (2011). Did export diversification soften the impact of the global financial crisis? *IMF Working Paper*, No. 11/99.

Dabla-Norris, E., and Bal Gündüz, Y. (2014). Exogenous shocks and growth crises in low-income countries: A vulnerability index. *World Development*, 59(July 2014), 360-378.

Dabla-Norris, E., Minoiu, C., and Zanna, L.-F. (2015). Business cycle fluctuations, large shocks, and development aid: New evidence. *World Development*, 69(May 2015), 44-61.

Dang, H.-A., Knack, S., and Rogers, F. H. (2013). International aid and financial crises in donor countries. *European Journal of Political Economy*, 32(December 2013), 232-250.

de Gregorio, J., Edwards, S., and Valdés, R. O. (2000). Controls on capital inflows: do they work? *Journal of Development Economics*, 63(1), 59-83.

De Haas, R., and Van Lelyveld, I. (2014). Multinational banks and the global financial crisis: Weathering the perfect storm? *Journal of Money, Credit and Banking*, 46(S1), 333-364.

Dercon, S. (2001). Assessing vulnerability to poverty. Unpublished paper prepared for DFID.

Development Research Group. (2008). Lessons from World Bank research on financial crises. *World Bank Policy Research Working Paper*, No. 4779.

Didier, T., Love, I., and Martínez Pería, M. S. (2012). What explains comovement in stock market returns during the 2007-2008 crisis? *International Journal of Finance and Economics*, 17(2), 182-202.

Didier, T., and Schmukler, S. L. (2014). Debt markets in emerging economies: Major trends. *Comparative Economic Studies*, 56(2), 200-228.

Dominguez, K. M. E. (2012). Foreign reserve management during the global financial crisis. *Journal of International Money and Finance*, 31(8), 2017-2037.

Dominguez, K. M. E., Hashimoto, Y., and Takatoshi, I. (2012). International reserves and the global financial crisis. *Journal of International Economics*, 88(2), 388-406.

Dooley, M., and Hutchison, M. (2009). Transmission of the U.S. subprime crisis to emerging markets: Evidence on the decoupling-recoupling hypothesis. *Journal of International Money and Finance*, 28(8), 1331-1349.

Dorsey, T. (2009). Trade finance stumbles. *Finance and Development*, 46(1), 18-19.

Eaton, J., Kortum, S., Neiman, B., and Romalis, J. (2011). Trade and the global recession. *NBER Working Paper*, No. 16666.

Edwards, S., and Levy Yeyati, E. (2005). Flexible exchange rates as shock absorbers. *European Economic Review*, 49(8), 2079-2105.

Ehlers, T., and Packer, F. (2013). FX and derivatives markets in emerging economies and the internationalisation of their currencies. *BIS Quarterly Review*, December 2013, 55-67.

Ehrlich, I., and Becker, G. S. (1972). Market insurance, self-insurance, and self-protection. *Journal of Political Economy*, 80(4), 623-648.

Eichengreen, B. (2011). *Exorbitant privilege: The rise and fall of the dollar and the future of the international monetary system*. New York, NY: Oxford University Press.

Eichengreen, B., and Hausmann, R. (1999). Exchange rates and financial fragility. In: Federal Reserve Bank of Kansas City (Ed.), *New challenges for monetary policy* (pp. 329-368). Kansas City, MO: Federal Reserve Bank of Kansas City.

Eichengreen, B., Hausmann, R., and Panizza, U. (2005). The pain of original sin. In: B. Eichengreen, and R. Hausmann (Eds.), *Other people's money: Debt denomination and financial instability in emerging market economies* (pp. 13-47). Chicago, IL: University of Chicago Press.

EUI. (2009). *European Report on Development 2009: Overcoming fragility in Africa. Forging a new European approach*. San Domenico di Fiesole: European University Institute.

Faini, R. (2006). Foreign aid and fiscal policy. *CEPR Discussion Paper*, No. 5721.

Fischer, S. (1999). On the need for an international lender of last resort. *Journal of Economic Perspectives*, 13(4), 85-104.

Frankel, J. A. (2011). Are bilateral remittances countercyclical? *Open Economies Review*, 22(1), 1-16.

Frankel, J. A., and Saravelos, G. (2012). Can leading indicators assess country vulnerability? Evidence from the 2008-09 global financial crisis. *Journal of International Economics*, 87(2), 216-231.

Frankel, J. A., Végh, C. A., and Vuletin, G. (2013). On graduation from fiscal procyclicality. *Journal of Development Economics*, 100(1), 32-47.

Fratzscher, M. (2009). What explains global exchange rate movements during the financial crisis? *Journal of International Money and Finance*, 28(8), 1390-1407.

Freund, C. (2009). The trade response to global downturns: Historical evidence. *World Bank Policy Research Working Paper*, No. 5015.

Freund, C., and Spatafora, N. (2008). Remittances, transaction costs and informality. *Journal of Development Economics*, 86(2), 356-366.

Friedman, J., and Schady, N. (2009). How many more infants are likely to die in Africa as a result of the global financial crisis? *World Bank Policy Research Working Paper*, No. 5023.

Frot, E. (2009). The consequences of financial crises on aid. Stockholm School of Economics mimeo.

Gallopín, G. C. (2006). Linkages between vulnerability, resilience, and adaptive capacity. *Global Environmental Change*, 16(3), 293-303.

Gelb, A., Tordo, S., and Halland, H. (2014). Sovereign wealth funds and long-term development finance: Risks and opportunities. *World Bank Policy Research Working Paper*, No. 6776.

Ghosh, S. R., and Ghosh, A. R. (2003). Structural vulnerabilities and currency crises. *IMF Staff Papers*, 50(3), 481-506.

Goh, S. K. (2005). New empirical evidence on the effects of capital controls on composition of capital flows in Malaysia. *Applied Economics*, 37(13), 1491-1503.

Goldstein, M., and Xie, D. (2009). The impact of the financial crisis on emerging Asia. *PIIE Working Paper*, No. 09-11.

Gorton, G. B. (2012). *Misunderstanding financial crises: Why we don't see them coming*. New York, NY: Oxford University Press.

Gravier-Rymaszewska, J. (2012). How aid responds to economic crises: A panel VAR approach. *UNU-WIDER Working Paper*, No. 2012/25.

Griffith-Jones, S., and Ocampo, J. A. (2009). The financial crisis and its impact on developing countries. *International Policy Centre for Inclusive Growth Working Paper*, No. 53.

Griffith-Jones, S., and Sharma, K. (2006). GDP-indexed bonds: Making it happen. *UNDESA Working Paper*, No. 21.

Guillaumont, P. (2001). On the economic vulnerability of low income countries. *CERDI Etudes et Documents*, No. E2011.02.

Guillaumont, P. (2009). An economic vulnerability index: Its design and use for international development policy. *Oxford Development Studies*, 37(3), 193-228.

Guillaumont, P., and Guillaumont Jeanney, S. (2009). State fragility and economic vulnerability: What is measured and why? EUI Background Paper prepared for the European Report on Development 2009.

Gupta, P., Mishra, D., and Sahay, R. (2007). Behavior of output during currency crises. *Journal of International Economics*, 72(2), 428-450.

Haddad, M., Harrison, A., and Hausman, C. (2010). Decomposing the great trade collapse: products, prices, and quantities in the 2008-2009 crisis. *NBER Working Paper*, No. 16253.

Haddad, M., Lim, J. J., Pancaro, C., and Saborowski, C. (2013). Trade openness reduces growth volatility when countries are well diversified. *Canadian Journal of Economics*, 46(2), 765-790.

Harper, C., Jones, N., Pereznieto, P., and McKay, A. (2011). Promoting children's well-being: Policy lessons from past and present economic crises. *Development Policy Review*, 29(5), 621-641.

Hausmann, R., and Panizza, U. (2011). Redemption or abstinence? Original sin, currency mismatches and counter-cyclical policies in the new millennium. *Journal of Globalization and Development*, 2(1), Article 4.

Heltberg, R., Hossain, N., and Reva, A. (2012). *Living through crises: How the food, fuel, and financial shocks affect the poor*. Washington, DC: World Bank.

Heltberg, R., Hossain, N., and Reva, A. (2013). Coping and resilience during the food, fuel, and financial Crises. *Journal of Development Studies*, 49(5), 705-718.

Hnatkovska, V., and Loayza, N. V. (2003). Volatility and growth. *World Bank Policy Research Working Paper*, No. 3184.

Hull, J. C. (2012). *Options, futures, and other derivatives (8th edition)*. Boston, MA: Prentice Hall.

IDS. (2008). *Voices from the south: The impact of the financial crisis on developing countries*. Sussex: Institute of Development Studies.

ILO, and World Bank. (2012). *Inventory of policy responses to the financial and economic crisis: Joint synthesis report*. Geneva/Washington, DC: ILO/World Bank.

Ilzetzki, E., and Végh, C. A. (2008). Procyclical fiscal policy in developing countries: Truth or fiction? *NBER Working Paper*, No. 14191.

IMF. (2007). *World Economic Outlook April 2007: Spillovers and cycles in the global economy*. Washington, DC: IMF.

IMF. (2008a). *Food and fuel prices: Recent developments, macroeconomic impact, and policy responses*. Washington, DC: IMF.

IMF. (2008b). *Sovereign wealth funds: A work agenda*. Washington, DC: IMF.

IMF. (2009a). *Creating policy space: Responsive design and streamlined conditionality in recent low-income country programs*. Washington, DC: IMF.

IMF. (2009b). *The implications of the global financial crisis for low-income countries*. Washington, DC: IMF.

IMF. (2009c). *Review of recent crisis programs*. Washington, DC: IMF.

IMF. (2009d). *World Economic Outlook April 2009: Crisis and recovery*. Washington, DC: IMF.

IMF. (2010a). *Emerging from the global crisis: Macroeconomic challenges facing low-income countries*. Washington, DC: IMF.

IMF. (2010b). *How did emerging markets cope in the crisis?* Washington, DC: IMF.

IMF. (2010c). *The IMF-FSB Early Warning Exercise: Design and methodological toolkit*. Washington, DC: IMF.

IMF. (2011a). *Managing volatility in low-income countries: The role and potential for contingent financial instruments*. Washington, DC: IMF.

IMF. (2011b). *Managing volatility: A vulnerability exercise for low-income countries*. Washington, DC: IMF.

IMF. (2012). *The liberalization and management of capital flows: An institutional view*. Washington, DC: IMF.

IMF. (2014a). *Macroeconomic developments in low-income developing countries*. Washington, DC: IMF.

IMF. (2014b). *Proposed new grouping in WEO country classifications: Low-income developing countries*. Washington, DC: IMF.

IMF. (2014c). *Review of Flexible Credit Line, the Precautionary and Liquidity Line, and the Rapid Financing Instrument*. Washington, DC: IMF.

IMF. (2014d). *Sustaining long-run growth and macro stability in low-income countries: the role of structural transformation and diversification - Background notes*. Washington, DC: IMF.

Jaramillo, L., and Weber, A. (2013). Bond yields in emerging economies: It matters what state you are in. *Emerging Markets Review*, 17(December 2013), 169-185.

Jorion, P. (2009). *Financial risk manager handbook (5th edition)*. Hoboken, NJ: Wiley.

Kabuya Kalala, F., and Cassimon, D. (2010). Democratic Republic of Congo Phase 2. *ODI Global Financial Crisis Discussion Series Paper*, No. 15.

Kaminsky, G. L., Reinhart, C. M., and Végh, C. A. (2003). The unholy trinity of financial contagion. *Journal of Economic Perspectives*, 17(4), 51-74.

Kaminsky, G. L., Reinhart, C. M., and Végh, C. A. (2005). When it rains, it pours: Procyclical capital flows and macroeconomic policies. In: M. L. Gertler, and K. S. Rogoff (Eds.), *NBER Macroeconomics annual 2004, Volume 19* (pp. 11-82). Cambridge, MA: National Bureau of Economic Research.

Kasekende, L., Brixova, Z., and Ndikumana, L. (2010). Africa's counter-cyclical response to the crisis. *Journal of Globalization and Development*, 1(1), Article 16.

Kasekende, L., Ndikumana, L., and Rajhi, T. (2009). Impact of the global financial and economic crisis on Africa. *African Development Bank Working Paper*, No. 96.

Kee, H. L., Neagu, C., and Nicita, A. (2013). Is protectionism on the rise? Assessing national trade policies during the crisis of 2008. *Review of Economics and Statistics*, 95(1), 342-346.

Kharroubi, E. (2007). Crises, volatility, and growth. *World Bank Economic Review*, 21(3), 439-460.

Kodama, M. (2013). External shocks and high volatility in consumption in low-income countries. *Developing Economies*, 51(3), 278-302.

Koren, M., and Tenreyo, S. (2007). Volatility and development. *Quarterly Journal of Economics*, 122(1), 243-287.

Kose, M. A., Prasad, E., Rogoff, K., and Wei, S.-J. (2009). Financial globalization: A reappraisal. *IMF Staff Papers*, 56(1), 8-62.

Krugman, P. (2008). *The return of depression economics and the crisis of 2008*. London: Penguin Books.

Kunzel, P., Lu, Y., Petrova, I., and Pihlman, J. (2011). Investment objectives of sovereign wealth funds: A shifting paradigm. *IMF Working Paper*, No. 11/19.

Laeven, L., and Valencia, F. (2013). Systemic banking crises database. *IMF Economic Review*, 61(2), 225-270.

Lane, P. R., and Milesi-Ferretti, G. M. (2007). The external wealth of nations mark II: Revised and extended estimates of foreign assets and liabilities, 1970-2004. *Journal of International Economics*, 73(2), 223-250.

Levchenko, A. A. (2005). Financial liberalization and consumption volatility in developing countries. *IMF Staff Papers*, 52(2), 237-259.

Levchenko, A. A., Lewis, L. T., and Tesar, L. L. (2010). The collapse of international trade during the 2008-09 crisis: In search of the smoking gun. *IMF Economic Review*, 58(2), 214-253.

Levchenko, A. A., and Mauro, P. (2007). Do some forms of financial flows help protect against 'sudden stops'? *World Bank Economic Review*, 21(3), 389-411.

Levy Yeyati, E. (2008). The cost of reserves. *Economic Letters*, 100(1), 39-42.

Lin, J. Y. (2008). The impact of the financial crisis on developing countries. Paper presented at the Korea Development Institute, Seoul, 31 October.

Lledó, V. D., Yackovlev, I., and Gadenne, L. (2011). A tale of cyclicality, aid flows and debt: Government spending in Sub-Saharan Africa. *Journal of African Economies*, 20(5), 823-849.

Loayza, N. V., and Raddatz, C. (2007). The structural determinants of external vulnerability. *World Bank Economic Review*, 21(3), 359-387.

Loayza, N. V., Rancière, R., Servén, L., and Ventura, J. (2007). Macroeconomic volatility and welfare in developing countries: An introduction. *World Bank Economic Review*, 21(3), 343-357.

Lu, Y., and Neftci, S. (2008). Financial instruments to hedge commodity price risk for developing countries. *IMF Working Paper*, No. 08/6.

Martin, M., and Bargawi, H. (2005). Protecting Africa against 'shocks'. In: J. J. Teunissen, and A. Akkerman (Eds.), *Protecting the poor: Global financial institutions and the vulnerability of low-income countries* (pp. 42-71). The Hague: FONDAD.

Mayer, J. (2008). Policy space: What, for what and where? *UNCTAD Discussion Paper*, No. 191.

Missale, A., and Bacchiocchi, E. (2012). Multilateral indexed loans and debt sustainability. *UNCTAD Discussion Paper*, No. 209.

Mold, A., Paulo, S., and Prizzon, A. (2009). Taking stock of the credit crunch: Implications for development finance and global governance. *OECD Development Centre Working Paper*, No. 277.

Montalbano, P. (2011). Trade openness and developing countries' vulnerability: Concepts, misconceptions, and directions for research. *World Development*, 39(9), 1489-1502.

Narayan, A., and Sanchez-Paramo, C. (2012). *Knowing when you do not know: Simulating the poverty and distributional impacts of an economic crisis*. Washington, DC: World Bank.

Naudé, W. (2009a). Fallacies about the global financial crisis harms recovery in the poorest countries. *CESifo Forum*, 10(4), 3-12.

Naudé, W. (2009b). The financial crisis of 2008 and the developing countries. *UNU-WIDER Discussion Paper*, No. 2009/01.

Naudé, W. (2010). Africa and the global economic crisis: A risk assessment and action guide. *EUI/Robert Schuman Centre for Advanced Studies Working Paper*, No. 2010/27.

Naudé, W., McGillivray, M., and Rossouw, S. (2009). Measuring the vulnerability of subnational regions. *Oxford Development Studies*, 37(3), 249-276.

Naudé, W., Santos-Paulino, A. U., and McGillivray, M. (2009a). Measuring vulnerability: An overview and introduction. *Oxford Development Studies*, 37(3), 183-191.

Naudé, W., Santos-Paulino, A. U., and McGillivray, M. (2009b). *Vulnerability in developing countries*. Tokyo: United Nations University Press.

Ocampo, J. A. (2011). A development-friendly reform of the international financial architecture. *Politics and Society*, 39(3), 315-330.

ODI. (2009). The global financial crisis and developing countries: Synthesis of the findings of 10 country case studies. *ODI Working Paper*, No. 306.

ODI. (2010). The global financial crisis and developing countries: Phase 2 synthesis. *ODI Working Paper*, No. 316.

Ostry, J. D., Ghosh, A. R., Habermeier, K., Chamon, M., Qureshi, M. S., and Reinhardt, D. B. S. (2010). Capital inflows: The role of controls. *IMF Staff Position Note*, No. 10/14.

Paci, P., Revenga, A., and Rijkers, B. (2012). Coping with crises: Policies to protect employment and earnings. *World Bank Research Observer*, 27(1), 106-141.

Packer, F., and Remolona, E. (2012). Attracting foreign participation in Asian local currency bond markets: The case of the Asian Bond Fund 2 initiative. *Pacific Economic Review*, 17(3), 415-433.

Palais-Royal Initiative. (2011). *Reform of the international monetary system: A cooperative approach for the twenty-first century*. Paris: Palais-Royal Intiative.

Pallage, S., and Robe, M. A. (2001). Foreign aid and the business cycle. *Review of International Economics*, 9(4), 641-672.

Papageorgiou, C., and Spatafora, N. (2012). Economic diversification in LICs: Stylized facts and macroeconomic implications. *IMF Staff Discussion Note*, No. 12/13.

Perry, G. (2009). *Beyond lending: How multilateral banks can help developing countries manage volatility*. Washington, DC: Center for Global Development.

Poulsen, L. S., and Hufbauer, G. C. (2011). Foreign direct investment in times of crisis. *Transnational Corporations*, 20(1), 19-37.

Prasad, E. S. (2014). *The dollar trap: How the U.S. dollar tightened its grip on global finance*. Princeton, NJ: Princeton University Press.

Raddatz, C. (2007). Are external shocks responsible for the instability of output in low-income countries? *Journal of Development Economics*, 84(1), 155-187.

Raddatz, C. (2008). Have external shocks become more important for output fluctuations in African countries? In: D. S. Go, and J. Page (Eds.), *Africa at a turning point? Growth, aid, and external shocks* (pp. 343-373). Washington, DC: World Bank.

Ramey, G., and Ramey, V. A. (1995). Cross-country evidence on the link between volatility and growth. *American Economic Review*, 85(5), 1138-1151.

Rand, J., and Tarp, F. (2002). Business cycles in developing countries: Are they different? *World Development*, 30(12), 2071-2088.

Ratha, D., Mohapatra, S., and Silwal, A. (2010). Outlook for remittance flows 2010-2011. *World Bank Migration and Development Brief*, No. 12.

Reinhart, C. M., and Rogoff, K. S. (2009). *This time is different: Eight centuries of financial folly*. Princeton, NJ: Princeton University Press.

Reyes, C. M., Sobreviñas, A. B., and Baris Jr., M. A. (2013). *Monitoring and mitigating the impact on poverty of the global financial and economic crisis*. Manila: PEP-CMBS Network Office.

Robinson, D. J. (2014). The IMF response to the global crisis: Assessing risks and vulnerabilities in IMF surveillance. *IEO Background Paper*, No. 14/09.

Rodrik, D. (2006). The social cost of foreign exchange reserves. *International Economic Journal*, 20(3), 253-266.

Roodman, D. (2008). History says financial crisis will suppress aid. Views from the Center, Center for Global Development Blog, October 13.

Rose, A. K., and Spiegel, M. M. (2010). Cross-country causes and consequences of the 2008 crisis: International linkages and American exposure. *Pacific Economic Review*, 15(3), 340-363.

Rose, A. K., and Spiegel, M. M. (2012). Cross-country causes and consequences of the 2008 crisis: Early warning. *Japan and the World Economy*, 24(1), 1-16.

Rosero, L. D. (2014). Regional pooling of international reserves: The Latin American Reserve Fund in perspective. *Latin American Policy*, 5(1), 62-86.

Ruiz, I., and Vargas-Silva, C. (2010). Another consequence of the economic crisis: A decrease in migrants' remittances. *Applied Financial Economics*, 20(1), 171-182.

Sirkeci, I., Cohen, J. H., and Ratha, D. (2012). *Migration and remittances during the global financial crisis and beyond*. Washington, DC: World Bank.

Stiglitz, J. E. (2006). *Making globalization work*. New York, NY: W.W. Norton & Company.

Stiglitz, J. E. (2009). The anatomy of a murder: Who killed America's economy? *Critical Review*, 21(2-3), 329-339.

Stiglitz, J. E. (2010). *Freefall: America, free markets, and the sinking of the world economy*. New York, NY: W.W. Norton & Company.

Sussangkarn, C. (2011). Chiang Mai Initiative Multilateralization: Origin, development, and outlook. *Asian Economic Policy Review*, 6(2), 203-220.

Svensson, J. (2000). When is foreign aid policy credible? Aid dependence and conditionality. *Journal of Development Economics*, 61(1), 61-84.

Swiston, A. (2010). Spillovers to Central America in light of the crisis: What difference a year makes. *IMF Working Paper*, No. 10/35.

Takagi, S., de Resende, C., Prieur, J., Loyola, F., and Nguyen, T. (2014). A review of crisis management programs supported by IMF Stand-By Arrangements, 2008-11. *IEO Background Paper*, No. 14/12.

Taleb, N. N. (2010). *The black swan: The impact of the highly improbable*. London: Penguin books.

te Velde, D. W. (2008). The global financial crisis and developing countries: Which countries are at risk and what can be done? *ODI Background Note*, October 2008.

te Velde, D. W. (2009). Economic policies in G-20 and African countries during the global financial crisis: Who's the apprentice, who's the master? Paper prepared for the AERC Conference on rethinking African economic policies, Nairobi, 6-8 December.

Teunissen, J. J., and Akkerman, A. (2005). *Protecting the poor: Global financial institutions and the vulnerability of low-income countries*. The Hague: FONDAD.

The Economist. (2010). Crumbs from the BRICs-man's table: Emerging powers have helped poorer nations weather the global recession, 18 March.

Turner, P. (2012). Weathering financial crisis: Domestic bond markets in EMEs. *BIS Papers*, 63(January 2012), 15-34.

UNCTAD. (2009). *Handbook of statistics*. Geneva: UNCTAD.

van Doorn, R., Suri, V., and Gooptu, S. (2010). Do middle-income countries continue to have the ability to deal with the global financial crisis? *World Bank Policy Research Working Paper*, No. 5381.

Van Waeyenberge, E., Bargawi, H., and McKinley, T. (2010). *Standing in the way of development? A critical survey of the IMF's crisis response in low income countries*. Brussels/Geneva: EURODAD/Third World Network.

Varangis, P., Varma, S., de Plaa, A., and Nehru, V. (2004). Exogenous shocks in low-income countries: Economic policy issues and the role of the international community. World Bank Background Paper prepared for the Report on managing the debt risk of exogenous shocks in low-income countries.

Villagrán de León, J. C. (2006). Vulnerability: A conceptual and methodological review. *UNU-EHS SOURCE Publication Series*, No. 4/2006.

Weisbrot, M., Ray, R., Johnston, J., Cordero, J. A., and Montecino, J. A. (2009). *IMF-supported macroeconomic policies and the world recession: A look at forty-one borrowing countries*. Washington, DC: Center for Economic and Policy Research.

Wolff-Hamacher, S. (2007). Local currency bond issues by international financial institutions. Background Paper prepared for the Committee on the Global Financial System Working Group.

World Bank. (2009a). *Global Economic Prospects 2009: Commodities at crossroads*. Washington, DC: World Bank.

World Bank. (2009b). *Global Monitoring Report 2009: A development emergency*. Washington, DC: World Bank.

World Bank. (2010). *Global Economic Prospects 2010: Crisis, finance and growth*. Washington, DC: World Bank.

World Bank. (2011). *Global Development Finance 2011: External debt of developing countries*. Washington, DC: World Bank.

# Chapter 3

# Local currency bond market development in Sub-Saharan Africa: A stock-taking exercise and analysis of key drivers


## Abstract

This paper studies the current state and drivers of government local currency bond markets (LCBMs) in Sub-Saharan Africa, a region whose progress in developing such markets has only recently received attention in the literature. We argue that well-developed LCBMs could help wash away or reduce 'original sin'; facilitate the mobilisation of domestic savings; reduce countries' exposure to external shocks; and may have other important financial, macroeconomic and institutional spill-overs. With detailed information collected from various sources, the paper first shows that quite a number of African countries have made significant progress in developing government LCBMs. Increasingly, African governments issue fixed-rate local currency bonds with tenors of ten years and more, on a regular basis. This does not imply all is well. We find that LCBMs in Africa often have low liquidity, feature very few corporate securities and generally have relatively narrow investor bases dominated by commercial banks. The second part of the paper presents an econometric analysis of the drivers of African government LCBMs based on a new panel dataset compiled by the OECD. Our results indicate that LCBM capitalisation in selected African countries is correlated negatively with governments' fiscal balance and inflation, and positively with common law legal origins, institutional quality and strong democratic political systems.



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## 1. Introduction

Concerns about financial stability associated with the external financing of developing countries have led to a renewed interest in the development of domestic capital markets (cf. Chapter 2). Most notably, in November 2011 the G20 endorsed its *Action Plan to Support the Development of Local Currency Bond Markets* (LCBMs) in emerging market and other developing economies. The action plan called upon international organisations to cooperate in data collection and analytical work on LCBMs. This resulted in a joint 'diagnostic framework' developed by the IMF, World Bank Group, EBRD and the OECD (IMF *et al.*, 2013), a toolkit designed to help country authorities analyse the state of their LCBMs and identify reform priorities. This paper focuses on government LCBM development in Sub-Saharan Africa more specifically, long time a blind spot in bond market research; mostly due to its relative underdevelopment and a lack of reliable, cross-country comparable data. Only very recently a number of studies have analysed LCBMs in the region (Blommestein and Horman, 2007; Adelegan and Radzewicz-Bak, 2009; Mu *et al.*, 2013).

At least four important reasons can be distinguished for the further development of liquid LCBMs in Sub-Saharan Africa. First, developing economies, and low-income countries in particular, have traditionally not been able to borrow in their local currency from abroad or even domestically (except with ultra-short maturities), a phenomenon known as 'original sin' (Eichengreen and Hausmann, 1999; see Khan, 2005 on Africa). Original sin often leads to severe currency mismatches, with destabilising effects in case of real exchange rate pressure (Goldstein and Turner, 2004; Eichengreen *et al.*, 2005b). LCBM development has the potential to 'wash away' (or at least reduce) original sin by changing debt denomination from predominantly foreign to local currency; by lengthening maturities; and by attracting non-resident investors to buy longer-term local currency bonds (Essers and Cassimon, 2012).

Second, Sub-Saharan Africa is in urgent need of additional funds for growth-enhancing investment. Recent OECD and World Bank reports, for example, point to a significant gap in Africa's infrastructure funding needs, in the range of US$30 billion to US$50 billion a year (Foster and Briceño-Garmendia, 2010; OECD, 2012). Part of this shortage could potentially be bridged using government and corporate infrastructure project bonds (Mbeng Mezui and Hundal, 2013). Developing countries may also face a more limited availability of official, concessional finance in the (near) future as traditional donors continue to grapple with post-crisis public debt overhangs and budgetary pressures (Gravier-Rymaszewska, 2012; Dang *et al.*, 2013; Dabla-Norris *et al.*, 2015). This would in particular affect aid-dependent African countries. More generally, LCBMs could help mobilise Africa's domestic savings by improving financial intermediation, discouraging capital flight and perhaps even encouraging capital to return. Indeed, much of Africa's private wealth has traditionally been held abroad, making the region a net capital exporter vis-à-vis the rest of the world (Collier *et al.*, 2001; Ndikumana and Boyce, 2011).

Third, the global financial and economic crisis of 2008-2009 and its aftershocks have demonstrated once more that developing economies, including African countries, remain vulnerable to external shocks, including sudden stops in private capital inflows (see Chapter 2 for an overview). Well-developed LCBMs, with a broad local investor base, would reduce countries' exposure to

external financial shocks, acting as a 'spare tyre' that stabilises the domestic economy (see e.g., Anderson *et al.*, 2011; Turner, 2012).[1]

Fourth, the process of government LCBM development in particular has positive spill-over effects. These include boosting broader financial market development, as government bonds fulfil the role of 'safe asset' in the domestic economy and provide a pricing benchmark for corporate bonds, equities and more complex (derivative) risk management products; encouraging sounder macroeconomic and monetary policy, as governments are forced to put their house in order and central banks use government securities in their open-market transactions; and furthering institutional quality, as LCBMs require a strong legal framework and may contribute to building governments' domestic accountability (World Bank and IMF, 2001; Kumhof and Tanner, 2005; Abbas and Christensen, 2010; Richard *et al.*, 2010; IMF *et al.*, 2013; Mu *et al.*, 2013; Laeven, 2014).[2]

LCBMs are no panacea, however. Probably the most-cited argument against over-reliance on government LCBMs is their potential to crowd out domestic credit to the private sector. The reasoning goes that, when issuing in domestic markets, 'governments tap domestic private savings that would otherwise be available to the private sector' (Christensen, 2005, p. 521). According to the so-called 'lazy bank' view, large holdings of government bonds by local banks, whether the result of banks' own choice or government coercion, may reduce bank efficiency and shrink their private sector loan portfolios. Reliable profits from lending to the government are said to reduce banks' incentives to actively look for private sector borrowers, especially in the risky banking environment of most developing countries (Emran and Farazi, 2009; Hauner, 2009; Ismihan and Ozkan, 2012). It should be noted, however, that the crowding out argument not only applies to LCBMs but equally to other forms of domestic government borrowing, like direct advances from local commercial banks or even the central bank. Arguably, for a given fiscal deficit, *all* borrowing by the government, unless from abroad, potentially crowds out private sector credit.

Another qualification that needs to be made to crowding out fears is that Sub-Saharan African banking systems have traditionally been characterised by high levels of liquid reserves. Common explanations for bank liquidity hoarding in Africa include the relatively high statutory reserve requirements, low bankability of the private sector, and its role as a precautionary strategy against liquidity risks on banks' volatile deposits (Honohan and Beck, 2007; Nketcha Nana and Samson, 2014). Saxegaard (2006) finds evidence of 'involuntary' excess bank reserves, above and beyond official requirements and precautionary motives, for Nigeria, Uganda and the CEMAC region and argues that such involuntary excess reserves are partly explained by the absence of sufficiently liquid and competitive markets for government securities. From this perspective, one could envisage a deepening of government LCBMs to lead banks to run down excess reserves but not necessarily to reduce their lending to the private sector (which is limited for other reasons). Nevertheless, a number of cross-country empirical studies do suggest that domestic public debt, which includes government LCBMs, crowds out private sector credit (Christensen, 2005; Emran and Farazi, 2009; Mbate, 2013).

[1] The 'spare tyre' metaphor is borrowed from Greenspan (1999), who uses it to describe the robustness of the diversified US financial system during various crises originating in emerging market economies.

[2] This spill-over argument is largely similar to the 'collateral benefits' thesis developed by Kose *et al.* (2009) in the context of financial globalisation (i.e., with respect to *external* finance). To the extent that some of the assumed rewards of LCBMs, such as better monetary policy or improved domestic accountability, are also preconditions for building deep LCBMs, this may give rise to threshold effects and the existence of multiple equilibria in LCBM development (see Van Campenhout and Cassimon, 2012, again for external finance).

A more easily verifiable claim is that debt service costs and refinancing/interest rate risks on local currency bonds are (typically much) higher when compared to non-market funding such as concessional bilateral and multilateral loans, or foreign currency market borrowing, especially in thin markets where such bonds bear higher interest rates and have shorter maturities (Beaugrand *et al.*, 2002; Christensen, 2005; Blommestein and Horman, 2007; Hanson, 2007). Moreover, it is hard for LCBMs to develop and deepen without a critical mass of investors and basic financial market infrastructure; which implies that some small economies may be better served by international capital markets or regional cooperation (Laeven, 2014).

The 'optimal' public debt structure is one that balances important trade-offs: local vs. hard currency, domestic vs. external creditors, short vs. long maturities, and nominal vs. price-indexed debt (Blommestein, 2005; Panizza, 2008, 2010). As in advanced and emerging economies, African LCBM development should ultimately be part of a broader, risk-based public debt management strategy (Blommestein, 2005; Blommestein and Santiso, 2007).

The contribution of this paper to the existing literature on LCBMs in Sub-Saharan Africa is twofold. First, bringing together cross-country comparable information that was hand-collected from various sources, including the OECD, the African Financial Market Initiative (AFMI) and private sector data providers, we present a detailed account of the current state of African government LCBMs and highlight important cross-country differences. Second, we introduce a new detailed panel dataset, compiled by the OECD, that covers government LCBM capitalisation in selected Sub-Saharan African countries over the period 2003-2012 and employ it to complement and extend the small but growing empirical literature on LCBM development in Africa and other developing regions. For example, we include in our econometric analysis explanatory variables such as inflation, democracy and other government debt stock, which have been ignored in comparable studies on Africa (Adelegan and Radzewicz-Bak, 2009; Mu *et al.*, 2013), and perform a battery of additional robustness tests.

The paper is structured as follows. In Section 2 we conduct a stock-taking exercise and show that quite a few African countries have made significant progress in developing their LCBMs. Increasingly, governments in the region issue fixed-rate bonds with tenors of ten years and more, on a regular basis. This does not imply all is well, since African LCBMs have often low liquidity, feature very few corporate securities and generally have relatively narrow investor bases. After reviewing the literature on the determinants of domestic public debt more generally, and LCBMs in particular, Section 3 presents the new OECD panel dataset and discusses original econometric results on the drivers of African government LCBMs using different estimators and model specifications. Our key findings are that, on average, government LCBM capitalisation is larger in African countries with lower fiscal balances, lower inflation, common law legal origins, higher institutional quality and stronger democratic political systems. Controlling for unobserved country-specific heterogeneity and persistence in LCBM development, we find above all that a worsening fiscal balance and declining inflation are associated with increases in government LCBM capitalisation. Section 4 concludes.

## 2. Taking stock: Sub-Saharan Africa's local currency government bond markets in perspective

### 2.1. Domestic vs. external public debt in Sub-Saharan Africa

To place LCBMs in a broader perspective, it is useful to first distinguish between domestic and external public debt. Panizza (2008) identifies three possible ways to make this distinction: first, based on the currency in which the debt is issued; second, based on the residency of the creditor, which is the criterion officially adopted by the IMF, World Bank, BIS, OECD and others; and third, based on the place of issuance and legislation governing the debt contract. The second definition of domestic and external public debt is analytically most correct, but difficult to apply in practice with respect to bonded debt, since it requires periodic surveys to identify the ultimate bond holders (which may be very difficult to accomplish; see Daniel, 2008). That is why, typically, the third method, which classifies external debt as debt issued on international markets, and in some instances the first method, according to currency denomination, are used as more feasible alternative taxonomies, for example, in joint IMF-World Bank Debt Sustainability Analyses (IMF and IDA, 2013, p. 15).

Figure 1 shows the historical evolution of (unweighted) average domestic and external public debt as a percentage of GDP, for the whole of Sub-Saharan Africa and separately for countries that have benefitted from the Heavily Indebted Poor Country (HIPC) initiative (since 1996) and its successor, the Multilateral Debt Relief Initiative (MDRI), and those that have remained outside such initiatives.[3] From Figure 1 it is obvious that, largely due to external debt relief under HIPC and MDRI, total public debt ratios have come down dramatically since 2000, and domestic public debt now constitutes an important part, around 40% on average, of public debt stocks in Sub-Saharan Africa. The build-up of domestic public debt by African non-HIPCs seems to have been larger than by HIPCs. Nonetheless, also HIPCs tapped domestic markets as they were limited in their non-concessional external borrowing (and prohibited from monetising deficits) as part of IMF programmes (Arnone and Presbitero, 2010).

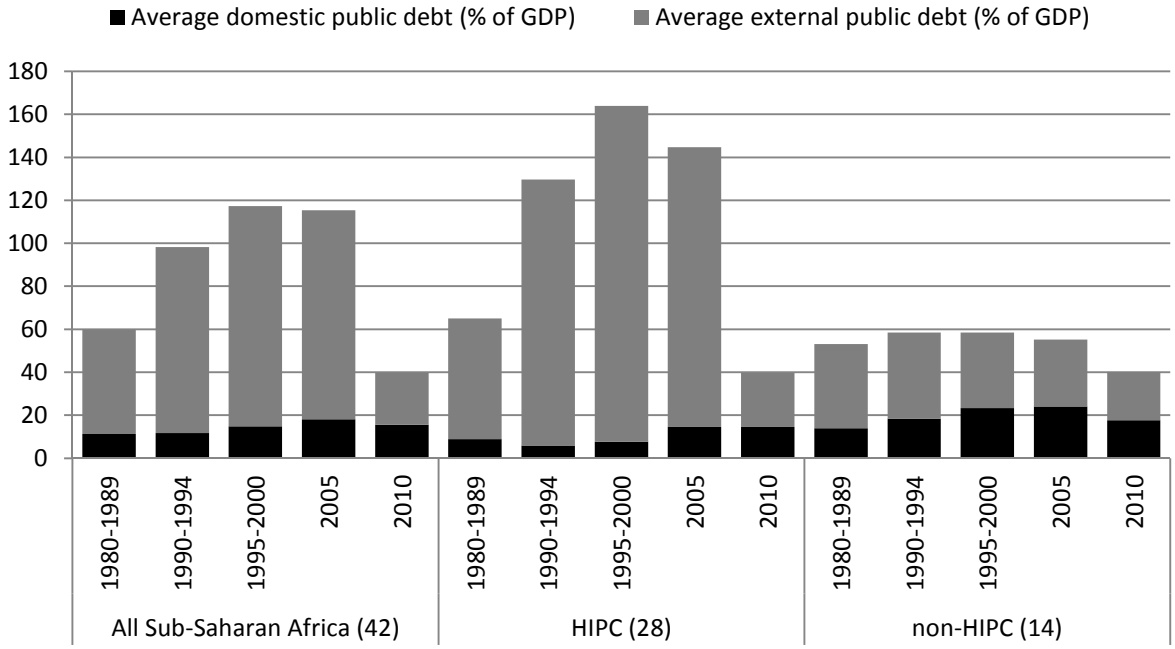
Importantly, not all of the domestic public debt reported in Figure 1 consists of (longer-tenor) bonds denominated in local currency. According to the official definitions applied by international organisations, domestic public debt may include a whole range of financial liabilities, including (but not limited to) securities such as bonds, notes and bills; loans; currency and deposits; insurance technical reserves; financial derivatives; and other accounts payable, such as trade credits and central bank advances (see BIS *et al.*, 2013). This in turn means that the benefits of government LCBMs (as discussed in Section 1) do not fully and automatically materialise in countries with large domestic public debt, and that narrower measures are needed to gain further insights into domestic public debt's potential and vulnerabilities.

Ideally, one would decompose domestic public debt figures, not only by type of instrument, but also by currency, maturity and creditor type. Such detailed information is, however, not systematically available for a larger sample of African countries. That said, some useful information has been collected by individual researchers (see Presbitero, 2012 for an overview and discussion of different databases). For a sample of African HIPCs, Arnone and Presbitero (2010) show that between 1994 and 2003 the growing domestic public debt stock was strongly biased towards short-term instruments (mainly treasury bills), suggesting that external debt's currency mismatches were initially

[3] Country-specific public debt figures can be found in Essers and Cassimon (2012, pp. 15-16).

replaced by domestic debt's maturity mismatches (see also Christensen, 2005). Moreover, central bank advances are still an important category of domestic public debt, especially for HIPCs, where they showed an increase post 2007 (as countries responded to the global crisis). Nonetheless, using 1996-2011 data on the domestic public debt structure of 15 low-income countries (again mostly African), Bua *et al.* (2014) find that the share of longer-term marketable securities has grown and borrowing costs have come down over time.

*Figure 1. Evolution of average domestic and external public debt in Sub-Saharan Africa, 1980-2010*




Notes: 1980-1989, 1990-1994 and 1995-2000 averages are from Christensen (2005), which excludes arrears and direct advances from central and commercial banks from domestic public debt; 2005 and 2010 figures are based on IMF Article IV Staff Reports and other IMF Country Reports (various years). 2005 and 2010 data are for most countries limited to central government debt, but sometimes include state and local governments and/or public company debt. Domestic-external debt classification is, in most cases, based on place of issuance. HIPCs include Benin, Burkina Faso, Burundi, Cameroon, Central African Republic, Chad, Democratic Republic of Congo, Republic of Congo, Côte d'Ivoire, Ethiopia, The Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Madagascar, Malawi, Mali, Mozambique, Niger, Rwanda, São Tomé and Príncipe, Senegal, Sierra Leone, Tanzania, Togo, Uganda and Zambia. Non-HIPCs include Angola, Botswana, Cape Verde, Gabon, Kenya, Lesotho, Mauritius, Namibia, Nigeria, Seychelles, South Africa, Sudan, Swaziland and Zimbabwe. Comoros, Equatorial Guinea, Eritrea, Djibouti, Mauritania, Somalia and South Sudan are excluded for data availability reasons.

### 2.2. Current state of local currency government bond markets in Sub-Saharan Africa

In the remainder of the paper we focus on one particular subcategory of domestic public debt, i.e., local currency marketable central government debt (or government LCBMs in short), irrespective of the residency of creditors or place of issuance. Table 1 presents information on a number of fairly detailed quantitative and qualitative government LCBM indicators for selected Sub-Saharan African countries, to which we have added as an appendage one column on corporate LCBM capitalisation. These cross-sectional data represent the most up-to-date information we were able to collect from various sources, primarily OECD (2013), Mu *et al.* (2013), the African Development Bank's AFMI website, Standard Chartered Bank's Local Market Compendium 2014 and Ecobank's Middle Africa Market Update, and have been cross-checked where possible. To our knowledge, these detailed

indicators are not available in panel data format (apart from central government and corporate LCBM capitalisation figures, see further). Table 1, although uneven in terms of data coverage, gives a first impression of the various stages of LCBM development countries in the region have attained.

We restrict ourselves to non-CFA (*Communauté Financière de l'Afrique* and *Coopération Financière Africaine*) countries only in Table 1. LCBMs in the CEMAC and WAEMU integration blocs are somewhat different from the rest of Sub-Saharan Africa as they are both organised and governed by regional organisations and institutions; bills, bonds and other debt instruments issued by individual member country governments, resident and non-resident development banks, and corporates are listed on regional stock exchanges in Libreville and Abidjan. The (separate) currency board arrangements of CEMAC and WAEMU with the French Treasury, which guarantees unlimited convertibility of both CFA francs with the euro in return for foreign reserves deposits by the CFA franc zone's central banks, have arguably contributed to monetary credibility in the two monetary unions (Gulde, 2008). *Ceteris paribus*, this should make CFA franc-denominated government bonds more attractive, especially for foreign investors. In practice however, the LCBMs of WAEMU and, especially, CEMAC members remain very underdeveloped and non-resident participation in these markets is marginal. Then again, because of the CFA francs' hard peg to the euro, CFA franc-denominated bonds may operate less as a debt-stabilising mechanism in CEMAC and WAEMU countries (and therefore provide less benefits) than in other African countries (especially those that have floating exchange rate regimes).[4]

Table 1 shows that South Africa's government LCBM is by far the largest and most advanced in Sub-Saharan Africa. In relative terms (i.e., as a percentage of GDP), its outstanding marketable central government debt is only surpassed by tiny Mauritius and Eritrea (a country that only issues treasury bills). Other relatively large government LCBMs are those of Kenya, Ghana, Ethiopia, Malawi and Nigeria. Also Zambia, Uganda, Namibia and Tanzania had marketable government debt stocks in excess of 10% of GDP in 2012.

Note that quite a few African governments are now able to issue longer-term bonds in local currency domestically. In addition to South Africa, also Kenya, Namibia and Nigeria have successfully issued bonds with original maturities of 20 years or more. The governments of Botswana, Mauritius, Angola, Lesotho, Swaziland and a number of former HIPCs (including Tanzania, Uganda, Zambia, Ethiopia and Mozambique) have issued bonds with tenors of at least ten years. Many of these governments have concrete plans to issue local currency debt with even longer maturities, thereby eliminating or, at least, reducing (domestic) original sin in Sub-Saharan Africa (Essers and Cassimon, 2012).

[4] For more details on the LCBMs of CEMAC (Economic and Monetary Community of Central Africa) and WAEMU (West African Economic and Monetary Union) countries we refer to Beaugrand *et al.* (2002), Sy (2010) and Diouf and Boutin-Dufresne (2012). CEMAC members include Cameroon, Central African Republic, Chad, Republic of Congo, Equatorial Guinea and Gabon. WAEMU comprises Benin, Burkina Faso, Côte d'Ivoire, Guinea-Bissau, Mali, Niger, Senegal and Togo.

*Table 1. LCBM indicators for selected Sub-Saharan African countries*

| | Central government LCBMs | | | | | | | | | | Corporate LCBMs |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Country** | **Capitalisation of marketable debt, % of GDP (year)** | **Full bond tenor span** | **Common bond tenors** | **Common bond coupon types** | **Published bond auction calendar / auction frequency** | **Primary dealer system** | **Main resident investors** | **Foreign investors** | **Restrictions on foreign investment** | **Bid-ask spread on secondary market (year)** | **Capitalisation, % of GDP (year)** |
| Angola | 7.8 (2012) | 1Y-12Y | 1Y-6Y | pre-determined / fixed; indexed; foreign currency | Yes / weekly | No | mainly commercial banks; also institutional investors (pension funds and insurance companies), central bank and mining and oil companies | negligible | Yes, strict exchange controls | no active secondary market | no corporate bond market |
| Botswana | 3.7 (2010) | 2Y-15Y | existing bond issues tapped at auction | fixed; floating | No / de facto half-yearly | Yes | mainly institutional investors (insurance companies and pension funds); also commercial banks and central bank | negligible | Yes, only up to 20% of bonds issued | 20bps (2013) | 3.1 (2010) |
| Burundi | 2.2 (2008) | 2Y-5Y | N/A | N/A | No / ad hoc | No | mainly commercial banks (65% in 2011); also institutional investors | negligible | No | very illiquid secondary market | no corporate bond market |
| Eritrea | 45.5 (2010) | only bills | none | none | No / none | No | N/A | N/A | N/A | no secondary market | no corporate bond market |
| Ethiopia | 20.6 (2009) | 5Y-10Y | N/A | fixed; floating; foreign currency | No / ad hoc | No | commercial banks and institutional and retail investors | none | Yes; infrastructure bonds only available to Ethiopian nationals and diaspora | no active secondary market | 7.2 (2010) |
| Ghana | 23.7 (2010) | 1Y-7Y | 1Y-7Y | fixed | No / de facto weekly | Yes | mainly commercial banks (35% in 2013); also national pension fund, retail investors, insurance companies, firms | considerable (>30% in 2013) | Yes, only allowed in bonds with tenors ≥3Y | 50bps (2013) | <0.1 (2010) |
| Kenya | 24.7 (2012) | 1Y-30Y | 2Y-20Y | fixed | Yes / monthly | No | mainly commercial banks (50% in 2013); also institutional investors (incl. mutual/pension funds and insurance companies) (30%) | limited (<1% in 2013) | No | 50bps (2013) | 0.7 (2010) |
| Lesotho | 5.0 (2010) | 3Y-10Y | N/A | fixed | Yes / two-monthly | No | mainly commercial banks (90% in 2012); also institutional investors | negligible | No | very illiquid secondary market | no corporate bond market |
| Madagascar | 6.6 (2012) | only bills | none | fixed | No / none | No | mainly commercial banks (80% in 2012) | negligible | No | very illiquid secondary market | no corporate bond market |
| Malawi | 19.1 (2012) | 2Y-5Y | N/A | fixed | No / ad hoc | No | mainly central bank (75% in 2012); also commercial banks (15%), pension funds | negligible | Yes, only up to 10% of any class of security | very illiquid secondary market | N/A |
| Mauritius | 40.5 (2012) | 3Y-15Y | 3Y-5Y | fixed; floating; indexed | Yes / monthly | Yes | diversified: institutional investors (incl. pension funds and insurance companies) (55% in 2013) and commercial banks (40%); also central bank, retail investors | limited (<1% in 2013) | No | 50-100bps (2013) | <0.2 (2006) |

*Table 1* (Continued)

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Mozambique | 4.5 (2012) | 3Y-10Y | 3Y-5Y | fixed; floating | Yes / at unequal intervals | Yes | mainly commercial banks (65% in 2013); also central bank, insurance companies, investment management companies | negligible | Yes, exchange controls and foreign investment only allowed in specific bond issues | very illiquid secondary market | few corporate bonds |
| Namibia | 11.1 (2010) | 2Y-22Y | N/A | fixed | Yes / two-weekly | No | mainly pension funds and insurance companies | N/A | No | illiquid secondary market | 6.2 (2010) |
| Nigeria | 15.2 (2012) | 2Y-20Y | 3Y-20Y | fixed; floating | Yes / monthly | Yes | mainly commercial banks (55% in 2012) and institutional investors (incl. pension funds and insurance companies) (20%); also central bank | considerable (20% in 2012) | No | 8-12bps for ≤3Y; 3-6bps for >3Y (2013) | 3.8 (2010) |
| Rwanda | 8.8 (2010) | 2Y-5Y | N/A | fixed | Yes / quarterly | No | mainly commercial banks, pension funds and insurance companies; also retail investors | limited | No | very illiquid secondary market | <0.1 (2010) |
| Sierra Leone | 7.5 (2012) | 1Y (and 5Y non-traded) | 1Y | fixed | Yes / monthly | Yes | mainly commercial banks (75% in 2013); also central bank, institutional and retail investors | N/A | No | very illiquid secondary market | no corporate bond market |
| South Africa | 34.9 (2012) | 1Y-35Y (> for indexed) | 2Y-10Y for fixed; 7Y-30Y for indexed | fixed; indexed | Yes / weekly | Yes | mainly institutional investors (incl. pension funds and insurance companies) (45% in 2013); also commercial banks (15%), central bank, retail investors, mutual funds and other | considerable (35-40% in 2013) | No | 2-4bps for fixed; 3-5bps for indexed (2013) | 20.0 (2010) |
| Swaziland | 6.4 (2010) | 2Y-10Y | N/A | fixed; floating | Yes / at unequal intervals | Yes | mainly commercial banks (70% in 2013); also non-bank financial institutions (20%), central bank and other | limited | No | very illiquid secondary market | 0.7 (2010) |
| Tanzania | 10.4 (2012) | 2Y-15Y | 2Y-10Y | fixed | Yes / two-weekly | Yes | mainly commercial banks (55% in 2013); also institutional investors (incl. pension funds and insurance companies) (40%), central bank | N/A | Yes, bonds only available to nationals and EAC foreigners | 50bps (2013) | 0.3 (2010) |
| Uganda | 13.0 (2012) | 2Y-15Y | 2Y-3Y | fixed | Yes / monthly | Yes | mainly commercial banks (50% in 2013); also institutional investors (incl. national social security fund and insurance companies), central bank | considerable (10-20% in 2013) | No | 50bps (2013) | 0.4 (2010) |
| Zambia | 13.6 (2012) | 2Y-15Y | 2Y-5Y | fixed | Yes / quarterly | No | mainly commercial banks (35-50% in 2013); also institutional investors (incl. pension funds and insurance companies) (>30%), central bank (15%) | limited (5% in 2012) | No | 100bps (2013) | 0.6 (2010) |

Notes: Data are sourced from OECD (2013), Mu *et al.* (2013), AFMI website (africanbondmarkets.org; last consulted: 16 October 2014), Standard Chartered Bank's Local Market Compendium 2014, Ecobank's Middle Africa Market Update (various issues) and country-specific reports and websites. Capitalisation figures are for end of year in parentheses. 'Indexed' means bond coupon indexed to domestic inflation rate; 'floating' means bond coupon linked to domestic or international reference interest rate; 'N/A' means not available.

Another notable feature associated with overcoming original sin is that most government bonds have fixed-rate coupons. But there are exceptions, such as Angola where, next to fixed-rate local currency (kwanza) bonds, issuance also includes bonds denominated in and indexed to the US dollar as well as inflation-indexed local currency bonds (see OECD, 2013). About two thirds of the African countries listed in Table 1 publish an official bond auction calendar and hold bond auctions at least quarterly; several among them even hold monthly auctions. Half of the counties use primary dealer systems, where a number of accredited financial firms (usually local commercial banks) act as principal intermediaries in the government LCBM.

In spite of these observations, which reveal a gradual expansion and deepening of African LCBMs, important policy challenges remain. Liquidity in most African LCBMs remains shallow, concentrated in government debt instruments of a handful of countries (particularly South Africa and Nigeria). Corporate LCBMs are at an early stage of development and even more illiquid than government LCBMs.[5] Only in South Africa there is currently a vibrant corporate LCBM; other African corporate bond markets are starting to grow, but from a very low base (Mu *et al.*, 2013). Activity is driven by relatively few issuers, mostly parastatals and commercial banks.

Local banks continue to be the dominant investor class in African government LCBMs. According to Table 1, domestic commercial banks often hold 50% or more of outstanding government securities, especially in countries with the least developed LCBMs (such as Lesotho, Sierra Leone, Swaziland and Burundi). In some cases this situation reflects regulatory requirements for banks to hold government debt in portfolio, but it may also mirror other forms of financial repression (Blommestein and Horman, 2007). Indeed, a sound banking system is thought to be a key precondition for LCBM development (IMF *et al.*, 2013). But the dominance of local commercial banks as (government) LCBM investors may also have important negative side effects. First, it changes the 'effective maturity' of government debt. In the event of a domestic banking crisis, local banks' (longer-term) bond holdings become overnight government debt (Panizza, 2010).[6] More generally, large local bank holdings of government debt could create negative feedback loops between sovereign and bank balance sheets, threatening domestic financial stability (Gennaioli *et al.*, 2014). Second, with banks as the dominant investor class, the envisioned diversification benefits of LCBMs are greatly diminished; LCBMs will no longer act as an alternative source of finance when countries are faced with a banking stress-induced credit crunch. In the words of Eichengreen (2008, p. 2), 'the spare [tyre] may go flat at the same time as the other'. Third, excessive holdings of local currency government debt by local banks increase the likelihood of crowding out private sector credit. This last point is deemed of particular relevance in the African context, where private companies rely primarily on bank lending, due to the underdevelopment of corporate LCBMs (Christensen, 2005); although the same qualifications highlighted in Section 1 again apply.

Therefore, an encouraging evolution in a number of African LCBMs is the growing role of local non-bank, institutional investors. For example, South African pension funds are now the largest group of resident investors in government bonds. Local pension funds and/or insurance companies are also major bond holders in Botswana, Mauritius, Namibia and Tanzania, and account for non-

[5] As we pointed out in Chapter 2, limited secondary bond market liquidity and the underdevelopment of corporate relative to public bond markets are not at all unique to Sub-Saharan Africa. Similar observations have been made by Didier and Schmukler (2014) with respect to the LCBMs of emerging market economies in Asia, Latin America and Eastern Europe.

[6] When a commercial bank fails, its assets, including government bonds, are typically liquidated to repay the bank's creditors.

negligible shares in Kenya, Nigeria, Uganda, Zambia and others. These institutional investors seek to match long-term assets with long-term liabilities (Adelegan and Radzewicz-Bak, 2009). As a result, the expansion of the institutional investor base has gone hand in hand with the lengthening of bond maturities.

Another dimension covered in Table 1, although very unevenly, is the existence of (*de jure*) restrictions on non-resident investment in government bonds, and the (*de facto*) presence of foreign investors in government LCBMs. We observe quite some diversity. For example, in Ethiopia foreigners are banned completely from investing in infrastructure bonds. Both Angola and Mozambique have in place strict exchange controls, whereas Botswana and Malawi apply quotas to foreign investment in certain bond issues. Tanzania has only very recently opened up its bond markets to residents of the East African Community (EAC), as part of its EAC common market commitments. The available estimates indicate that, in practice, only South Africa, Ghana, Nigeria and Uganda have markets with a considerable presence of non-resident investors.

Foreign investment in emergent (government) LCBMs has both pros and cons. On the one hand, foreign investor participation expands the investor base, typically boosting liquidity and demand for longer-maturity bonds (IMF *et al.*, 2013), and contributes to international risk sharing. Also, it may put extra pressure on improving the quality of financial intermediation and the associated market infrastructure, thereby strengthening market functioning (World Bank and IMF, 2001; Peiris, 2010). On the other hand, greater reliance on foreign investors could amplify market stress, given the volatility and potential rapid reversal of foreign capital flows. As argued by Sienaert (2012, p. 12), foreign investors in local currency bonds are 'not a monolithic bloc that can be characterized merely as a source of 'hot money''. But some categories of foreign investors, such as hedge funds, are more sensitive to (global) risk and typically manage their bond portfolios very actively (World Bank and IMF, 2001). This increases the vulnerability of host countries to external shocks, especially of countries with weaker fundamentals (Pomerleano, 2010; Ebeke and Lu, 2014).[7]

## 3. Drivers of local currency government bond markets in Sub-Saharan Africa: An econometric assessment

After the cross-sectional overview of the current state of African government LCBMs in the previous section, we now turn to an examination of the factors that have driven LCBM development in the region in recent years. To this end, we will introduce and analyse a novel, detailed panel dataset on government LCBM capitalisation in selected Sub-Saharan African countries. We start, however, with a review of previous studies on the determinants of domestic public debt, and LCBMs more specifically.

### 3.1. Literature review

The question of what drives domestic public debt and LCBM development in emerging market economies and other developing countries has been the subject of a relatively new, but growing

[7] As discussed in Chapter 2 of this dissertation, some LCBMs of larger emerging market economies were temporarily affected during the crisis, because of the exit of foreign investors (and local subsidiaries of foreign banks) (see Miyajima *et al.*, 2012; Turner, 2012). Also in South Africa and Nigeria non-resident investment in government LCBMs took a hit in 2008 (Essers and Cassimon, 2012).

literature. First, a number of studies have focused on the determinants of the domestic component of original sin, i.e., the inability of a country to borrow long-term in its own currency domestically. With cross-sectional data for up to 21 emerging market economies from JP Morgan reports, Hausmann and Panizza (2003) tentatively find that domestic original sin is determined by higher average inflation and the absence of capital controls. For a larger panel of emerging market economies, with hand-collected data on 33 countries over 1994-2004, Mehl and Reynaud (2005) confirm the association with inflation but not with capital controls. They also identify the slope of the yield curve of government debt, the size of the investor base and, to a lesser extent, the debt service burden as predictors of domestic original sin.

The same dataset (extended to 2006) allows Mehl and Reynaud (2010) to gauge the determinants of a 'risky' composition of domestic public debt, defined as debt that is denominated in foreign currency, has short maturities or is indexed. They find that overall economic size, size of the investor base, inflation and the fiscal balance are all related with the riskiness of domestic public debt. Only inflation bears on all three forms of risky debt. Based on a 1980-2005 dataset of 19 emerging market economies' central government debt structure collected by Jeanne and Guscina (2006), Guscina (2008) shows that an unstable macroeconomic environment, low institutional quality and political uncertainty limit the development of markets for (traded) domestic public debt, and shift debt structure away from local currency long-term fixed-rate domestic public debt towards foreign currency, short-term and/or indexed debt. Forslund et al. (2011) use data assembled by Panizza (2008) to investigate the correlates of the domestic share of total government debt for up to 95 developing countries over 1994-2006. They conclude that a large set of candidate variables, although mostly taking the theoretically expected signs in panel regressions, do not go far in explaining regional variation in government debt composition. Only in countries with moderate or no capital controls a negative correlation between inflation and the domestic debt share is observed; not so in countries with high capital controls (where governments can force their debt on investors despite low monetary credibility).

Other studies have adopted a narrower focus on LCBMs, instead of domestic public debt as a whole. Burger and Warnock (2006) rely on unpublished BIS statistics augmented with Merrill Lynch data in a 2001 cross-section of 49 developed and emerging market countries to analyse the determinants of longer-term LCBMs, both government and corporate (and irrespective of the place of issuance). Their main findings are that countries with a better historical inflation performance, a stronger rule of law and more creditor-friendly legislation have greater LCBM capitalisation and depend less on foreign currency bonds. It is further argued that the determinants of bond markets are very similar to those of the domestic banking system. Also using BIS statistics, for a 1993-2000 panel of 35 developed and emerging market countries, Claessens *et al.* (2007) link country size, size of the domestic banking sector and stock market, low inflation, a higher fiscal burden, British legal origins, democracy, capital account openness and more flexible exchange rate regimes to larger government LCBMs and a greater local currency share in total bonded government debt. Similarly, Eichengreen and Luengnaruemitchai (2006) employ BIS panel data for 41 countries over 1990-2001 and find country size, institutional quality, greater fiscal deficits and capital account openness to be positively correlated with the capitalisation of LCBMs. In contrast with Claessens *et al.* (2007) they argue that exchange rate stability has encouraged LCBM development.

The work of Eichengreen and Luengnaruemitchai (2006) is expanded upon by Eichengreen *et al.* (2008), who use a larger sample of 56 countries over 1990-2004 and distinguish between government, corporate and financial sector domestic bonds. Their analysis of government LCBMs

identifies country size, GDP per capita, trade openness, total government debt, institutional quality, stricter capital controls, a privatised pension system and lower domestic interest rates as the main correlates. When the sample is restricted to 21 emerging market economies, country size is no longer a significant factor and having a fixed exchange rate regime gains importance. Bae (2012) draws on 1990-2009 BIS panel data for 43 developed and emerging market countries. He finds that GDP per capita and the fiscal balance explain most of the variation in outstanding domestic government bonds. Institutional quality seems to matter only for foreign (US) participation in government LCBMs. Lastly, Bhattacharyay (2013) studies government and corporate bond markets in 11 East Asian economies over 1998-2008 and concludes that their size is correlated with GDP, GDP per capita, trade openness, banking sector development and interest and exchange rate variability.

Apart from Forslund *et al.* (2011), none of the above has considered Sub-Saharan African countries other than South Africa. The current paper is most related to two recent studies with a particular focus on the Sub-Saharan African region. Adelegan and Radzewicz-Bak (2009) have collected data from IMF and World Bank databases and country desks on domestic government and corporate debt stocks in 23 Sub-Saharan African countries over 1990-2008. Their analysis suggests that economic structure, institutional quality, size of the banking sector, GDP per capita, domestic interest rates, exchange rates, capital controls and fiscal balances all matter for LCBM capitalisation but often have different effects on government and corporate debt. A recent paper by Mu *et al.* (2013) extends the dataset of Adelegan and Radzewicz-Bak (2009) with extra IMF and primary national sources to obtain panel data on government LCBM capitalisation, more specifically domestically issued and marketable securities, for 36 African countries over 1980-2010; and on corporate LCBM capitalisation for 24 countries. Using a range of static and dynamic panel estimation techniques, the authors find that the interest rate spread, fiscal balance, exchange rate volatility, trade and capital account openness, and country area size are all negatively correlated with their measure of government LCBM capitalisation; whereas British legal origins, institutional quality and domestic (inter-bank) interest rate volatility are positively correlated.[8]

### 3.2. Empirical strategy and data description

#### *3.2.1. Model specification*

To investigate the determinants of African government LCBM capitalisation in a multivariate context we estimate a series of reduced-form panel data models which, in their most general set-up, can be written as follows:

$$Y_{i,t} = \alpha + \beta X_{i,t-1} + \delta\mu_i + \gamma\pi_t + \varepsilon_{i,t} \quad (1)$$

where $Y_{i,t}$ is the dependent variable, i.e., government LCBM capitalisation for country $i$ in year $t$; $X_{i,t-1}$ is a vector of one-year lagged[9] time-varying and time-invariant explanatory variables derived from

[8] Unlike most other LCBM studies, Adelegan and Radzewicz-Bak (2009) and Mu *et al.* (2013) do not control explicitly for inflation in their estimations.

[9] The reasons for using lagged variables here are twofold. First, as shown in Section 3.2.2, our dependent variable extends to the year 2012, whereas some explanatory variables were only available up to 2011 at the time of writing. The use of lagged values therefore increases our sample size. Second, it also diminishes endogeneity concerns.

the literature and described in more detail in the next section; $\mu_i$ are country-specific effects; $\pi_t$ is a common global factor; and $\varepsilon_{i,t}$ is a well-behaved error term.

In our search for drivers of government LCBMs, we will use and compare a variety of panel data estimation techniques and model specifications. For our baseline estimations we rely on (i) pooled ordinary least squares (POLS), assuming a common intercept across countries ($\delta$ = 0 in Equation (1)) and (ii) the fixed effects (FE) ('within') estimator, which allows for country-specific effects that are correlated with other regressors. In the robustness section we also discuss the results of (iii) feasible generalised least squares (FGLS) with heteroskedastic error structures and panel-specific autocorrelation (which is the most commonly used estimator in the studies reviewed in Section 3.1); and (iii) the random effects (RE) estimator, which models the country-specific constant terms $\mu_i$ as distributed randomly across countries and independently from the other explanatory variables. We present summary statistics to assess the goodness of fit of the various specifications and, where possible, diagnostic tests for the assumptions inherent to the different estimators. However, given the relatively small size of our sample and limited within-country variation (see next section), some of these tests may not provide definitive answers to questions of model choice. Moreover, given the dominance of between-country variation, it makes sense to consider other estimators in parallel with FE (which eliminates all time-invariant heterogeneity between countries).

In separate regressions we will control for persistence in LCBM capitalisation, in view of the possibility that government LCBM capitalisation is a process of gradual adjustment, where market development in one period heavily influences the state of the market in the next period. To model these dynamics explicitly, we add a lagged dependent variable $Y_{i,t-1}$ to Equation (1) and estimate the autoregressive relation by means of the 'system' generalised method of moments (GMM) estimator. This estimator uses internal instrumental variables to overcome dynamic panel bias and allows us to control for the potential endogeneity (or predeterminedness) of other explanatory variables too.[10]

### *3.2.2. Sample, data sources and descriptive statistics*

As the source for our dependent variable we use the fourth edition of the OECD's *African Central Government Debt Statistical Yearbook* (OECD, 2013), henceforth the 'African Yearbook', which has a number of advantages over the datasets used by related papers covering Sub-Saharan Africa. First of

[10] In principle, one should also examine in greater detail the time-series properties of our panel data, such as potential non-stationarity (which may lead to spurious correlations) (see Söderbom *et al.*, 2015 for an overview). The presence of unit roots is, however, difficult to detect and distinguish from high persistence, especially in small samples with a short time dimension. Nevertheless, we have experimented with applying different panel unit root tests to our dependent variable LCBM capitalisation. The Levin *et al.* (2002) test, which assumes all panels share a common autoregressive parameter, strongly rejects the null hypothesis of unit roots in favour of stationarity of LCBM capitalisation, whether or not we include a linear time trend or add extra lags to the augmented Dicky-Fuller regressions the test implements. Variations of the Im *et al.* (2003) test procedure, which allows for panel-specific autoregression, similarly tend to reject the null of all panels containing unit roots against the alternative of some panels being stationary. Conversely, the heteroskedasticity-robust test proposed by Hadri (2000), which also permits panel-specific autoregression but reverses the null and alternative hypothesis, strongly suggests that some panels are indeed non-stationary. When applied to the first-differenced LCBM capitalisation series, the Hadri test can no longer reject the null of overall stationarity. It thus seems that, for some countries at least, LCBM capitalisation may be integrated of order one; although we should be careful in interpreting the above tests because of their asymptotic assumptions. In line with the literature surveyed in Section 3.1 we do not attempt to control for non-stationarity (by estimating more complex error-correction models) in the current paper, but keep in mind that it may influence our results, especially those based on POLS and FE estimators.

all, the African Yearbook sources all its data on debt stocks directly from African debt management offices (or similar national agencies) participating in the OECD *Project on African Public Debt Management and Bond Markets* (see Blommestein and Ibarlucea Flores, 2011) whereas other papers tend to mix primary and secondary (usually IMF and World Bank) data (Mu *et al.*, 2013; Bua *et al.*, 2014). Data collection is accomplished through a standardised questionnaire, circulated since 2010, that follows the methodology of the *Statistical Yearbook on Central Government Debt* for OECD countries. We believe this contributes to the cross-country comparability of the debt stock data.

Second, the African Yearbook explicitly includes only central government debt (excluding the debt of state and local government, social security funds and other state guarantees, which tend to be more heterogeneous across countries) and classifies this debt according to *currency* and whether or not it concerns *marketable* instruments.[11] This allows us to construct a measure of government LCBM capitalisation, i.e., year-end outstanding local currency marketable central government debt as a percentage of GDP (*lc_mdebt_gdp*), which proxies well the kind of debt stock that protects governments against currency mismatches and generates positive spill-overs (cf. Section 1). Other datasets classify (marketable) government debt based on creditor residency (Bua *et al.*, 2014) or the place of issuance (Mu *et al.*, 2013) and do not seem to explicitly take into account currency denomination.[12]

The fourth edition of the African Yearbook covers 17 countries, of which 15 in Sub-Saharan Africa, over the span of ten years, from 2003 to 2012: Angola, Cameroon, Gabon, Kenya, Madagascar, Malawi, Mauritius, Mozambique, Namibia, Nigeria, Sierra Leone, South Africa, Tanzania, Uganda, Zambia (all Sub-Saharan Africa) and Morocco and Tunisia. Limiting ourselves to Sub-Saharan Africa only, leaves us with government LCBM capitalisation figures for an almost balanced panel sample of 137 observations.[13] Because of the limited coverage of countries, we cannot claim that our results will be fully representative of LCBM development in Sub-Saharan Africa.[14] Nevertheless, we believe this small but diverse set of African low-income, lower-middle income and upper-middle income countries makes for interesting comparisons.

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[11] 'Local currency' debt is defined in the African Yearbook as debt denominated in, or indexed to, local currency. This may include debt for which settlements occur in foreign currency, provided that the cash flows are not indexed to foreign currency (i.e., economic exposure needs to be to the local currency). 'Marketable' debt refers to instruments (securities) that can be bought and sold in the secondary market. The African Yearbook further subdivides non-marketable debt into loans from multilateral, bilateral and commercial creditors and a residual category (which may include central bank advances) (see OECD, 2013).

[12] We do not know, however, of any issuance of local currency securities in international markets by African governments themselves (in contrast to a number of such issues by multilateral development banks; see Chapter 2). Hence, all local currency marketable central government debt we consider can be assumed to have been issued domestically.

[13] Our dependent variable has missing values for Gabon in the years 2003-2007 and 2010-2012, and for Namibia in 2008-2012, resulting in 15 (countries) times ten (years) minus 13 (missings), or 137 observations.

[14] Selection bias could potentially be an issue, although not a major one, we believe. Over the years, the OECD has approached a group of African countries, larger than the 17 countries mentioned, to ask them to participate in the African Yearbook. In practice, an important criterion to invite countries has been a minimum level of development of public debt management functions; so that a small number of highly fragile countries lacking these basic functions have been excluded a priori (Somalia, Sudan, Eritrea, etc.). Invited countries then basically self-selected into the African Yearbook sample by filling out and sending back the questionnaires. There are some indications that failure to return the questionnaires in a timely fashion may have been linked to capacity constraints and political turmoil (especially in Northern Africa). The eventual sample is however very diverse in terms of economic development and institutional quality, as well as debt structure (see further). We choose to ignore possible selection bias in the remainder of the paper.

Figure A.1 in Appendix evaluates our dependent variable against figures from Mu *et al.* (2013), which in principle should be similar, except for the fact that the latter do not exclude domestically issued *foreign currency* marketable debt. It shows that the two data sources generally correspond well, although not always. Closer inspection reveals large (hard-to-explain) breaks in Mu *et al.* (2013)'s government debt series for some countries, including Uganda and Sierra Leone, unlike in the African Yearbook data. Our analysis of an alternative dataset therefore constitutes a useful check of previous studies.

Figure A.2 in Appendix plots the evolution of government LCBM capitalisation in our sample. There seems to be no clear common trend over the 2003-2012 period. In Mauritius, for example, market capitalisation steadily declined from 2003 to 2008 and remained stable thereafter, whereas in South Africa it increased rapidly after reaching a trough in 2009. The expansion of South Africa's government LCBM in recent years is also apparent from Figure A.3 in Appendix, which plots the size of the four largest government LCBMs in absolute (nominal) US$ terms.[15] Other notable expansions are those of Nigeria, over the whole of the 2003-2012 period, and of Angola in 2008.[16]

Government LCBMs' share of total central government debt is shown in Figure A.4 in Appendix. Again we observe large country variations and very diverse trajectories. In South Africa and Mauritius LCBMs constituted more than 80% of total government debt over the full sample period; whereas in Nigeria the share of LCBMs increased from just over 20% in 2003-2004 to 80% and beyond in 2006-2012, due to a huge debt relief package agreed on by Nigeria's Paris Club creditors in October 2005. Similarly, the large increase in the range of LCBM shares of total government debt for other sample countries from 2006 onwards seems to have gone together with HIPC and MDRI debt relief. We will return to the effect of debt relief on government LCBM capitalisation in the robustness section.

The independent variables in our analysis were assembled from different databases and selected in line with the literature and maximum data availability for our specific sample. Below we discuss their definitions and the rationale for incorporating them as potential determinants of government LCBM capitalisation. As will become clear, it is not always straightforward to predict the direction of the relation between our dependent variable and individual regressors; expected supply and demand effects sometimes run in opposite ways (cf. Forslund *et al.*, 2011). Table A.1 in Appendix lists all baseline variables, their labels, definitions and sources, and gives the descriptive statistics. Figure A.5 in Appendix plots our measure of government LCBM capitalisation against each of the (one-year lagged) explanatory variables. Data points for South Africa and Mauritius, which are outliers in a number of dimensions, are indicated in white and grey, respectively.

*Country size*

Larger-sized economies have scale advantages in developing deep and liquid bond markets as the greater availability of (potential) buyers and sellers reduces price volatility and encourages investment, or because of important fixed costs in establishing bond market infrastructure

[15] Besides South Africa, a number of other countries, including Kenya, Mauritius, Tanzania and Zambia, also show declines in the absolute US$ value of their government LCBMs in 2008 and/or 2009. This seems to be related to adverse exchange rate movements during the height of the global crisis (cf. Chapter 2).

[16] In April 2014, Nigeria revised its GDP base year (from 1990 to 2010), resulting in an 89% increase of its 2013 GDP estimate, from 42 to 80 trillion naira. In this paper we use the old nominal GDP series to scale our LCBM measure, which is arguably how market participants perceived the Nigerian economy prior to the rebasing.

(Eichengreen and Luengnaruemitchai, 2006; Claessens *et al.*, 2007). Also, small economic size is considered a key determinant of international original sin, i.e., the inability to borrow abroad in local currency (Hausmann and Panizza, 2003; Eichengreen *et al.*, 2005a; Özmen and Arinsoy, 2005). LCBMs of larger economies are said to more easily attract foreign investors due to the greater diversification benefits they offer, which in turn could spur the further development of these markets. Since foreign participation plays only a very small role in Sub-Saharan African LCBMs, with a few exceptions (see Section 2.2), we do not expect this argument to be of major relevance here. On the other hand, smaller (often less-diversified) economies may need to rely more heavily on domestic public funding, lacking the creditworthiness to borrow sizeable amounts from abroad (in foreign currency) (Mu *et al.*, 2013). We use the log of GDP at purchasing power parity (PPP), sourced from the IMF's World Economic Outlook (WEO) database, as our preferred measure of economic size (*ln_gdp_ppp*). We complement it with a geographic measure of country size, log surface area in squared kilometres (*ln_area*), from the World Bank's African Development Indicators (ADI) database.

Panel (a) of Figure A.5 suggests no clear relation between log GDP and our government LCBM measure. Panel (b) shows a significantly negative association of log surface area with LCBM capitalisation, but only because of the relatively large LCBM in island state Mauritius.

*Economic development*

Financial development, in its various aspects, is often thought to co-evolve with broader economic development; a large body of literature points to the existence of a complex, bi-directional finance-growth relationship (see e.g., Demetriades and Hussein, 1996; Calderón and Liu, 2003; Levine, 2005). Financial intermediation makes capital formation and investment possible by bringing together savers and borrowers (from both the public and private sector). But as an economy grows, the demand for financial services and instruments is also expected to increase. This is what Patrick (1966) refers to as the 'demand-following' phenomenon in financial development. We take the log of GDP per capita (PPP), from the WEO, as a broad proxy for the developmental stage of the economy (*ln_gdppc_ppp*). To the extent that GDP per capita is correlated with better governance and policies, stronger creditor rights and a more favourable investment climate, it may also capture some aspects of institutional development not fully covered by the more explicit measures we consider (see further).

In line with our priors, panel (c) of Figure A.5 indicates that LCBM capitalisation is positively correlated with economic development. This positive correlation however disappears when leaving out both South Africa and Mauritius.

*Trade openness*

The expected relationship of government LCBM development with trade openness is somewhat ambiguous. On the one hand, authors such as Rajan and Zingales (2003) argue that in countries that are more open to trade, incumbent interest groups are less able to insist on policies that protect their advantage in relationship-based financing and suppress competing sources of finance, such as securities markets (which could erode the incumbent parties' rents). On the other hand, the supply side may also matter here. For given financing needs, less integrated countries may be more incentivised to develop domestic bond markets (Mu *et al.*, 2013). Following the literature surveyed in

Section 3.1, we measure trade openness as the ratio of total exports of goods and services to GDP (*x_gdp*), with data from the ADI database.

It seems that in our particular sample the first effect dominates the second; panel (d) of Figure A.5 points to a weak, non-significant positive association between trade openness and LCBM capitalisation, at least when Mauritius is included.

*Banking sector size*

Bank- and (bond) market-based finance can be either substitutes or complements (see e.g., Levine, 2002; Song and Thakor, 2010). To the extent that banks already cater directly to the government there may be no immediate need to set up large and deep LCBMs from a supply-side perspective. But, on the demand side, local banks often serve as primary dealers and market makers (Eichengreen *et al.*, 2008) and in most African countries are also the dominant class of investors in government bonds (see Section 2.2), whether or not because of specific government-imposed requirements to which they need to adhere. Moreover, some of the necessary conditions and policies for LCBM development may be similar to those that foster development of the banking system (Burger and Warnock, 2006). We follow previous studies and the broader literature on bank financing in taking as a proxy for banking sector size, domestic credit provided to the private sector (as a percentage of GDP) (*domcred_gdp*), which we obtain from the ADI database.

Panel (e) of Figure A.5 provides support for the complementarity hypothesis; it shows a significant positive relation between private sector domestic credit and government LCBM capitalisation. This relationship increases in strength when South Africa and Mauritius are excluded.

*Fiscal balance*

Another potentially important driver, mostly on the supply side, is the fiscal balance, i.e., government revenue minus government expenditure. *Ceteris paribus*, countries running negative fiscal balances (deficits) have greater need for issuing government bonds than those with positive balances (surpluses). That said, the fiscal balance may well be endogenous to LCBM development. Especially in Africa, many governments face constraints in their ability to borrow so that the size of the fiscal deficit may be in part driven by the availability of bond financing (Mu *et al.*, 2013). Besides, large and sustained fiscal deficits could perhaps undermine the trust of potential LCBM investors; although we anticipate this positive link between the fiscal balance and LCBM capitalisation on the demand side to be dominated by the negative supply effect. To smooth out transient factors we use a three-year moving average of the fiscal balance (Eichengreen and Luengnaruemitchai, 2006), defined as the difference between revenue and total expenditure including the net acquisition of non-financial assets by the general government (and expressed as a percentage of GDP), from the WEO (*av_fiscbal_gdp*).[17]

The expected negative association between past fiscal balances and LCBMs is clearly apparent from panel (f) of Figure A.5.

[17] This measure is also referred to as government 'net lending/borrowing' by the IMF.

*Inflation*

A lack of monetary policy credibility, as evident from high and/or volatile inflation rates, is often seen (and has been empirically established) as a key demand-side impediment to developing LCBMs (Hausmann and Panizza, 2003; Mehl and Reynaud, 2005; Burger and Warnock, 2006; Claessens *et al.*, 2007). If creditors, domestic or foreign, fear that their claims may be inflated away by the government, this will prevent the latter from issuing longer-term local currency bonds (that are not indexed to domestic prices or foreign currency), unless they resort to financial repression of course (Forslund *et al.*, 2011). Alternatively, on the supply side, governments may not need to issue large debts in high-inflation environments as they derive revenues from the 'inflation tax'. However, inflation may be endogenous too. Eichengreen and Hausmann (1999), for example, propose that better-developed LCBMs may create a political constituency opposed to inflationary policies and other forms of debt dilution. In support of this assertion, Rose (2014) finds that the existence of a longer-term government LCBM significantly lowers inflation, but only so in countries with an inflation-targeting regime. We will consider here the inflation rate based on the consumer price index (*infl_cp*), collected from the WEO.

Panel (g) of Figure A.5 shows that inflation is indeed negatively related to LCBM development, although the statistical significance of this negative association depends on the presence of three outlying data points, i.e., Angola's inflation rates of 108.9% in 2002, 98.3% in 2003 and 43.6% in 2004.

*Capital account openness*

The effect of capital account openness on LCBM development is again theoretically ambivalent. On the demand side (and similar to trade openness), an open capital account can expose countries to market discipline, which would make domestic investors more interested in bonds (Claessens *et al.*, 2007); it is also a necessary condition to attract foreign investors. Conversely, on the supply side, governments may use capital controls to prevent domestic capital from leaving the country and create a captive investor base, which would imply a negative relation between capital account openness and LCBM capitalisation (Forslund *et al.*, 2011). We employ a time-varying index of *de jure* capital account openness developed by Chinn and Ito (2006) and updated to 2011 (*kaopen*). The Chinn-Ito index is based on a set of dummy variables that code the presence of different sorts of restrictions on cross-border financial transactions as reported in the IMF's Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER).[18] Higher values of the index signify less capital controls and thus a more open capital account.

In panel (h) of Figure A.5 we observe a weak, non-significant positive correlation between capital account openness and LCBM capitalisation, which disappears when excluding Mauritius from our sample.

[18] Fernández *et al.* (2015) provide more detailed capital control measures, also derived from the AREAR, including separate indicators for restrictions on the purchase by non-residents of local money market instruments and bonds. Unfortunately, these measures are available for only eight of our 15 Sub-Saharan African sample countries.

*Legal origins*

La Porta *et al.* (1998) argue that in countries whose legal rules originate in the British common law tradition, investors tend to be better protected than in countries where the legal system is based on civil law, in particular French civil law. Such legal protection may be especially important for LCBM demand (Claessens *et al.*, 2007). Others, including Laeven (2014), claim that securities laws differ a great deal across countries, even if they are part the same legal family. Based on data from Andrei Shleifer's website, we construct a dummy variable indicating whether the country in question has common law legal origins or not (*comlaw*). In our Sub-Saharan African sample, nine out of 15 are classified as common law countries (Kenya, Malawi, Namibia, Nigeria, Sierra Leone, South Africa, Tanzania, Uganda and Zambia); the other six all have a dominant French civil law tradition (Angola, Cameroon, Gabon, Madagascar, Mauritius and Mozambique).

Panel (i) of Figure A.5 suggests a positive link between common law legal origins and LCBMs. The bivariate relation is highly significant if we disregard Mauritius, a country with a relatively large LCBM despite a legal system that is classified as civil law-based.[19]

*Other government debt*

Some factors we have considered so far, such as economic development and the fiscal balance, may be correlated with both LCBMs and other marketable and non-marketable government debt stocks. However, on the supply side, there could also be substitution effects between different kinds of debt for given financing needs. Moreover, with the exception of South Africa, Mauritius, Namibia and Angola, all countries in our sample have enjoyed substantial external debt relief or at least debt restructuring in recent years[20]; eight of them have participated in the HIPC initiative and MDRI. Since HIPC granted debt relief on non-marketable debt owed to foreign multilateral (mostly the African Development Bank, World Bank and IMF), bilateral and commercial creditors, while at the same time 'forcing' countries to use their domestic debt markets (according to Arnone and Presbitero, 2010), we would again expect a negative relation between LCBMs and the rest of the government debt stock (especially in FE estimations). To ensure consistency with our dependent variable, we use as other government debt stock the complement of LCBM capitalisation, i.e., all central government debt apart from local currency marketable debt as a percentage of GDP, taken from the OECD's African Yearbook (*othdebt_gdp*). This broad measure thus includes all foreign and local currency non-marketable government debt (i.e., multilateral, bilateral and commercial loans, but also central bank advances) as well as foreign currency marketable government debt (i.e., foreign currency securities, irrespective of whether they were issued domestically or in international markets).

[19] It should be noted that Mauritius has a complex colonial history, which includes early Portuguese and Dutch settlements on the island followed by roughly a century of French (1715-1810) and a century and a half of British (1810-1968) domination. Angelo (2014) shows that Mauritius has therefore very mixed legal origins. With respect to commercial law, however, he notes that 'though there are English law influenced Acts in all major fields of activity, the rules of, for instance, contract remain those of French origin' (Angelo, 2014, p. 124). For an extensive survey of the main critiques on the legal origins literature and a rebuttal (by its founding fathers), see La Porta *et al.* (2008).

[20] See Das *et al.* (2012). South Africa restructured parts of its external debt owed to commercial creditors in 1987, 1989 and 1993. Angola received a debt treatment from its official bilateral Paris Club creditors in 1989.

Panel (j) of Figure A.5 indeed hints at a negative relation between LCBM capitalisation and other government debt, but one which hinges on the inclusion of Mauritius and South Africa (which both have relatively little other government debt, cf. Figure A4).

*Institutional quality*

Many formal and informal institutional arrangements beyond those captured by dichotomous time-invariant legal origins could have an effect on the development of government LCBMs, mostly by stimulating demand; these institutions include contract and property rights enforcement, the impartiality of the legal system, strength of the regulatory framework, and corruption (Mu *et al.*, 2013).

Since we have no priors on the relative importance of different institutional dimensions we construct a composite index from four of the most commonly used time-varying indicators of the International Country Risk Guide (ICRG) published by the Political Risk Services (PRS) Group, a commercial provider of country risk ratings and forecasts marketed towards investors. Our measure is the simple sum of rescaled zero-to-one ICRG scores on countries' investment profile (which evaluates subareas of contract viability and expropriation, profits repatriation and payment delays); law and order (which evaluates the legal system and popular observance of the law); bureaucracy quality (which evaluates whether the bureaucracy has the strength and expertise to govern without drastic changes in policy or interruptions in government services); and corruption (which evaluates issues such as patronage and business-politics ties) (*comprisk_icrg*). Higher values of the composite index indicate better overall institutional quality (as assessed by the PRS Group's in-house experts).

As expected, we observe a positive relation between overall institutional quality and LCBM development in panel (k) of Figure A.5. Note that Mauritius is not rated on these specific institutional dimensions by the PRS Group.

*Democracy*

It is often argued that the strength of democratic political systems has a distinct impact on the choice of government policies (although this is not a consensus view; see Mulligan *et al.*, 2004). By extension, there may also be an impact on the pace and scope of financial market development, including progress in the development of LCBMs. Haber *et al.* (2007) claim that the openness and competitiveness of a country's political system tend to be reflected in the openness and competitiveness of its financial system. Moreover, one of the key demand-side arguments for the historical development of public debt contracts is that the checks and balances and other constraints on the power of democratic governments increase political stability and enhance the credibility of commitments towards investors/creditors (North and Weingast, 1989). More generally, inclusive political institutions may be necessary requirements for the kind of economic institutions that are inherent to successful longer-term economic and, perhaps, financial development (Acemoglu and Robinson, 2012). We follow Claessens *et al.* (2007) in using as an explanatory variable the institutionalised democracy index of the Polity IV database (*democ*) (Marshall *et al.*, 2013). This zero-to-10 index scores countries on the competitiveness of political participation, the openness and competitiveness of executive recruitment, and constraints on the chief executive; with higher scores meaning stronger democratic institutions.

The positive correlation between democracy and LCBM capitalisation in panel (l) of Figure A.5 is statistically highly significant (with or without Mauritius and South Africa).

*Global factors*

To control for common global conditions ($\pi_t$ in Equation (1)) we also include in our estimations the annual average of the Chicago Board Options Exchange (CBOE) Volatility Index or VIX, a general measure of global investor sentiment calculated from stock index option prices (with higher values indicating higher global risk aversion) (*vix*).[21] We expect overall investor demand for a relatively exotic asset class as African local currency bonds to be negatively related to the VIX.

From the descriptive statistics in Table A.1 in Appendix it is clear that the lion share of variation arises from differences *between* countries rather than from *within*-country changes over time, except for independent variables inflation and other government debt. For this reason, we believe it is important not to limit ourselves to FE estimations only, which allow us to control for all unobserved time-invariant heterogeneity but, by construction, ignore between-country variation; an issue to which we come back in the following sections. Having described our empirical strategy and data in some detail, we will now attempt to identify the key drivers of government LCBM capitalisation in a multivariate setting.

## 3.3. Results and discussion

### *3.3.1. Baseline estimations*

Table 2 presents the estimation results for different specifications of Equation (1), estimated by POLS and FE. Because of our limited sample, both in terms of countries and years, it is hard to find variables that are robustly correlated with the capitalisation of African government LCBMs. Moreover, the reduced-form estimates do not allow us to fully disentangle demand and supply. However, there seem to be a number of macroeconomic and institutional variables which do show significant effects and/or consistent signs throughout and can be plausibly linked to demand or supply factors driving LCBM capitalisation.

POLS estimates, which capture jointly between- and within-country variation and ignore country-specific effects, show that better past fiscal balances are negatively correlated with LCBM capitalisation, most probably due to their supply-side impact, i.e., the lesser need for governments to issue bonds. This result is in line with previous studies, for Africa and other regions. As expected, past inflation is found to exert a negative (but economically small) effect on capitalisation, likely because expected inflation depresses government bond demand. Countries with a common law tradition have government LCBMs that are significantly larger than countries with legal origins rooted in French civil law, a result that again conforms with the literature and arguably relates to the stronger protection of investors. POLS models further suggest that the banking sector (the size of which is proxied by private sector credit) and government LCBMs are complements (in three out of four

[21] We choose not to include time fixed effects (year dummies) to account for global trends as this leads to 'overfitted' models with few degrees of freedom, due to our small sample size. Very similar estimation results are obtained if we replace the VIX with other (yearly averaged) global variables, such as the Bank of America-Merrill Lynch US high yield spread (of below-investment grade US corporate bonds over US Treasuries) or the US Effective Federal Funds rate, or when including a linear time trend instead.

specifications), and indicate positive partial correlations of trade openness, overall institutional quality and the strength of democracy with LCBM capitalisation. The negative coefficient of other central government debt is statistically significant (at the 20% level) but not economically meaningful. Smaller-sized countries have on average relatively larger government LCBMs, but this seems to be due to the inclusion in our sample of Mauritius (which is absent from the model in column (3)). We do not discern any clear effects of GDP, GDP per capita, capital account openness or the VIX.

*Table 2. Baseline results - POLS/FE estimations*

| | POLS | | | | FE | | | |
|---|---|---|---|---|---|---|---|---|
| | **(1)** | **(2)** | **(3)** | **(4)** | **(1)** | **(2)** | **(3)** | **(4)** |
| *L.ln_gdp_ppp* | 0.134 | -0.016 | 0.147 | 0.988 | 13.731 | 13.648 | -5.576 | 15.105 |
| | [0.955] | [0.856] | [0.962] | [1.098] | [20.449] | [18.665] | [12.097] | [20.417] |
| *ln_area* | -3.609*** | -3.532*** | -1.090 | -3.163*** | | | | |
| | [0.683] | [0.626] | [1.560] | [0.755] | | | | |
| *L.ln_gdppc_ppp* | -1.507 | -1.459 | -1.863 | 1.111 | -20.352 | -19.533 | 9.523 | -23.210 |
| | [2.279] | [2.372] | [1.847] | [2.802] | [31.130] | [30.286] | [17.436] | [31.578] |
| *L.x_gdp* | 0.309*** | 0.304*** | 0.201** | 0.214* | -0.002 | -0.040 | -0.037 | -0.006 |
| | [0.084] | [0.083] | [0.073] | [0.110] | [0.056] | [0.092] | [0.072] | [0.052] |
| *L.domcred_gdp* | 0.169*** | 0.163*** | 0.128** | 0.070 | -0.098* | -0.103* | -0.091+ | -0.089+ |
| | [0.043] | [0.048] | [0.046] | [0.068] | [0.050] | [0.055] | [0.060] | [0.051] |
| *L.av_fiscbal_gdp* | -0.520*** | -0.618** | -0.287* | -0.516*** | -0.187* | -0.235** | -0.156+ | -0.205* |
| | [0.149] | [0.217] | [0.143] | [0.158] | [0.097] | [0.104] | [0.095] | [0.101] |
| *L.infl_cp* | -0.123** | -0.109** | -0.073** | -0.111+ | -0.101* | -0.108* | -0.054+ | -0.107* |
| | [0.055] | [0.047] | [0.029] | [0.067] | [0.055] | [0.054] | [0.032] | [0.058] |
| *L.kaopen* | 0.646 | 0.564 | -0.231 | 0.568 | -1.188 | -1.293 | -0.589 | -1.600 |
| | [0.698] | [0.635] | [0.831] | [0.634] | [1.470] | [1.516] | [1.220] | [1.654] |
| *comlaw* | 7.250*** | 6.971*** | 9.335*** | 6.350*** | | | | |
| | [1.841] | [1.845] | [1.928] | [1.759] | | | | |
| *othdebt_gdp* | | -0.030+ | | | | -0.005 | | |
| | | [0.018] | | | | [0.016] | | |
| *L.comprisk_icrg* | | | 4.510+ | | | | 2.859+ | |
| | | | [2.923] | | | | [2.048] | |
| *L.democ* | | | | 1.026** | | | | 0.594 |
| | | | | [0.461] | | | | [0.473] |
| *vix* | -0.071 | -0.052 | -0.046 | -0.079 | 0.024 | 0.044 | 0.015 | 0.027 |
| | [0.077] | [0.087] | [0.077] | [0.073] | [0.054] | [0.052] | [0.059] | [0.053] |
| constant | 54.728*** | 54.590** | 17.629 | 27.823 | 124.479 | 121.678 | -39.941 | 138.090 |
| | [17.920] | [18.528] | [23.918] | [22.665] | [164.158] | [165.076] | [87.518] | [166.109] |
| Observations | 137 | 124 | 127 | 137 | 137 | 124 | 127 | 137 |
| Overall F *p*-value | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| $R^2$/$R^2$-within (for FE) | 0.850 | 0.858 | 0.761 | 0.871 | 0.208 | 0.231 | 0.177 | 0.227 |
| Intra-class correlation ρ | | | | | 0.992 | 0.992 | 0.973 | 0.993 |
| Hausman *p*-value | | | | | 0.000 | 0.000 | 0.000 | 0.000 |

Notes: Dependent variable is *lc_mdebt_gdp*, year-end outstanding local currency marketable central government debt (% of GDP). Sample countries, years and independent variables as defined in the text and Table A.1 in Appendix. All independent variables are one-year lagged, except for *ln_area*, *comlaw*, *othdebt_gdp* and *vix*. Standard errors, clustered at the country level, are reported in brackets. ***$p$<0.01; **$p$<0.05; *$p$<0.10; +$p$<0.20.

The picture that emerges from the FE estimates in Table 2, concentrating on within-country variation, is rather different.[22] Controlling for unobserved country heterogeneity, we find, above all, that worsening fiscal balances and declining inflation are associated with increases in government LCBM capitalisation. Also the positive correlation with institutional quality is preserved. Making

[22] Since country area and legal origins are time-invariant variables they are dropped in the FE estimations.

abstraction of endogeneity for the moment, on the supply side it appears that African governments use LCBMs for deficit financing; on the demand side, it is greater (monetary) policy credibility that seems to win over LCBM investors. Contrary to POLS, however, the FE estimator seems to point at substitution effects between banks and bonds.[23] None of the other coefficients is significantly different from zero.

Breusch-Pagan LM tests lead to a clear rejection of the null hypothesis of no country-specific effects, whereas Hausman-type overidentification tests strongly reject the null that such country effects are uncorrelated with the other regressors, and that for all four model specifications.[24] This seems to imply that the FE estimator is preferred over POLS and RE. However, diagnostic tests such as the Hausman test may perform poorly in small samples and when within-country time variation of variables is limited, which very much applies to our panel (as we noted above). Similarly, FE's sole focus on within-country differences may not be appropriate to assess whether certain slowly-changing variables, such as institutional quality or the strength of democracy, drive government LCBM development. It thus seems imperative to also study and compare the results of other estimators, like simple POLS.

### *3.3.2. General robustness tests*[25]

There are many ways in which we can test our baseline findings for robustness. First, we re-estimate the models of Table 2 with FGLS, an estimator that can better handle heteroskedastic error structures and panel-specific autocorrelation than POLS; and with RE, which is more efficient than FE but assumes the country-specific effects are distributed randomly across countries and independently from other explanatory variables. Table A.2 in Appendix shows that FGLS and RE estimations confirm the negative correlation of fiscal balances and inflation with LCBM capitalisation and the positive coefficients of common law legal origins, institutional quality and democracy that we found using POLS and/or FE. Other effects we identified in POLS models, such as those of trade openness and banking sector size, seem not particularly robust.

Second, in Table A.3 in Appendix we exclude, in turn, South Africa and Mauritius from our sample, which can be considered outliers in terms of absolute/relative government LCBM sizes and in a number of other dimensions (see Figures A.2-A.5). Apart from Mauritius' influence on the negative area size effect, none of our findings seems to be entirely driven by any of these two countries. If anything, the exclusion of Mauritius boosts the economic significance of the common law dummy. Excluding both countries reduces the significance of the fiscal balance coefficient, but leaves other results intact. Regressions without the two CEMAC countries in our sample, Cameroon and Gabon, show coefficients that are very similar to those in Table 2. Removing crisis years 2008 and 2009 from the regressions does not alter our main results; on the contrary, in FE estimations this omission strengthens the economic and statistical significance of the negative fiscal balance effect on government LCBM capitalisation.

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[23] This negative relation could perhaps reflect the crowding out of private sector credit by (within-country) LCBM expansion we referred to in Sections 1 and 2.2.

[24] More specifically, we use the artificial regression approach described in Wooldridge (2002, pp. 290-291) and apply it to a RE model without time-invariant variables (to make a proper comparison with the FE model). The Hausman-type tests we perform are robust to arbitrary heteroskedasticity and within-group correlation.

[25] For reasons of brevity, not all estimations mentioned in this section are reported. The full robustness results are, however, available from the authors upon request.

Third, we have tried alternative measures for some of our key variables. Replacing consumer price-based inflation with a GDP deflator-based measure somewhat reduces the economic significance of the inflation coefficient but produces otherwise almost identical results. When we cap consumer price inflation at 25%, which effectively eliminates three data points with extreme inflation from our sample (i.e., Angola in 2002, 2003 and 2004), the economic and statistical significance of the negative inflation effect on LCBM capitalisation increases rather than decreases. Also, replacing our preferred three-year moving average fiscal balance measure with a simple one-year lag yields very similar results. To further investigate the role of institutional quality, we have substituted our ICRG composite measure by a similarly constructed index based on the World Bank's Worldwide Governance Indicators (WGI) dimensions of regulatory quality, the rule of law, government effectiveness and control of corruption (see Kaufmann *et al.*, 2010). Government LCBM capitalisation is again positively correlated with better institutions. This positive correlation is highly significant in POLS models, but not when employing FE (probably due to the even more limited time variation in this institutional quality index). Inserting the different ICRG scores separately rather than as part of a composite index, we find it is not straightforward to pinpoint the positive effect of overall institutional quality to one particular dimension. The strongest results are for the investment profile and bureaucracy quality, the coefficients of which are statistically significant in POLS specifications. We have also replaced our broad institutionalised democracy index with one of its components, executive constraints, which more narrowly measures the extent of institutionalised restraints on the decision-making powers of a country's chief executives, be it individuals or collective bodies, and ranges from 'unlimited authority' to 'executive parity or subordination' (Marshall *et al.*, 2013). In line with our baseline results, this variable is found to be positively and highly significantly correlated with government LCBM capitalisation using POLS, but not in the case of FE.

Fourth, to check the potential influence of multicollinearity on the baseline results and observe whether it can explain the (non-) or low significance of some of our regressors, we estimate a set of more parsimonious models in Table A.4 in Appendix. We exclude either GDP per capita, GDP and area size, or all three variables from the baseline specification, since variance inflation factors (VIFs) suggest that these regressors are most collinear among themselves and with other regressors. Table A.4 indicates that excluding country size as a determinant of LCBM capitalisation increases the economic significance of inflation and, especially, the fiscal balance effect, but reduces the economic and statistical significance of the common law coefficient under POLS. There is also a large increase in the capital account openness coefficient, which becomes significant at the 20% level; countries with fewer restrictions on cross-border transactions now seem to have larger LCBMs. In FE regressions the omission of country size and/or economic development variables has limited impact apart from an increase in the statistical significance of inflation.

Lastly, LCBMs' share of total central government debt was attempted as an alternative dependent variable (*lc_mdebt_totdebt*). Whereas the emphasis of the current paper is on explaining the *size* of government LCBMs, scaled to GDP, it is an interesting exercise to test how the proposed baseline variables perform as drivers of debt *structure*, in the trend of Claessens *et al.* (2007), Guscina (2008), Mehl and Reynaud (2010) and Forslund *et al.* (2011). It should be noted, however, that this alternative regressand further reduces sample size, because the OECD African Yearbook data on other government debt has additional missing values.[26] Table A.5 in Appendix shows clear communalities with our baseline findings in Table 2, but also some notable differences. Inflation has

[26] Besides the earlier-mentioned missing years for Gabon and Namibia, there is no data on total central government debt for Tanzania (over the full sample period) and Angola in the years 2010-2012.

again a significantly negative effect on the relative importance of LCBMs, in both POLS and FE estimations. We also observe the same positive correlations with common law legal origins, institutional quality and democracy, significant only in the POLS models. Conversely, we find no clear negative correlation of the fiscal balance with the share of LCBMs, except for when the total debt stock (*totdebt_gdp*) is controlled for; the FE estimator even hints at a positive effect. Together with our previous results this appears to imply that the fiscal balance, a supply-side factor proxying the financing needs of governments, is related foremost to the size of government LCBMs and matters less for debt composition. The effect of the overall debt stock itself on the share of LCBMs is clearly negative, including in FE regressions, in part because of it being the denominator of the dependent variable, but also due to HIPC and other debt relief applied to the non-marketable debt stock (which has significantly altered debt structure; cf. Figures 1 and A.4). Another difference with baseline Table 2 is the consistently positive effect of economic size on the LCBM share.

### *3.3.3. Additional correlates*

In addition to the general robustness tests discussed in the previous section we have considered a number of other potential demand- and/or supply-side correlates of government LCBM capitalisation.

In Table A.6 in Appendix we augment one of our baseline model specifications (column (1) of Table 2) in turn with three explanatory variables, suggested by Adelegan and Radzewicz-Bak (2009) and Mu *et al.* (2013) and constructed with data from the IMF's International Financial Statistics (IFS). First, the bank lending spread (*bankspread*), which we define as the (annually averaged) difference between the interest rate charged by banks on loans to prime private sector customers and the LIBOR, bears a significantly negative coefficient in the FE model. This may point to lower bank competition and/or efficiency hampering LCBM development (as banks are important participants in government LCBMs). The inclusion of bank lending spreads renders the inflation coefficient insignificant, which can be explained by high collinearity between spreads and inflation in our sample.

Second, a measure of interest rate variability (*intvol*) is included, calculated as the yearly standard deviation of monthly treasury bill rates (or money market rates, if treasury bill rates were unavailable). We find this measure to be negatively correlated with government LCBM capitalisation, although not significantly so in FE estimations. Volatile interest rates increase uncertainty and reduce the attractiveness of securities for both (risk-averse) investors and issuers; alternatively, such volatility may just reflect illiquid money and bond markets (Mu *et al.*, 2013).

Third, we have added a common indicator of exchange rate variability, i.e., the yearly standard deviation of first differences in log nominal monthly exchange rates against the US dollar (which proxies unanticipated deviations from a constant trend) (*xrtvol*). The effect of exchange rate variability on LCBMs is *a priori* ambiguous. On the one hand, less volatile exchange rates may encourage investor demand for local currency bonds, especially from foreign investors (Mu *et al.*, 2013). On the other hand, relatively stable exchange rates may lead foreigner investors (and governments) to underestimate the risk of foreign currency lending (borrowing) and thereby reduce incentives to develop domestic financial intermediation (Eichengreen and Luengnaruemitchai, 2006). Table A.6 indicates that the exchange rate variability coefficient is very imprecisely estimated in both

POLS and FE models. The estimated effects of key variables like the fiscal balance and inflation remain however virtually unchanged.[27]

Other demand-side variables one could possibly control for are more explicit measures of governments' creditworthiness, such as, for example, sovereign (local currency) credit ratings. However, several of our sample countries have not or only recently been rated by major credit rating agencies Standard & Poor's (S&P), Moody's and/or Fitch; this complicates integrating sovereign credit ratings into our analysis.[28] That said, because of the way they are constructed, based on assessments of macroeconomic fundamentals and institutional quality, it may well be that much of the information underlying these ratings is already captured by our other demand-side regressors (see Standard & Poor's, 2014).

On the supply side, we have looked more closely at the role of debt relief in government LCBM development. Arnone and Presbitero (2010) present some evidence suggestive of increased domestic public debt accumulation after countries' graduation from their HIPC decision points, whereas Merotto *et al.* (2014) find that the recent (mostly moderate) return to borrowing by African governments having enjoyed debt relief has been driven predominantly by new external borrowing (in foreign currency). Figure A.6 in Appendix shows the evolution of the non-marketable debt stock that has been the subject of debt relief under the HIPC initiative (i.e., outstanding loans owed to multilateral, bilateral and commercial creditors) as well as our measure of government LCBM capitalisation for the five countries that reached their HIPC completion points during the 2003-2012 sample period: Madagascar (2004), Zambia (2005), Cameroon (2006), Malawi (2006) and Sierra Leone (2006).[29] To facilitate cross-country comparison, we have plotted the evolution of debt stocks in a five-year window centred around each of these HIPCs' respective completion points. From panel (a) of Figure A.6 one immediately sees the direct effect of HIPC debt relief on non-marketable debt stocks in the completion point and/or subsequent years. However, in panel (b) we do not discern a very clear impact on LCBMs. Only in Malawi and Zambia there seems to have been an increase in government LCBM capitalisation following completion point. We have experimented with introducing HIPC completion point dummies and their lags into our baseline models. Unreported POLS and FE estimations suggest that there is no immediate response of LCBM capitalisation to HIPC debt relief, although we do find a small positive coefficient for the two-year lagged HIPC completion point dummy. This could possibly indicate a delayed effect of HIPC debt relief on LCBMs, or reflect the fact that often (part of) actual debt stock relief takes place sometime after the official completion point.[30] As expected, and in line with Table A.5, the economic and statistical significance of HIPC completion point dummies are much greater in models where the LCBM *share* is taken as the

[27] We deviate from Mu *et al.* (2013) in calculating annual interest rate and exchange rate variability rather than over ten-year periods. We do so because of our limited sample period and in order to bring in more within-country variation.

[28] At the moment of writing, Malawi, Madagascar, Sierra Leone and Tanzania were not (or no longer) rated by any of the big three credit rating agencies. An additional complication is the difference in country coverage between agencies. For example, Mauritius is rated by Moody's but not by S&P or Fitch, whereas Cameroon is rated by both S&P and Fitch but not by Moody's.

[29] All HIPCs in our sample passed their decision points before 2003. Uganda reached its (enhanced) HIPC completion point in 2000, and Mozambique and Tanzania both in 2001.

[30] Similar results are obtained if we incorporate into these dummy variables Nigeria's 2005 Paris Club deal (which entailed substantial relief outside HIPC). The positive debt relief effect disappears completely when including instead dummies for all post-HIPC completion point years or for the year 2006 (when all HIPCs in our sample received MDRI relief).

dependent variable. We acknowledge that more research, beyond the scope of the current paper, is needed to fully disentangle the links between debt relief and government LCBMs.[31]

Given the link between fiscal deficits and LCBM capitalisation uncovered before, we have also further tested the substitutability between LCBMs and alternative sources of public finance, such as aid inflows, foreign currency marketable debt (which includes the international bonds some of our sample countries have issued) and foreign currency non-marketable loans from commercial creditors (typically syndicated international bank loans). In short, the results indeed suggest substitution effects between government LCBMs and other financing, but only with statistical significance in POLS estimations. Interestingly, the negative fiscal balance effect on government LCBM capitalisation seems only marginally affected by the inclusion of other public finance variables.

### *3.3.4. Dynamic panel estimations*

So far we have not allowed for the likely possibility that government LCBM capitalisation is a cumulative process. LCBM development in one period is expected to be an important determinant of the state of the LCBM in the next period; most obviously because LCBM capitalisation is a stock variable (with longer-maturity bond issues staying on government books for several years), but perhaps also due to the typically gradual nature of adaptations to the existing market infrastructure, or the persistence of a good/bad reputation in repaying bonds. The most straightforward way to introduce these dynamics into our model is by adding a one-year lag of the dependent variable, $Y_{i,t-1}$, to Equation (1). For such an autoregressive model (of order one), however, estimators such as POLS, FGLS, RE and standard FE are known to be biased and inconsistent (especially in short panels as ours), because of the correlation of the lagged dependent variable with the error term (Nickell, 1981).

The difference and system GMM estimators developed and popularised by Holtz-Eakin *et al.* (1988), Arellano and Bond (1991), Arellano and Bover (1995) and Blundell and Bond (1998) tackle the dynamic panel bias; in addition, they can be used to control for the endogeneity of other regressors too. Whereas these estimators were originally developed for microeconomic panel data research with many cross-sectional units (large N) and short time series (small T), they are now also commonly used in macroeconomic research (for an early example, see Bond *et al.*, 2001).[32] The idea behind difference GMM is to apply a first-difference transformation to the dynamic model, in order to remove the fixed effects, and then to instrument the first-differenced lagged dependent variable and other potentially non-exogenous regressors with suitable lags of the untransformed (level) explanatory variables. Identification of the model and the validity of using particular lags as internal instruments are based on the assumed orthogonality restrictions (also called moment conditions),

[31] Ideally, one would attempt to account for the original concessionality of the debt stock concerned in debt relief operations and for whether the relief consists of outright debt forgiveness or concessional rescheduling by using Net Present Value (NPV) estimates of debt relief. Such NPV measures have been constructed by Depetris Chauvin and Kraay (2005) and used, for example, in Presbitero (2009) and Johansson (2010). To our knowledge, however, the annual NPV debt relief measures of Depetris Chauvin and Kraay (2005) have not been updated beyond 2003, which prevents us from including them in our econometric analysis.

[32] Of the related studies surveyed in Section 3.1, both Mu *et al.* (2013) and Mehl and Reynaud (2005) report system GMM estimations. Only Mehl and Reynaud (2005), who analyse domestic original sin, include a lagged dependent variable in one of their models. Mu *et al.* (2013) use GMM techniques primarily to attempt to address the potential endogeneity of some of the regressors in their models and do not seem to account explicitly for persistence in LCBM capitalisation with an autoregressive factor.

through which explanatory variables are classified as either strictly exogenous (i.e., uncorrelated with past, current or future errors), predetermined (i.e., correlated with past errors but not with current or future errors) or endogenous (i.e., correlated with past and current errors but not with future errors).

One problem with the difference GMM estimator is that it may produce large finite sample bias and very imprecise estimates, in particular when the process under study is highly persistent, i.e., the autoregressive parameter on $Y_{i,t-1}$ is substantial (in which case lagged levels of variables are only weak instruments for first differences); when time series are short; and/or when the variance of fixed effects is large relative to the variance of idiosyncratic errors.[33] In these instances, Arellano and Bover (1995) and Blundell and Bond (1998) suggest using the system GMM estimator, which exploits additional moment conditions to reduce finite sample bias and improve efficiency. In addition to the first-differenced equation instrumented by lagged levels, system GMM uses lagged differences of explanatory variables as instruments in the original level equation. The validity of these extra conditions and instruments rests on the assumption that deviations of the dependent variable from its long-run conditional mean are not systematically related to the fixed effects. This implies that the subjects studied (here countries' government LCBMs) should not be too far from their steady states at the beginning of the study period (see Roodman, 2009b).

Table 3 presents the results of applying system GMM to the dynamic, autoregressive LCBM capitalisation model, implemented using the well-known *xtabond2* Stata package created and described in detail by Roodman (2009a). The reported results are all based on the two-step version of the system GMM estimator with small sample statistics and the Windmeijer (2005) correction for standard errors (without which standard errors would be downward biased). Importantly, Roodman (2009b) points out that GMM estimations with too many instruments tend to 'overfit' the endogenous variables (thereby failing to isolate their exogenous components) and concurrently weaken the power of Hansen tests for instrument validity. There is, however, no formal definition of what constitutes 'too many' instruments. To keep the total instrument count below (or at least close to) the number of cross-sectional units we limit the number of instrument lags to just one; 'collapse' the instrument matrix, as suggested by Roodman (2009b); and estimate only the model specifications for which we have data on all 15 sample countries (i.e., the specifications in columns (1) and (4) of Table 2).[34]

[33] Consider, for example, the case where the underlying data-generating process is simply a random walk, which implies that the autoregressive parameter equals one (i.e., the series has a unit root). In such an extreme case there will be no correlation at all between the first-differenced series (which is just 'white noise') and lagged levels of the series. This means that the difference GMM estimator, which applies the first difference transformation and instruments using lags, does not identify the autoregressive parameter and will not provide any information on this parameter, even in large samples (Bond *et al.*, 2005).

[34] Models with a higher instrument count, relative to cross-sectional units, lead to very inefficient estimates and unreliable diagnostic test statistics.

*Table 3. Dynamic panel results - system GMM estimations*

| | System GMM | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **(1a)** | **(1b)** | **(1c)** | **(1d)** | **(2a)** | **(2b)** | **(2c)** | **(2d)** |
| *L.lc_mdebt_gdp* | 0.787*** | 0.728*** | 0.916*** | 0.700*** | 0.783*** | 0.727*** | 0.901*** | 0.726*** |
| | [0.140] | [0.149] | [0.236] | [0.115] | [0.131] | [0.114] | [0.238] | [0.084] |
| *ln_gdp_ppp* | 0.307 | 0.294 | 0.197 | 0.248 | 0.523+ | 0.241 | 0.222 | 0.562 |
| | [0.385] | [0.320] | [0.373] | [0.288] | [0.314] | [1.268] | [0.368] | [0.458] |
| *ln_area* | -0.468 | -0.744 | -0.173 | -0.868* | -0.407 | -0.145 | -0.216 | -0.683* |
| | [0.490] | [0.623] | [0.841] | [0.427] | [0.443] | [2.097] | [0.779] | [0.324] |
| *ln_gdppc_ppp* | -0.225 | 0.325 | -1.554** | -0.191 | 0.102 | 2.671 | -1.449+ | 0.155 |
| | [0.767] | [1.509] | [0.722] | [1.039] | [0.877] | [6.954] | [1.055] | [1.181] |
| *x_gdp* | 0.101* | 0.088 | 0.086* | 0.131*** | 0.086+ | 0.013 | 0.085* | 0.106** |
| | [0.049] | [0.132] | [0.045] | [0.041] | [0.051] | [0.194] | [0.044] | [0.043] |
| *domcred_gdp* | 0.014 | 0.019 | 0.022 | 0.026 | -0.004 | -0.028 | 0.021 | 0.001 |
| | [0.025] | [0.029] | [0.035] | [0.022] | [0.023] | [0.100] | [0.025] | [0.031] |
| *av_fiscbal_gdp* | -0.421*** | -0.417 | -0.034 | | -0.409** | -0.318 | -0.040 | |
| | [0.139] | [0.636] | [0.128] | | [0.144] | [0.329] | [0.127] | |
| *infl_cp* | -0.213*** | -0.089 | -0.149* | -0.144*** | -0.214*** | -0.066+ | -0.153* | -0.147*** |
| | [0.044] | [0.077] | [0.073] | [0.046] | [0.045] | [0.039] | [0.077] | [0.045] |
| *kaopen* | 0.054 | 0.056 | 0.071 | 0.038 | 0.045 | 0.178 | 0.072 | 0.011 |
| | [0.181] | [0.255] | [0.193] | [0.151] | [0.150] | [0.431] | [0.162] | [0.133] |
| *comlaw* | 1.846 | 2.075 | 0.990 | 2.623** | 1.692+ | 1.848*** | 1.074 | 2.158** |
| | [1.397] | [2.301] | [1.733] | [1.097] | [1.217] | [0.568] | [1.562] | [0.856] |
| *democ* | | | | | 0.228 | 0.396 | 0.037 | 0.292+ |
| | | | | | [0.178] | [0.719] | [0.276] | [0.175] |
| *fiscbal_gdp* | | | | -0.425* | | | | -0.379* |
| | | | | [0.223] | | | | [0.198] |
| *vix* | -0.003 | -0.018 | 0.035 | -0.099 | -0.005 | -0.028 | 0.031 | -0.092 |
| | [0.042] | [0.102] | [0.064] | [0.085] | [0.042] | [0.054] | [0.066] | [0.078] |
| constant | 6.310 | 5.886 | 10.782 | 12.263* | 2.362 | -17.141 | 10.616+ | 6.103 |
| | [7.657] | [13.289] | [9.852] | [6.110] | [7.435] | [67.422] | [6.458] | [7.826] |
| Observations | 109 | 109 | 109 | 109 | 109 | 109 | 109 | 109 |
| # instruments | 14 | 15 | 14 | 14 | 15 | 16 | 15 | 15 |
| Overall F *p*-value | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.331 | 0.000 | 0.000 |
| AR(1) *p*-value | 0.018 | 0.061 | 0.017 | 0.020 | 0.014 | 0.008 | 0.020 | 0.008 |
| AR(2) *p*-value | 0.536 | 0.496 | 0.560 | 0.561 | 0.531 | 0.436 | 0.559 | 0.480 |
| Hansen *p*-value | 0.635 | 0.593 | 0.477 | 0.756 | 0.705 | 0.630 | 0.472 | 0.881 |

Notes: Dependent variable is *lc_mdebt_gdp*, year-end outstanding local currency marketable central government debt (% of GDP). Sample countries, years and independent variables as defined in the text and Appendix Table A.1. Windmeijer-corrected standard errors are reported in brackets. Number of observations refers to number of data points in the untransformed (level) equation. Number of instrument lags is limited to one and instrument matrix is collapsed. Columns (a): only *av_fiscbal_gdp* predetermined; columns (b): *av_fiscbal_gdp* and *infl_cp* predetermined; columns (c): *av_fiscbal_gdp* endogenous; columns (d): *fiscbal_gdp* endogenous. ***$p$<0.01; **$p$<0.05; *$p$<0.10; +$p$<0.20.

Whereas our primary motivation for employing GMM estimation techniques here is to be able to include lagged government LCBM capitalisation as an extra explanatory variable, we have also attempted to account for the potential endogeneity of some of our baseline regressors using GMM's internal instruments. Good external instruments would arguably be better-suited to establish causality but are very difficult to find in practice. Following Mu *et al.* (2013) and our prior economic intuitions (spelled out in Section 3.2.2) we choose to instrument, above all, the fiscal balance and, in second instance, also inflation. Table 3 makes different endogeneity assumptions: in columns (a) the fiscal balance variable is modelled as a predetermined variable, whereas the other independent variables are considered strictly exogenous; in columns (b) both the fiscal balance and inflation are assumed predetermined; in columns (c) the fiscal balance is modelled to be endogenous; and in

columns (d) we replace the original three-year moving average fiscal balance by an endogenised single-year measure.[35]

Table 3 clearly shows the high degree of persistence in LCBM development; the autoregressive parameter on the lagged dependent variable (*L.lc_mdebt_gdp*) is estimated as being between 0.7 and 0.9. As in the static FE models, it is difficult to robustly identify effects for most explanatory variables. The coefficients for time-invariant legal origins and our slowly changing democracy variable always take the expected positive sign, but are estimated with relatively large standard errors. However, in line with our previous results, we find a significantly negative impact of inflation on LCBM development in seven out of eight system GMM estimations. The fiscal balance coefficient is also consistently negative, but becomes very small and statistically insignificant once modelled as endogenous. Interestingly, when the three-year moving average fiscal balance is substituted by an endogenised single-year measure (with inherently more within-country variation), we again find a significantly negative impact on LCBMs. This illustrates that one needs to be realistic about the extent to which GMM estimators can be used to firmly establish causality in our sample, because of relatively small sample size (GMM being a large-N estimator) and limited time variation in most variables.

Looking at the diagnostic tests at the bottom of Table 3, the Arellano-Bond AR(2) tests reassure us that there is no second-order autocorrelation in differenced residuals and therefore no first-order correlation in the level residuals (which would invalidate the use of some of our instrument lags). The Hansen test of overidentifying restrictions furthermore suggests that the null of joint validity of our instruments is never rejected. For robustness, in Table A.7 in Appendix we re-estimate the specifications of Table 3 using the difference GMM estimator, which is less efficient than system GMM but also makes fewer assumptions (see above).[36] The results are overall very similar; controlling for persistence in LCBM capitalisation, the fiscal balance and inflation stand out as the most robust correlates. Moreover, applying system GMM to the alternative specifications we have considered before, i.e., models including (one by one) bank lending spreads, interest or exchange rate variability, HIPC completion point dummies, aid inflows, foreign currency marketable debt, or commercial creditor loans, we fail to find any statistically significant correlation with government LCBMs beyond the negative effects of the fiscal balance, inflation and, perhaps, aid inflows (significant at the 10% level).

## 4. Concluding remarks

This paper has studied the current state and drivers of government LCBMs in Sub-Saharan Africa, a region whose progress in developing such markets has not received much systematic attention in the literature thus far. We have argued that well-developed LCBMs could help wash away or reduce

[35] We have experimented with system GMM regressions where, in addition to the fiscal balance and inflation, also banking sector size and/or capital account openness are considered predetermined. These regressions yield qualitatively similar but typically less precise estimates than those reported in Table 3, most probably due to problems of weak instruments and over-instrumentation. There is only so much endogeneity we can try to control for in our relatively small sample.

[36] Usually difference-in-Hansen tests are used to check whether the additional moment conditions of system GMM compared to difference GMM (related to the differenced instruments in the level equation) are fulfilled. However, because the difference GMM estimations we present are only just identified, no such tests could be conducted.

'original sin'; facilitate the mobilisation of domestic savings; reduce countries' exposure to external shocks; and may have other important financial, macroeconomic and institutional spill-over effects. Nevertheless, LCBMs should not be considered a panacea. Policymakers will need to balance the advantages and disadvantages of particular sources and types of government debt.

With detailed information collected from various sources, the paper has shown that quite a number of African countries have made significant progress in developing LCBMs. Increasingly, African governments issue fixed-rate local currency bonds with tenors of ten years and more, on a regular basis. Moreover, the non-bank, local institutional investor base has continued to grow. But we have also demonstrated that LCBMs in Africa often have low liquidity, feature very few corporate securities and, in general, still have relatively narrow investor bases dominated by local commercial banks. Moreover, non-resident participation seems to be limited to only a few African government LCBMs.

In the second part of our study we have presented an econometric analysis of the drivers of African government LCBMs based on of a novel OECD-compiled panel dataset of central government debt in 15 African countries. Our results indicate that, on average, government LCBM capitalisation is larger in African countries with lower fiscal balances, lower inflation, common law legal origins, higher institutional quality and stronger democratic political systems. Controlling for unobserved country-specific heterogeneity and persistence in LCBM development, we find above all that a worsening fiscal balance and declining inflation are associated with increases in government LCBM capitalisation. This suggests that, on the supply side, LCBMs in the region are mainly used for deficit financing and that, on the demand side, their development goes hand in hand with improvements in macroeconomic management and institutional strengthening, which increases governments' credibility towards (domestic and international) investors. These key results are robust to the use of different estimators, the exclusion of outliers, alternative measures for our baseline variables, and the inclusion of additional potential correlates of government LCBMs. There are some indications that LCBM capitalisation may also be linked to greater capital account openness, lower bank lending spreads, lower interest rate variability, past debt relief and alternative financing sources, including aid, although such links were found not to be particularly robust across estimators and require further research.

Our main findings generally correspond well with those of the broader domestic public debt and bond market literature and of Adelegan and Radzewicz-Bak (2009) and Mu *et al.* (2013) on Africa, in particular on the importance of the fiscal balance, legal origins and institutions. Some of the differences in results between the current and the latter two papers, for example the lack of significance of exchange rate variability and trade openness as drivers of government LCBMs in our estimations, may be due to subtle differences in the way LCBM capitalisation is defined and our use of primary rather than secondary IMF and World Bank data; differences in the set of regressors we include; and our explicit accounting for LCBM persistence in GMM specifications; as well as to differences in sample countries and the time period considered. We acknowledge that relatively small sample size and limited within-country variation are drawbacks to our econometric analysis. Larger country samples and longer time series will be needed to increase the representativeness of our results for Sub-Saharan Africa and to achieve better identification of any causal relations.

Moreover, the econometric work in this paper has narrowly focused on government LCBM *capitalisation* in Sub-Saharan Africa, ignoring other equally important dimensions of LCBM development. From our more detailed, multi-source cross-sectional overview it is apparent that African LCBMs differ in many other aspects too, including liquidity and the length of tenors of bonds

typically issued. Panel data analysis of variables such as secondary market turnover, bid-ask spreads, average original maturity of outstanding bonds, and of bond yields would complement the current paper and enrich our understanding of Sub-Sahara African LCBMs. To our knowledge, however, such data are currently not (publicly) available (in a comparable format) for a wider range of countries in the region.

## Appendices

*Table A.1. Labels, definitions, sources and descriptive statistics of baseline variables*

| Variable | Label | Definition | Source | Period | Obs. | Mean | Min | Max | Std. dev. | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Dependent** | | | | | | | | | overall | between | within |
| Local currency bond market (LCBM) capitalisation | *lc_mdebt_gdp* | Year-end outstanding marketable central government debt denominated in, or indexed to, local currency (in % of GDP) | OECD 2013 African Central Government Debt Statistical Yearbook (4th edition) | 2003-12 | 137 | 15.423 | 1.066 | 58.662 | 11.894 | 11.997 | 2.798 |
| **Independent** | | | | | | | | | | | |
| Total GDP | *ln_gdp_ppp* | Natural logarithm of GDP at purchasing power parity (PPP) (in international dollar billions) | IMF World Economic Outlook (WEO) | 2002-11 | 150 | 3.413 | 1.201 | 6.324 | 1.208 | 1.223 | 0.230 |
| Country area size | *ln_area* | Natural logarithm of country surface area (in squared kilometres) | World Bank African Development Indicators (ADI) | 2003-12 | 150 | 12.753 | 7.621 | 14.036 | 1.599 | 1.649 | 0 |
| GDP per capita | *ln_gdppc_ppp* | Natural logarithm of GDP per capita at PPP (in international dollars) | WEO | 2002-11 | 150 | 7.698 | 6.278 | 9.651 | 1.015 | 1.033 | 0.166 |
| Trade openness | *x_gdp* | Total exports of goods and services (in % of GDP) | ADI | 2002-11 | 150 | 35.523 | 8.648 | 86.018 | 16.516 | 16.401 | 4.478 |
| Domestic credit | *domcred_gdp* | Domestic credit to the private sector (in % of GDP) | ADI | 2002-11 | 150 | 28.553 | 2.181 | 167.536 | 36.540 | 37.130 | 6.311 |
| Fiscal balance | *av_fiscbal_gdp* | 3-year moving average of the general government fiscal balance, i.e., revenue minus total expenditure including the net acquisition of non-financial assets (in % of GDP) | WEO | 2002-11 | 150 | -0.896 | -9.581 | 13.507 | 4.493 | 3.422 | 3.031 |
| Inflation | *infl_cp* | Year-on-year change in annually averaged consumer price index (CPI) (in %) | WEO | 2002-11 | 150 | 10.095 | -3.659 | 108.893 | 12.443 | 7.804 | 9.880 |
| Capital account openness | *kaopen* | Chinn-Ito coding of restrictions on cross-border financial transactions based on IMF Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER) | Chinn-Ito KAOPEN database | 2002-11 | 150 | -0.281 | -1.864 | 2.439 | 1.488 | 1.515 | 0.237 |
| Legal origins | *comlaw* | Dummy which equals 1 for countries with a British common law heritage and 0 otherwise | Andrei Shleifer's personal website: http://scholar.harvard.edu/shleifer | 2003-12 | 150 | 0.600 | 0 | 1 | 0.492 | 0.507 | 0 |
| Other government debt | *othdebt_gdp* | Complement of *lc_mdebt_gdp*: year-end outstanding (foreign and local currency) non-marketable and foreign currency marketable central government debt (in % of GDP) | OECD 2013 African Central Government Debt Statistical Yearbook (4th edition) | 2003-12 | 124 | 30.843 | 0 | 139.192 | 32.245 | 19.133 | 26.116 |
| Institutional quality ICRG | *comprisk_icrg* | Unweighted sum of normalised (0-to-1) scores on four ICRG political risk dimensions: 'investment profile', 'law and order', 'bureaucracy quality' and 'corruption' | Political Risk Services (PRS) Group International Country Risk Guide (ICRG) | 2002-11 | 140 | 1.887 | 1.003 | 2.646 | 0.321 | 0.314 | 0.103 |
| Democracy | *democ* | Polity IV institutionalised democracy index combining scores on 'competitiveness of political participation', 'openness and competitiveness of executive recruitment' and 'constraints on chief executive' | University of Maryland Polity IV Project database | 2002-11 | 150 | 4.853 | 0 | 10 | 2.973 | 2.947 | 0.823 |
| VIX | *vix* | Annually averaged Chicago Board of Options Exchange (CBOE) Volatility Index measuring the implied volatility of S&P 500 index options | Federal Reserve bank of St. Louis Federal Reserve Economic Data (FRED) | 2003-12 | 150 | 20.934 | 12.810 | 32.690 | 6.707 | 0 | 6.707 |

*Table A.2. Robustness - FGLS/RE estimations*

| | FGLS | | | | RE | | | |
|---|---|---|---|---|---|---|---|---|
| | **(1)** | **(2)** | **(3)** | **(4)** | **(1)** | **(2)** | **(3)** | **(4)** |
| *L.ln_gdp_ppp* | -0.793+ | -0.631 | -1.124** | -0.617 | -0.409 | -0.101 | -0.903 | -0.330 |
| | [0.540] | [0.527] | [0.573] | [0.683] | [1.665] | [2.177] | [1.187] | [1.349] |
| *ln_area* | -3.938*** | -4.043*** | 1.713+ | -3.206*** | -4.171** | -4.379* | 3.645** | -3.569** |
| | [0.546] | [0.542] | [1.064] | [0.594] | [2.034] | [2.321] | [1.860] | [1.739] |
| *L.ln_gdppc_ppp* | 1.117 | 1.689 | -1.050 | 3.923*** | 0.037 | 0.827 | 1.918 | 0.524 |
| | [1.330] | [1.386] | [0.892] | [1.381] | [3.109] | [4.085] | [2.171] | [2.671] |
| *L.x_gdp* | 0.089** | 0.088** | 0.038 | 0.038 | 0.110 | 0.060 | -0.031 | 0.098 |
| | [0.041] | [0.043] | [0.039] | [0.039] | [0.102] | [0.131] | [0.066] | [0.102] |
| *L.domcred_gdp* | 0.139*** | 0.129*** | 0.107*** | 0.043+ | 0.053 | -0.001 | -0.037 | 0.027 |
| | [0.030] | [0.030] | [0.032] | [0.032] | [0.046] | [0.053] | [0.051] | [0.055] |
| *L.av_fiscbal_gdp* | -0.166** | -0.198*** | -0.150** | -0.115* | -0.233** | -0.286** | -0.153+ | -0.253** |
| | [0.073] | [0.076] | [0.065] | [0.064] | [0.112] | [0.136] | [0.095] | [0.119] |
| *L.infl_cp* | -0.035+ | -0.043+ | -0.038+ | -0.029 | -0.079** | -0.083*** | -0.060*** | -0.080** |
| | [0.027] | [0.029] | [0.025] | [0.026] | [0.033] | [0.031] | [0.019] | [0.036] |
| *L.kaopen* | 0.006 | -0.035 | -1.225*** | -0.171 | -0.012 | -0.416 | -0.761 | -0.195 |
| | [0.350] | [0.339] | [0.404] | [0.303] | [1.112] | [1.261] | [1.049] | [1.138] |
| *comlaw* | 7.031*** | 7.060*** | 10.265*** | 7.288*** | 8.608** | 9.103** | 13.996*** | 7.405** |
| | [1.139] | [1.097] | [1.236] | [1.130] | [3.497] | [4.203] | [3.578] | [2.943] |
| *othdebt_gdp* | | 0.014 | | | | -0.005 | | |
| | | [0.011] | | | | [0.020] | | |
| *L.comprisk_icrg* | | | 3.364** | | | | 2.816+ | |
| | | | [1.407] | | | | [2.170] | |
| *L.democ* | | | | 1.208*** | | | | 0.875* |
| | | | | [0.174] | | | | [0.480] |
| *vix* | -0.032 | -0.010 | -0.030 | -0.060** | -0.036 | -0.001 | 0.007 | -0.039 |
| | [0.033] | [0.034] | [0.030] | [0.030] | [0.065] | [0.063] | [0.064] | [0.065] |
| constant | 50.113*** | 46.124*** | -14.248 | 17.905+ | 60.086+ | 58.179 | -58.807* | 46.118+ |
| | [11.600] | [11.950] | [16.437] | [12.996] | [39.615] | [52.181] | [34.220] | [32.384] |
| Observations | 137 | 124 | 127 | 137 | 137 | 124 | 127 | 137 |
| Overall $\chi^2$ *p*-value | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| $R^2$ | | | | | 0.682 | 0.559 | 0.514 | 0.745 |
| Intra-class correlation ρ | | | | | 0.738 | 0.833 | 0.887 | 0.712 |
| Breusch-Pagan *p*-value | | | | | 0.000 | 0.000 | 0.000 | 0.000 |

Notes: Dependent variable is *lc_mdebt_gdp*, year-end outstanding local currency marketable central government debt (% of GDP). Sample countries, years and independent variables as defined in the text and Table A.1 in Appendix. All independent variables are one-year lagged, except for *ln_area*, *comlaw*, *othdebt_gdp* and *vix*. Standard errors, clustered at the country level, are reported in brackets. ***$p$<0.01; **$p$<0.05; *$p$<0.10; +$p$<0.20.

*Table A.3. Robustness - POLS/FE estimations excluding South Africa or Mauritius*

| | POLS excl. South Africa | | | | FE excl. South Africa | | | | POLS excl. Mauritius | | | | FE excl. Mauritius | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **(1)** | **(2)** | **(3)** | **(4)** | **(1)** | **(2)** | **(3)** | **(4)** | **(1)** | **(2)** | **(3)** | **(4)** | **(1)** | **(2)** | **(3)** | **(4)** |
| *L.ln_gdp_ppp* | -0.099 | -0.076 | 0.330 | 0.491 | 14.593 | 14.436 | -9.645 | 16.138 | -0.632 | -0.739 | 0.147 | 0.207 | -5.296 | -4.493 | -5.576 | -4.294 |
| | [0.642] | [0.693] | [0.871] | [0.865] | [21.750] | [20.468] | [11.709] | [21.701] | [0.852] | [0.923] | [0.962] | [1.103] | [12.067] | [10.630] | [12.097] | [12.506] |
| *ln_area* | -2.791*** | -2.793*** | -2.197+ | -2.666*** | | | | | -0.470 | 1.146 | -1.090 | -0.447 | | | | |
| | [0.706] | [0.736] | [1.262] | [0.721] | | | | | [1.473] | [1.621] | [1.560] | [1.407] | | | | |
| *L.ln_gdppc_ppp* | -3.438+ | -3.347+ | -3.671* | -1.401 | -22.418 | -21.943 | 11.066 | -25.683 | -1.281 | -0.488 | -1.863 | 1.033 | 9.226 | 11.316 | 9.523 | 7.275 |
| | [2.204] | [2.196] | [1.902] | [2.968] | [31.955] | [31.454] | [17.446] | [32.568] | [2.287] | [2.114] | [1.847] | [3.003] | [17.470] | [16.600] | [17.436] | [18.430] |
| *L.x_gdp* | 0.281*** | 0.289*** | 0.226*** | 0.226** | 0.012 | -0.008 | 0.024 | 0.008 | 0.193** | 0.122+ | 0.201** | 0.121 | -0.038 | -0.112 | -0.037 | -0.039 |
| | [0.076] | [0.076] | [0.057] | [0.100] | [0.051] | [0.087] | [0.059] | [0.046] | [0.085] | [0.086] | [0.073] | [0.115] | [0.071] | [0.089] | [0.072] | [0.071] |
| *L.domcred_gdp* | 0.359*** | 0.354*** | 0.339** | 0.258* | -0.107 | -0.107 | 0.062 | -0.093 | 0.144*** | 0.100* | 0.128** | 0.059 | -0.081 | -0.096+ | -0.091+ | -0.077 |
| | [0.093] | [0.107] | [0.122] | [0.122] | [0.140] | [0.140] | [0.098] | [0.133] | [0.041] | [0.049] | [0.046] | [0.070] | [0.062] | [0.067] | [0.060] | [0.063] |
| *L.av_fiscbal_gdp* | -0.288* | -0.327+ | -0.146 | -0.329** | -0.162+ | -0.205* | -0.124 | -0.180* | -0.355** | -0.484** | -0.287* | -0.371** | -0.144+ | -0.168* | -0.156+ | -0.155+ |
| | [0.143] | [0.189] | [0.117] | [0.148] | [0.094] | [0.099] | [0.103] | [0.096] | [0.145] | [0.159] | [0.143] | [0.141] | [0.092] | [0.084] | [0.095] | [0.095] |
| *L.infl_cp* | -0.079* | -0.077* | -0.044* | -0.079+ | -0.103* | -0.107* | -0.056* | -0.110* | -0.083** | -0.070** | -0.073** | -0.075+ | -0.055+ | -0.061* | -0.054+ | -0.059+ |
| | [0.045] | [0.040] | [0.022] | [0.052] | [0.054] | [0.054] | [0.031] | [0.058] | [0.036] | [0.031] | [0.029] | [0.048] | [0.033] | [0.034] | [0.032] | [0.035] |
| *L.kaopen* | 0.314 | 0.332 | -0.085 | 0.329 | -1.358 | -1.423 | -0.757 | -1.785 | -0.040 | -0.707 | -0.231 | -0.025 | -0.537 | -0.714 | -0.589 | -0.814 |
| | [0.479] | [0.477] | [0.615] | [0.475] | [1.437] | [1.462] | [1.275] | [1.630] | [0.717] | [0.746] | [0.831] | [0.588] | [1.163] | [1.209] | [1.220] | [1.356] |
| *comlaw* | 7.460*** | 7.387*** | 7.934*** | 6.848*** | | | | | 9.590*** | 11.396*** | 9.335*** | 8.508*** | | | | |
| | [1.955] | [2.052] | [1.799] | [1.740] | | | | | [1.962] | [2.395] | [1.928] | [1.586] | | | | |
| *othdebt_gdp* | | 0.000 | | | | -0.004 | | | | -0.017+ | | | | 0.006 | | |
| | | [0.021] | | | | [0.016] | | | | [0.011] | | | | [0.014] | | |
| *L.comprisk_icrg* | | | 4.181+ | | | | 2.227 | | | | 4.510+ | | | | 2.859+ | |
| | | | [2.374] | | | | [1.886] | | | | [2.923] | | | | [2.048] | |
| *L.democ* | | | | 0.657+ | | | | 0.612 | | | | 0.899* | | | | 0.309 |
| | | | | [0.457] | | | | [0.485] | | | | [0.496] | | | | [0.366] |
| *vix* | -0.062 | -0.029 | -0.048 | -0.068 | 0.040 | 0.063 | 0.032 | 0.042 | -0.022 | 0.043 | -0.046 | -0.030 | 0.020 | 0.035 | 0.015 | 0.022 |
| | [0.075] | [0.083] | [0.074] | [0.075] | [0.057] | [0.055] | [0.064] | [0.057] | [0.079] | [0.071] | [0.077] | [0.072] | [0.061] | [0.060] | [0.059] | [0.061] |
| constant | 56.292*** | 54.600*** | 42.108** | 38.856* | 134.952 | 134.286 | -42.981 | 151.083 | 15.626 | -9.839 | 17.629 | -3.708 | -33.637 | -49.538 | -39.941 | -24.336 |
| | [13.536] | [14.559] | [19.317] | [19.960] | [168.216] | [170.865] | [89.218] | [171.347] | [25.187] | [23.921] | [23.918] | [27.587] | [88.249] | [86.811] | [87.518] | [92.740] |
| Observations | 127 | 114 | 117 | 127 | 127 | 114 | 117 | 127 | 127 | 114 | 127 | 127 | 127 | 114 | 127 | 127 |
| Overall F *p*-value | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| $R^2$/$R^2$-within (for FE) | 0.870 | 0.875 | 0.728 | 0.878 | 0.200 | 0.218 | 0.168 | 0.222 | 0.744 | 0.769 | 0.761 | 0.781 | 0.163 | 0.253 | 0.177 | 0.171 |
| Intra-class correlation ρ | | | | | 0.994 | 0.994 | 0.980 | 0.995 | | | | | 0.971 | 0.974 | 0.973 | 0.963 |
| Hausman *p*-value | | | | | 0.000 | 0.000 | 0.000 | 0.000 | | | | | 0.000 | 0.000 | 0.000 | 0.000 |

Notes: Dependent variable is *lc_mdebt_gdp*, year-end outstanding local currency marketable central government debt (% of GDP). Sample countries, years and independent variables as defined in the text and Table A.1 in Appendix. All independent variables are one-year lagged, except for *ln_area*, *comlaw*, *othdebt_gdp* and *vix*. Standard errors, clustered at the country level, are reported in brackets. ***$p$<0.01; **$p$<0.05; *$p$<0.10; +$p$<0.20.

*Table A.4. Robustness - POLS/FE estimations of more parsimonious models*

| | POLS | | | FE | | |
|---|---|---|---|---|---|---|
| | **(1)** | **(2)** | **(3)** | **(1)** | **(2)** | **(3)** |
| *L.ln_gdp_ppp* | 0.037 | | | 0.027 | | |
| | [0.814] | | | [1.593] | | |
| *ln_area* | -3.456*** | | | | | |
| | [0.621] | | | | | |
| *L.ln_gdppc_ppp* | | 2.831 | | | -0.764 | |
| | | [3.718] | | | [3.112] | |
| *L.x_gdp* | 0.265*** | 0.224+ | 0.311** | 0.017 | 0.023 | 0.017 |
| | [0.061] | [0.148] | [0.126] | [0.073] | [0.078] | [0.059] |
| *L.domcred_gdp* | 0.147*** | 0.112+ | 0.158*** | -0.125** | -0.113** | -0.125+ |
| | [0.022] | [0.068] | [0.046] | [0.055] | [0.047] | [0.072] |
| *L.av_fiscbal_gdp* | -0.572*** | -1.022** | -0.939** | -0.191* | -0.194* | -0.191* |
| | [0.166] | [0.353] | [0.360] | [0.105] | [0.108] | [0.101] |
| *L.infl_cp* | -0.113** | -0.175* | -0.202* | -0.079*** | -0.083** | -0.079*** |
| | [0.049] | [0.090] | [0.098] | [0.027] | [0.032] | [0.022] |
| *L.kaopen* | 0.639 | 1.779+ | 1.880+ | -1.262 | -1.317 | -1.265 |
| | [0.730] | [1.160] | [1.243] | [1.399] | [1.446] | [1.367] |
| *comlaw* | 7.298*** | 4.773+ | 4.555+ | | | |
| | [1.758] | [2.968] | [3.319] | | | |
| *vix* | -0.066 | 0.006 | 0.001 | 0.017 | 0.021 | 0.017 |
| | [0.079] | [0.102] | [0.100] | [0.055] | [0.054] | [0.054] |
| constant | 43.501*** | -19.062 | -1.265 | 18.362*** | 23.586 | 18.423*** |
| | [8.100] | [22.836] | [3.702] | [4.490] | [21.556] | [1.919] |
| Observations | 137 | 137 | 137 | 137 | 137 | 137 |
| Overall F *p*-value | 0.000 | 0.001 | 0.001 | 0.000 | 0.000 | 0.001 |
| $R^2$/$R^2$-within (for FE) | 0.848 | 0.690 | 0.683 | 0.187 | 0.188 | 0.187 |
| Intra-class correlation ρ | | | | 0.971 | 0.971 | 0.971 |
| Hausman *p*-value | | | | 0.000 | 0.000 | 0.000 |

Notes: Dependent variable is *lc_mdebt_gdp*, year-end outstanding local currency marketable central government debt (% of GDP). Sample countries, years and independent variables as defined in the text and Table A.1 in Appendix. All independent variables are one-year lagged, except for *ln_area*, *comlaw*, and *vix*. Standard errors, clustered at the country level, are reported in brackets. ***$p$<0.01; **$p$<0.05; *$p$<0.10; +$p$<0.20.

*Table A.5. Robustness - POLS/FE estimations with local currency marketable share of total government debt as dependent variable*

| | POLS | | | | FE | | | |
|---|---|---|---|---|---|---|---|---|
| | **(1)** | **(2)** | **(3)** | **(4)** | **(1)** | **(2)** | **(3)** | **(4)** |
| *L.ln_gdp_ppp* | 4.541 | 2.441 | 6.085*** | 6.261 | 118.513** | 40.375 | 76.503* | 120.444** |
| | [4.984] | [4.090] | [1.988] | [4.900] | [49.466] | [50.024] | [41.820] | [47.716] |
| *ln_area* | -5.407+ | -6.134** | 14.540*** | -4.415+ | | | | |
| | [3.120] | [2.450] | [2.325] | [3.055] | | | | |
| *L.ln_gdppc_ppp* | -2.152 | -3.999 | -0.248 | 3.328 | -129.777* | -50.845 | -63.402 | -133.723* |
| | [10.075] | [7.718] | [3.234] | [10.013] | [67.726] | [67.775] | [61.310] | [64.867] |
| *L.x_gdp* | 0.910*** | 0.868*** | 0.039 | 0.707** | 0.146 | -0.011 | -0.047 | 0.133 |
| | [0.266] | [0.234] | [0.168] | [0.281] | [0.279] | [0.269] | [0.174] | [0.282] |
| *L.domcred_gdp* | 0.367** | 0.381** | -0.111 | 0.157 | -0.057 | 0.036 | -0.113 | -0.045 |
| | [0.157] | [0.127] | [0.095] | [0.165] | [0.126] | [0.159] | [0.159] | [0.118] |
| *L.av_fiscbal_gdp* | -0.150 | -1.038** | 0.518 | -0.054 | 0.803+ | -0.229 | 0.799+ | 0.782+ |
| | [0.464] | [0.450] | [0.580] | [0.452] | [0.552] | [0.446] | [0.477] | [0.550] |
| *L.infl_cp* | -0.422** | -0.321** | -0.198** | -0.386** | -0.198+ | -0.229* | -0.089 | -0.208* |
| | [0.147] | [0.139] | [0.065] | [0.164] | [0.116] | [0.124] | [0.087] | [0.113] |
| *L.kaopen* | 1.384 | 0.563 | -7.148*** | 1.370 | -0.722 | -1.604 | -2.879 | -1.272 |
| | [1.390] | [1.339] | [1.280] | [1.378] | [3.896] | [3.030] | [3.728] | [3.762] |
| *comlaw* | 27.328*** | 28.409*** | 49.361*** | 24.820*** | | | | |
| | [6.599] | [5.561] | [5.448] | [6.152] | | | | |
| *totdebt_gdp* | | -0.355*** | | | | -0.299*** | | |
| | | [0.067] | | | | [0.063] | | |
| *L.comprisk_icrg* | | | 28.274*** | | | | 27.208 | |
| | | | [7.393] | | | | [23.803] | |
| *L.democ* | | | | 2.325** | | | | 0.767 |
| | | | | [0.844] | | | | [2.081] |
| *vix* | 0.076 | -0.051 | 0.332** | 0.041 | 0.070 | 0.184+ | -0.011 | 0.073 |
| | [0.197] | [0.198] | [0.142] | [0.196] | [0.120] | [0.132] | [0.148] | [0.120] |
| constant | 55.530 | 103.089+ | -260.891*** | -1.457 | 618.322* | 300.521 | 196.896 | 637.540* |
| | [90.530] | [67.316] | [42.947] | [89.640] | [347.968] | [348.967] | [299.884] | [332.440] |
| Observations | 124 | 124 | 114 | 124 | 124 | 124 | 114 | 124 |
| Overall F *p*-value | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| $R^2$/$R^2$-within (for FE) | 0.772 | 0.841 | 0.833 | 0.788 | 0.435 | 0.571 | 0.516 | 0.436 |
| Intra-class correlation ρ | | | | | 0.996 | 0.983 | 0.985 | 0.996 |
| Hausman *p*-value | | | | | 0.000 | 0.000 | 0.000 | 0.000 |

Notes: Dependent variable is *lc_mdebt_totdebt*, year-end outstanding local currency marketable central government debt (% of total central government debt). Sample countries, years and independent variables as defined in the text and Table A.1 in Appendix. All independent variables are one-year lagged, except for *ln_area*, *comlaw*, *totdebt_gdp* and *vix*. Standard errors, clustered at the country level, are reported in brackets. ***$p$<0.01; **$p$<0.05; *$p$<0.10; +$p$<0.20.

*Table A.6. Additional correlates - POLS/FE estimations including bank lending spreads, interest rate variability or exchange rate variability*

| | POLS | | | FE | | |
|---|---|---|---|---|---|---|
| | **(1)** | **(2)** | **(3)** | **(1)** | **(2)** | **(3)** |
| *L.ln_gdp_ppp* | 0.147 | -0.065 | 0.156 | 29.144 | 20.133 | 13.998 |
| | [0.967] | [0.714] | [0.946] | [23.786] | [26.004] | [20.792] |
| *ln_area* | -3.611*** | -3.397*** | -3.630*** | | | |
| | [0.681] | [0.551] | [0.660] | | | |
| *L.ln_gdppc_ppp* | -1.508 | -0.078 | -1.501 | -44.475 | -29.048 | -20.829 |
| | [2.462] | [2.505] | [2.290] | [36.504] | [38.808] | [31.676] |
| *L.x_gdp* | 0.308*** | 0.309** | 0.309*** | -0.010 | -0.013 | -0.002 |
| | [0.090] | [0.125] | [0.084] | [0.060] | [0.055] | [0.057] |
| *L.domcred_gdp* | 0.168*** | 0.140** | 0.168*** | -0.077* | -0.094+ | -0.095* |
| | [0.045] | [0.046] | [0.043] | [0.041] | [0.055] | [0.050] |
| *L.av_fiscbal_gdp* | -0.529*** | -0.638*** | -0.522*** | -0.306** | -0.202+ | -0.186* |
| | [0.152] | [0.184] | [0.147] | [0.126] | [0.145] | [0.098] |
| *L.infl_cp* | -0.117 | -0.157* | -0.123** | -0.049 | -0.129+ | -0.101* |
| | [0.105] | [0.074] | [0.055] | [0.053] | [0.076] | [0.055] |
| *L.kaopen* | 0.637 | 0.572 | 0.633 | -0.672 | -0.990 | -1.181 |
| | [0.699] | [0.710] | [0.693] | [1.269] | [1.516] | [1.479] |
| *comlaw* | 7.155*** | 7.866*** | 7.265*** | | | |
| | [1.994] | [2.329] | [1.805] | | | |
| *L.bankspread* | -0.009 | | | -0.116** | | |
| | [0.089] | | | [0.052] | | |
| *intvol* | | -0.382* | | | -0.036 | |
| | | [0.179] | | | [0.152] | |
| *xrtvol* | | | 3.931 | | | -6.145 |
| | | | [24.458] | | | [10.964] |
| *vix* | -0.073 | -0.049 | -0.072 | 0.042 | 0.019 | 0.026 |
| | [0.075] | [0.078] | [0.079] | [0.055] | [0.057] | [0.054] |
| constant | 54.986** | 42.836** | 54.830*** | 254.518 | 169.095 | 127.151 |
| | [19.039] | [15.746] | [17.751] | [193.434] | [201.507] | [167.082] |
| Observations | 134 | 124 | 137 | 134 | 124 | 137 |
| Overall F *p*-value | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| $R^2$/$R^2$-within (for FE) | 0.847 | 0.848 | 0.850 | 0.257 | 0.208 | 0.209 |
| Intra-class correlation ρ | | | | 0.998 | 0.995 | 0.992 |
| Hausman *p*-value | | | | 0.000 | 0.000 | 0.000 |

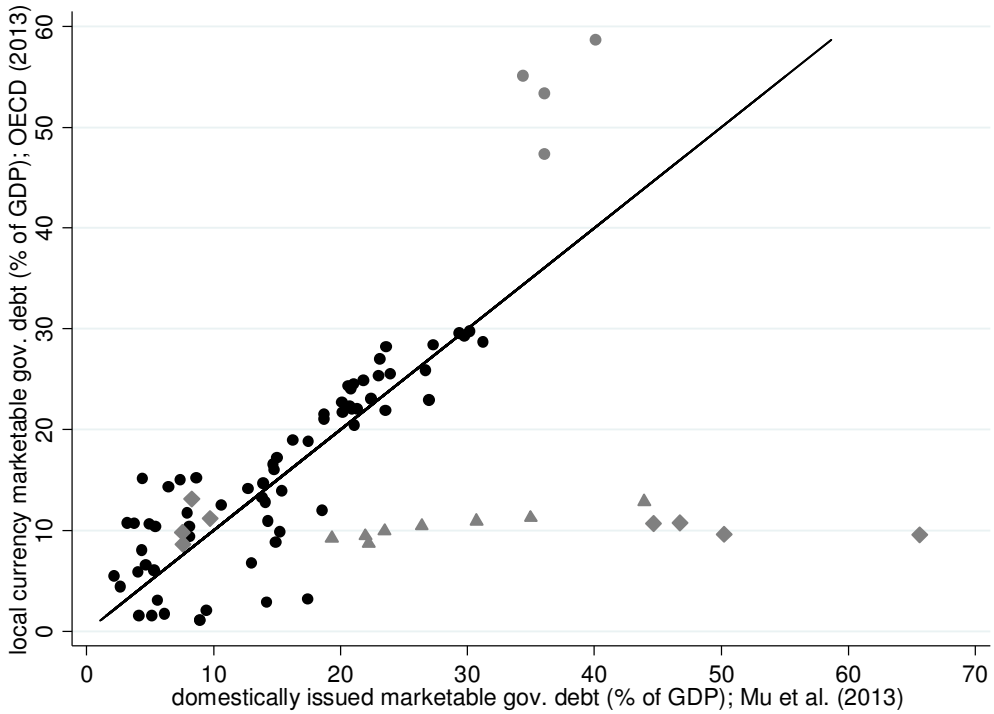
Notes: Dependent variable is *lc_mdebt_gdp*, year-end outstanding local currency marketable central government debt (% of GDP). Sample countries, years and independent variables as defined in the text and Table A.1 in Appendix. All independent variables are one-year lagged, except for *ln_area*, *comlaw*, *intvol*, *xrtvol* and *vix*. Standard errors, clustered at the country level, are reported in brackets. ***$p$<0.01; **$p$<0.05; *$p$<0.10; +$p$<0.20.

*Table A.7. Dynamic panel results - difference GMM estimations*

| | Difference GMM | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **(1a)** | **(1b)** | **(1c)** | **(1d)** | **(2a)** | **(2b)** | **(2c)** | **(2d)** |
| *L.lc_mdebt_gdp* | 0.804*** | 0.866*** | 0.809*** | 0.798*** | 0.798*** | 0.862*** | 0.820*** | 0.770*** |
| | [0.179] | [0.220] | [0.204] | [0.158] | [0.181] | [0.224] | [0.207] | [0.155] |
| *ln_gdp_ppp* | -1.237 | -5.190 | 8.474 | 5.662 | -0.749 | -4.797 | 7.594 | 8.304 |
| | [22.897] | [26.159] | [18.205] | [11.563] | [23.150] | [26.465] | [18.842] | [10.955] |
| *ln_area* | | | | | | | | |
| *ln_gdppc_ppp* | 2.379 | 9.188 | -10.889 | -6.246 | 1.565 | 8.531 | -9.410 | -10.695 |
| | [31.460] | [37.524] | [24.771] | [16.653] | [31.921] | [38.063] | [25.631] | [15.498] |
| *x_gdp* | 0.115 | 0.125 | 0.046 | 0.142 | 0.115 | 0.125 | 0.045 | 0.135 |
| | [0.129] | [0.155] | [0.106] | [0.153] | [0.129] | [0.155] | [0.108] | [0.152] |
| *domcred_gdp* | -0.038 | -0.043 | -0.041 | -0.060 | -0.038 | -0.042 | -0.042 | -0.055 |
| | [0.071] | [0.080] | [0.068] | [0.064] | [0.071] | [0.080] | [0.069] | [0.063] |
| *av_fiscbal_gdp* | -0.429+ | -0.471+ | -0.035 | | -0.427+ | -0.470+ | -0.037 | |
| | [0.265] | [0.297] | [0.132] | | [0.266] | [0.298] | [0.129] | |
| *infl_cp* | -0.210*** | -0.127 | -0.166** | -0.135+ | -0.210*** | -0.128 | -0.166** | -0.138* |
| | [0.065] | [0.112] | [0.074] | [0.079] | [0.065] | [0.113] | [0.075] | [0.074] |
| *kaopen* | 0.518 | 0.391 | 0.655 | -0.607 | 0.519 | 0.393 | 0.654 | -0.480 |
| | [0.761] | [0.804] | [0.820] | [0.948] | [0.769] | [0.812] | [0.821] | [0.963] |
| *comlaw* | | | | | | | | |
| *democ* | | | | | 0.103 | 0.077 | -0.193 | 0.530 |
| | | | | | [0.452] | [0.480] | [0.309] | [0.714] |
| *fiscbal_gdp* | | | | -0.335 | | | | -0.302 |
| | | | | [0.252] | | | | [0.240] |
| *vix* | 0.018 | 0.001 | -0.001 | -0.062 | 0.017 | 0.001 | -0.001 | -0.058 |
| | [0.072] | [0.064] | [0.077] | [0.083] | [0.073] | [0.064] | [0.078] | [0.079] |
| constant | | | | | | | | |
| Observations | 94 | 94 | 94 | 94 | 94 | 94 | 94 | 94 |
| # instruments | 9 | 9 | 9 | 9 | 10 | 10 | 10 | 10 |
| Overall F *p*-value | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| AR(1) *p*-value | 0.021 | 0.047 | 0.016 | 0.015 | 0.022 | 0.050 | 0.017 | 0.011 |
| AR(2) *p*-value | 0.520 | 0.505 | 0.454 | 0.374 | 0.520 | 0.504 | 0.447 | 0.358 |
| Hansen *p*-value | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |

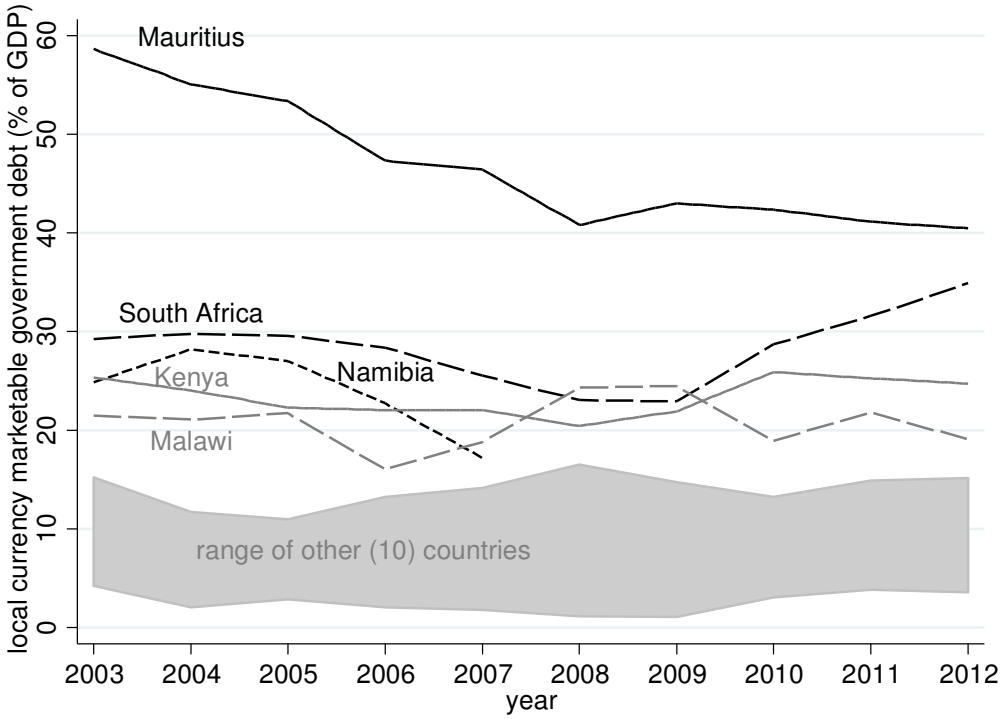
Notes: Dependent variable is *lc_mdebt_gdp*, year-end outstanding local currency marketable central government debt (% of GDP). Sample countries, years and independent variables as defined in the text and Appendix Table A.1. Windmeijer-corrected standard errors are reported in brackets. Number of observations refers to number of data points in the transformed (first-differenced) equation. Number of instrument lags is limited to one and instrument matrix is collapsed. Columns (a): only *av_fiscbal_gdp* predetermined; columns (b): *av_fiscbal_gdp* and *infl_cp* predetermined; columns (c): *av_fiscbal_gdp* endogenous; columns (d): *fiscbal_gdp* endogenous. 'N/A' means statistic could not be calculated because specification is just identified. ***$p$<0.01; **$p$<0.05; *$p$<0.10; +$p$<0.20.

*Figure A.1. Comparison of dependent variable of current paper with that of Mu et al. (2013)*



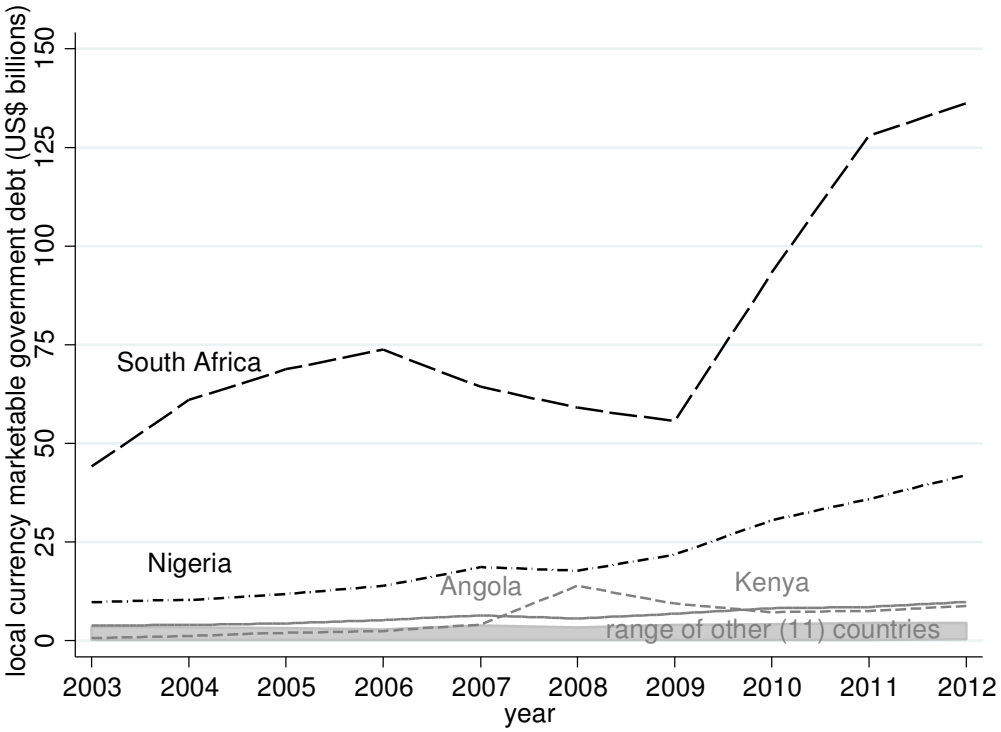

Notes: Straight line is 45° line. Data points for Mauritius are grey dots, for Sierra Leone grey triangles, and for Uganda grey diamonds.

*Figure A.2. Evolution of local currency marketable government debt (% of GDP) for sample countries, 2003-2012*



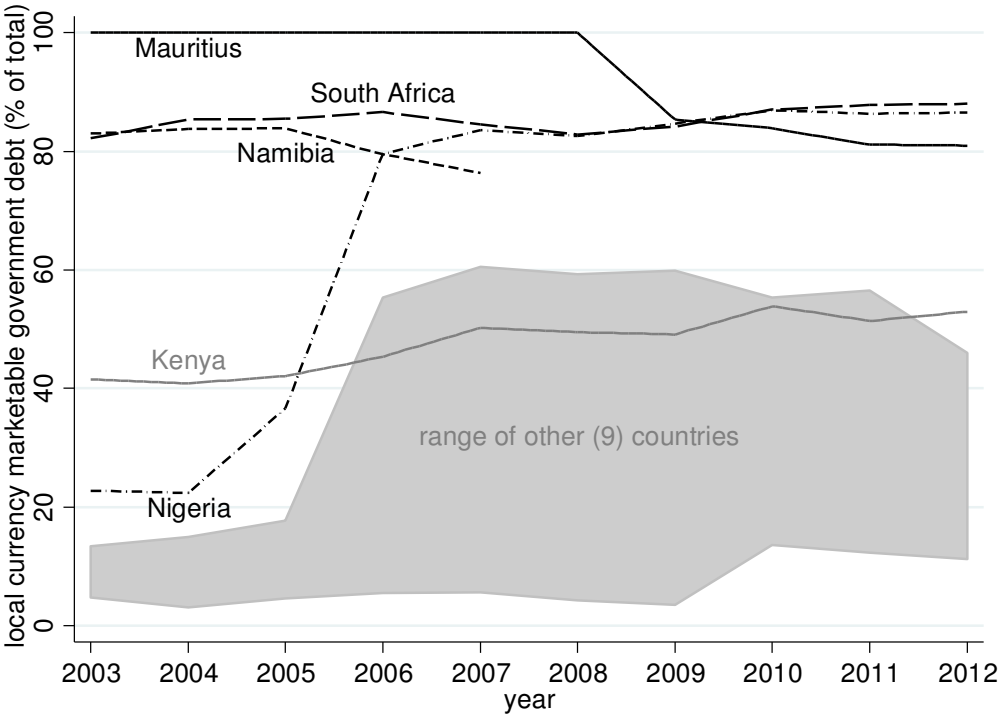

Notes: For presentation purposes, only five largest LCBMs (relative to GDP) are shown separately. Range represents the minimum and maximum values of LCBM capitalisation for other ten sample countries: i.e., in descending order of relative LCBM size (averaged over 2003-2012), Zambia, Nigeria, Tanzania, Uganda, Sierra Leone, Angola, Madagascar, Mozambique, Cameroon and Gabon.

*Figure A.3. Evolution of local currency marketable government debt (current US$ billions) for sample countries, 2003-2012*



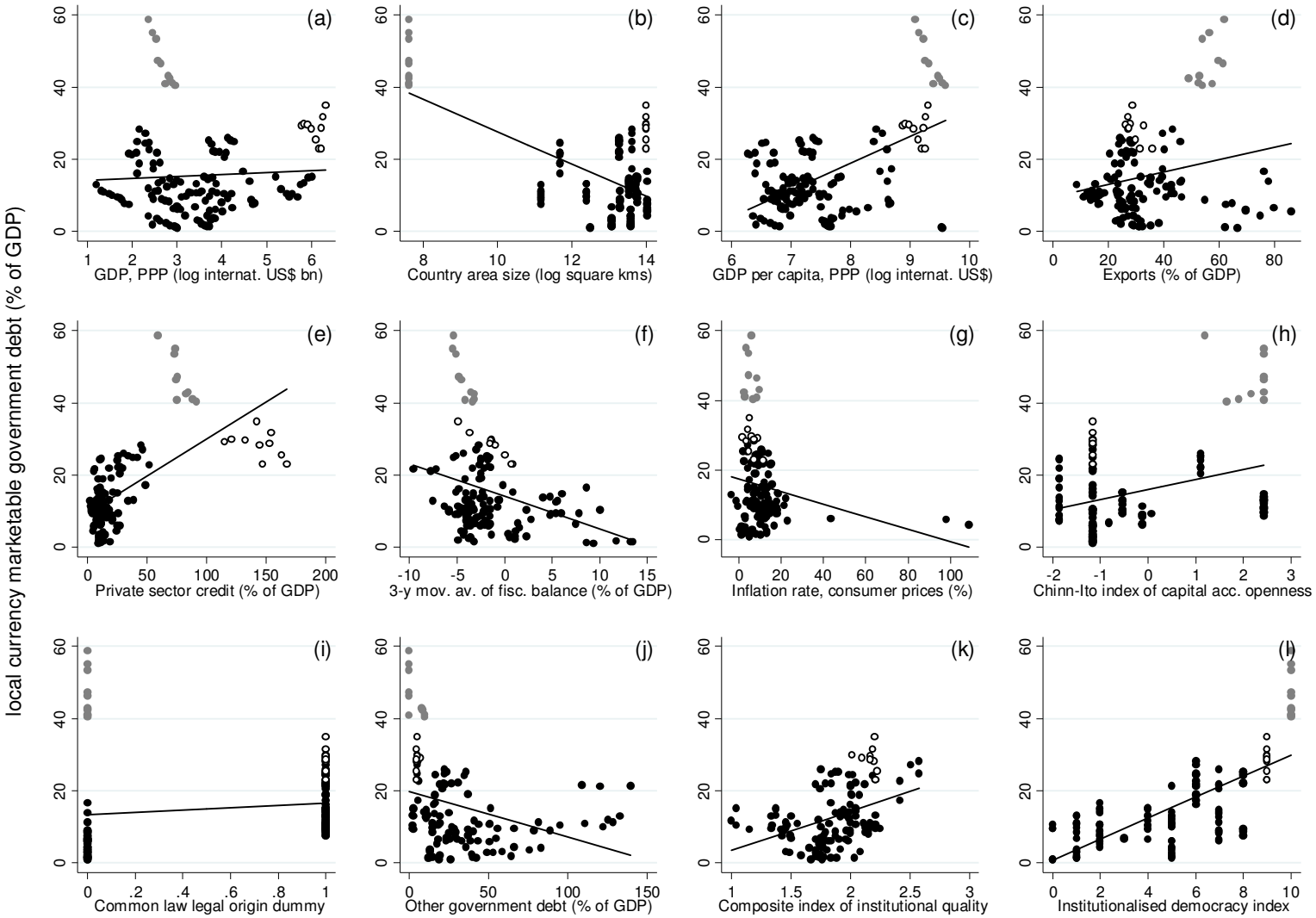

Notes: For presentation purposes, only four largest LCBMs (in absolute US$ terms) are shown separately. Range represents the minimum and maximum values of LCBM size for other 11 sample countries: i.e., in descending order of absolute LCBM size (averaged over 2003-2012), Mauritius, Tanzania, Zambia, Namibia, Uganda, Malawi, Cameroon, Madagascar, Mozambique, Sierra Leone and Gabon.

*Figure A.4. Evolution of local currency marketable government debt (% of total government debt) for sample countries, 2003-2012*



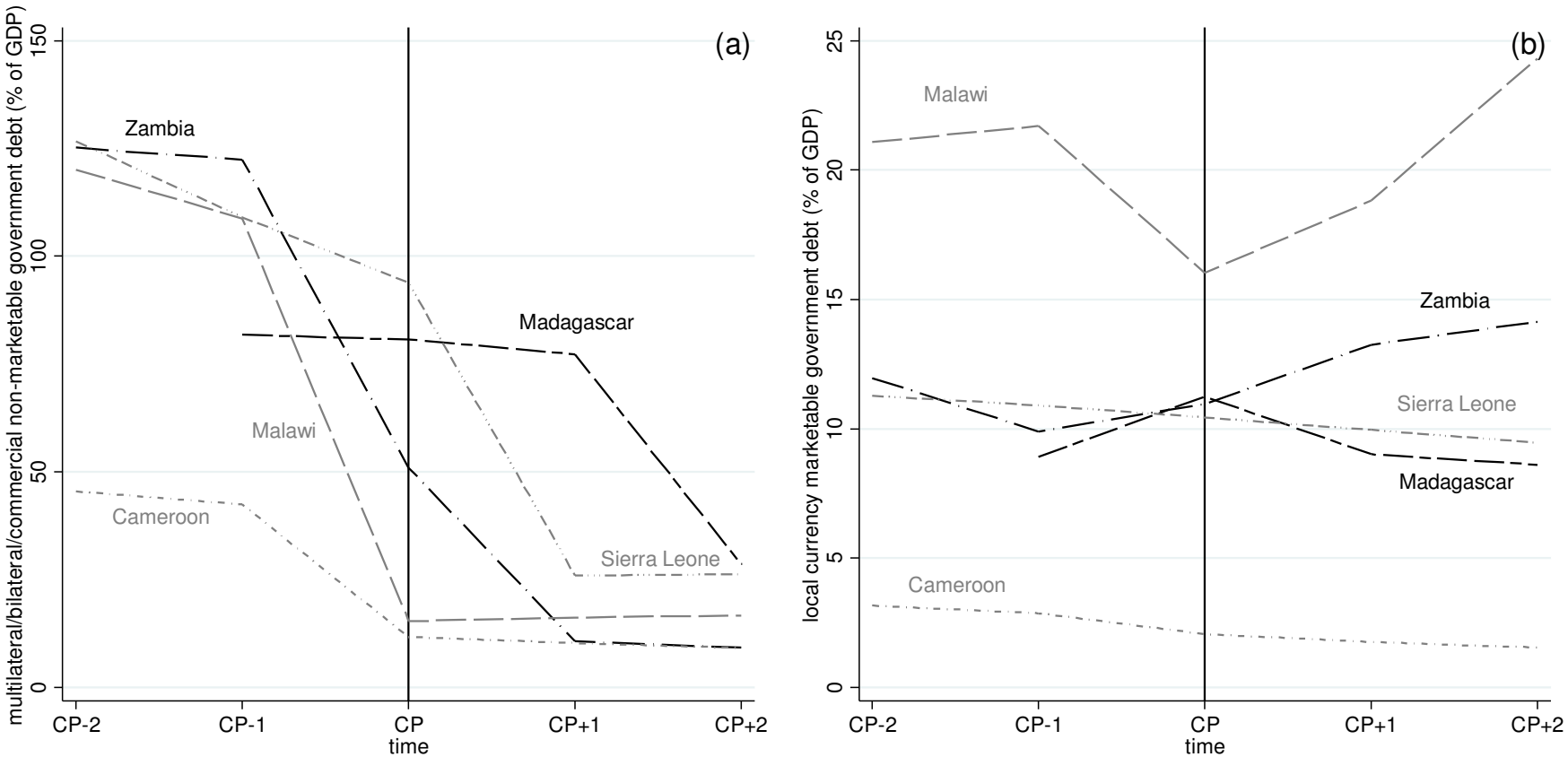

Notes: For presentation purposes, only five largest LCBM shares of total government debt are shown separately. Range represents the minimum and maximum values of LCBM shares of total government debt for other nine sample countries: i.e., in descending order of LCBM shares (averaged over 2003-2012), Zambia, Malawi, Uganda, Angola, Madagascar, Sierra Leone, Cameroon, Mozambique and Gabon. Total government debt is not available for Tanzania.

*Figure A.5. Bivariate scatter plots: local currency marketable government debt (% of GDP) vs. explanatory variables*




Notes: Sample countries, years and variables as defined in the text and Table A.1 in Appendix. All explanatory variables are one-year lagged, except for country size, common law dummy and other government debt. Lines represent best linear fit. Data points for South Africa are white dots, and for Mauritius grey dots.

*Figure A.6. Evolution of non-marketable government debt and local currency marketable government debt (as % of GDP) for sample HIPCs around completion point*




Notes: For presentation purposes, non-marketable government debt stock and LCBM capitalisation are only shown for five sample countries that reached HIPC completion point during 2003-2012: Madagascar (2004), Zambia (2005), Cameroon (2006), Malawi (2006) and Sierra Leone (2006). To facilitate comparison, evolution of HIPCs' debt stocks is shown in five-year window centred around respective completion points.

## References


Abbas, S. M. A., and Christensen, J. E. (2010). The role of domestic debt markets in economic growth: An empirical investigation for low-income countries and emerging markets. *IMF Staff Papers*, 57(1), 209-255.

Acemoglu, D., and Robinson, J. A. (2012). *Why nations fail: The origins of power, prosperity and poverty*. London: Profile Books.

Adelegan, O. J., and Radzewicz-Bak, B. (2009). What determines bond market development in sub-Saharan Africa? *IMF Working Paper*, No. 09/213.

Anderson, P. R. D., Caputo Silva, A., and Velandia-Rubiano, A. (2011). Public debt management in emerging market economies: Has this time been different? In: C. A. Primo Braga, and G. A. Vincelette (Eds.), *Sovereign debt and the financial crisis: Has this time been different?* (pp. 383-411). Washington, DC: World Bank.

Angelo, T. (2014). Mauritius: Capitulation, consolidation, creation. In: S. Farran, E. Örücü, and S. P. Donlan (Eds.), *A study of mixed legal systems: Endangered, entrenched or blended* (pp. 117-138). Surrey: Ashgate.

Arellano, M., and Bond, S. (1991). Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. *Review of Economic Studies*, 58(2), 277-297.

Arellano, M., and Bover, O. (1995). Another look at the instrumental variable estimation of error-components models. *Journal of Econometrics*, 68(1), 29-51.

Arnone, M., and Presbitero, A. F. (2010). *Debt relief initiatives: Policy design and outcomes*. Surrey: Ashgate.

Bae, K.-H. (2012). Determinants of local currency bonds and foreign holdings: Implications for bond market development in the People's Republic of China. *Asian Development Bank Working Paper Series on Regional Economic Integration*, No. 97.

Beaugrand, P., Loko, B., and Mlachila, M. (2002). The choice between external and domestic debt in financing budget deficits: The case of Central and West African countries. *IMF Working Paper*, No. 02/79.

Bhattacharyay, B. N. (2013). Determinants of bond market development in Asia. *Journal of Asian Economies*, 24(1), 124-137.

BIS, Commonwealth Secretariat, ECB, Eurostat, IMF, OECD, Paris Club, UNCTAD, and World Bank. (2013). *Public sector debt statistics: Guide for compilers and users*. Washington, DC: IMF.

Blommestein, H. J. (2005). *Advances in risk management of government debt*. Paris: OECD.

Blommestein, H. J., and Horman, G. (2007). Government debt management and bond markets in Africa. *OECD Journal: Financial Market Trends*, 2011(1), 217-244.

Blommestein, H. J., and Ibarlucea Flores, P. (2011). OECD Statistical Yearbook on African Central Government Debt: Summary and overview. *OECD Journal: Financial Market Trends*, 2011(1), 277-283.

Blommestein, H. J., and Santiso, J. (2007). New strategies for emerging domestic sovereign bond markets in the global financial landscape. *Global Economy Journal*, 7(2), Article 2.

Blundell, R., and Bond, S. (1998). Initial conditions and moment restrictions in dynamic panel data models. *Journal of Econometrics*, 87(1), 115-143.

Bond, S. R., Hoeffler, A., and Temple, J. R. W. (2001). GMM estimation of empirical growth models. *CEPR Discussion Paper*, No. 3048.

Bond, S. R., Nauges, C., and Windmeijer, F. (2005). Unit roots: Identification and testing in micro panels. *CEMMAP Working Paper*, No. CWP07/05.

Bua, G., Pradelli, J., and Presbitero, A. F. (2014). Domestic public debt in low-income countries: Trends and structure. *Review of Development Finance*, 4(1), 1-19.

Burger, J. D., and Warnock, F. E. (2006). Local currency bond markets. *IMF Staff Papers*, 53(Special Issue), 133-146.

Calderón, C., and Liu, L. (2003). The direction of causality between financial development and economic growth. *Journal of Development Economics*, 72(1), 321-334.

Chinn, M. D., and Ito, H. (2006). What matters for financial development? Capital controls, institutions, and interactions. *Journal of Development Economics*, 81(1), 163-192.

Christensen, J. E. (2005). Domestic debt markets in Sub-Saharan Africa. *IMF Staff Papers*, 52(3), 518-538.

Claessens, S., Klingebiel, D., and Schmukler, S. L. (2007). Government bonds in domestic and foreign currency: The role of institutional and macroeconomic factors. *Review of International Economics*, 15(2), 370-413.

Collier, P., Hoeffler, A., and Pattillo, C. (2001). Flight capital as a portfolio choice. *World Bank Economic Review*, 15(1), 55-80.

Dabla-Norris, E., Minoiu, C., and Zanna, L.-F. (2015). Business cycle fluctuations, large shocks, and development aid: New evidence. *World Development*, 69(May 2015), 44-61.

Dang, H.-A., Knack, S., and Rogers, F. H. (2013). International aid and financial crises in donor countries. *European Journal of Political Economy*, 32(December 2013), 232-250.

Daniel, L. (2008). Foreign investors participation in emerging market economies' domestic bond markets. *Banque de France Bulletin Digest*, 173(May-June 2008).

Das, U. S., Papaioannou, M. G., and Trebesch, C. (2012). Sovereign debt restructurings 1950–2010: Concepts, literature survey, and stylized facts. *IMF Working Paper*, No. 12/203.

Demetriades, P. O., and Hussein, K. A. (1996). Does financial development cause economic growth? Time-series evidence from 16 countries. *Journal of Development Economics*, 51(2), 387-411.

Depetris Chauvin, N., and Kraay, A. (2005). What has 100 billion dollars worth of debt relief done for low-income countries? World Bank mimeo.

Didier, T., and Schmukler, S. L. (2014). Debt markets in emerging economies: Major trends. *Comparative Economic Studies*, 56(2), 200-228.

Diouf, M. A., and Boutin-Dufresne, F. (2012). Financing growth in the WAEMU through the regional securities market: Past successes and current challenges. *IMF Working Paper*, No. 12/249.

Ebeke, C., and Lu, Y. (2014). Emerging market local currency bond yields and foreign holdings in the post-Lehman period: A fortune or misfortune? *IMF Working Paper*, No. 14/29.

Eichengreen, B. (2008). Rationale and obstacles to the development of bond markets in emerging economies. *GEMLOC Advisory Services Guest Commentary*, May 2008.

Eichengreen, B., and Hausmann, R. (1999). Exchange rates and financial fragility. In: Federal Reserve Bank of Kansas City (Ed.), *New challenges for monetary policy* (pp. 329-368). Kansas City, MO: Federal Reserve Bank of Kansas City.

Eichengreen, B., Hausmann, R., and Panizza, U. (2005a). The mystery of original sin. In: B. Eichengreen, and R. Hausmann (Eds.), *Other people's money: Debt denomination and financial instability in emerging market economies* (pp. 233-265). Chicago, IL: University of Chicago Press.

Eichengreen, B., Hausmann, R., and Panizza, U. (2005b). The pain of original sin. In: B. Eichengreen, and R. Hausmann (Eds.), *Other people's money: Debt denomination and financial instability in emerging market economies* (pp. 13-47). Chicago, IL: University of Chicago Press.

Eichengreen, B., and Luengnaruemitchai, P. (2006). Why doesn't have Asia bigger bond markets? In: BIS (Ed.), *Asian bond markets: Issues and prospects* (pp. 40-77). Basel: BIS.

Eichengreen, B., Panizza, U., and Borensztein, E. (2008). Prospects for Latin American bond markets: A cross-country view. In: E. Borensztein, K. Cowan, B. Eichengreen, and U. Panizza (Eds.), *Bond markets in Latin America: On the verge of a big bang?* (pp. 247-290). Cambridge, MA: MIT Press.

Emran, M. S., and Farazi, S. (2009). Lazy banks? Government borrowing and private credit in developing countries. *Institute for International Economic Policy Working Paper*, No. 2009-9.

Essers, D., and Cassimon, D. (2012). Washing away original sin: Vulnerability to crisis and the role of local currency bonds in Sub-Saharan Africa. *IOB Working Paper*, No. 2012.12.

Fernández, A., Klein, M. W., Rebucci, A., Schindler, M., and Uribe, M. (2015). Capital control measures: A new dataset. *NBER Working Paper*, No. 20970.

Forslund, K., Lima, L., and Panizza, U. (2011). The determinants of the composition of public debt in developing and emerging market countries. *Review of Development Finance*, 1(3-4), 207-222.

Foster, V., and Briceño-Garmendia, C. (2010). *Africa's infrastructure: A time for transformation*. Washington, DC: World Bank.

Gennaioli, N., Martin, A., and Rossi, S. (2014). Sovereign defaults, domestic banks, and financial institutions. *Journal of Finance*, 69(2), 819-866.

Goldstein, M., and Turner, P. (2004). *Controlling currency mismatches in emerging markets*. Washington, DC: Peterson Institute for International Economics.

Gravier-Rymaszewska, J. (2012). How aid responds to economic crises: A panel VAR approach. *UNU-WIDER Working Paper*, No. 2012/25.

Greenspan, A. (1999). Lessons from global crises. Speech before the World Bank Group and the IMF, Program of Seminars, Washington, DC, 27 September.

Gulde, A.-M. (2008). Overview. In: A.-M. Gulde, and C. G. Tsangarides (Eds.), *The CFA franc zone: Common currency, uncommon challenges* (pp. 1-24). Washington, DC: IMF.

Guscina, A. (2008). Impact of macroeconomic, political, and institutional factors on the structure of government debt in emerging market countries. *IMF Working Paper*, No. 08/205.

Haber, S., North, D. G., and Weingast, B. R. (2007). *Political institutions and financial development*. Stanford, CA: Stanford University Press.

Hadri, K. (2000). Testing for stationarity in heterogeneous panel data. *Econometrics Journal*, 3(2), 148-161.

Hanson, J. A. (2007). The growth in government domestic debt: Changing burdens and risks. *World Bank Policy Research Working Paper*, No. 4348.

Hauner, D. (2009). Public debt and financial development. *Journal of Development Economics*, 88(1), 171-183.

Hausmann, R., and Panizza, U. (2003). On the determinants of Original Sin: An empirical investigation. *Journal of International Money and Finance*, 22(7), 957-990.

Holtz-Eakin, D., Newey, W., and Rosen, H. S. (1988). Estimating vector autoregressions with panel data. *Econometrica*, 56(6), 1371-1395.

Honohan, P., and Beck, T. (2007). *Making finance work for Africa*. Washington, DC: World Bank.

Im, K. S., Pesaran, M. H., and Shin, Y. (2003). Testing for unit roots in heterogeneous panels. *Journal of Econometrics*, 115(1), 53-74.

IMF, and IDA. (2013). *Staff guidance note on the application of the joint Bank-Fund Debt Sustainability Framework for low-income countries*. Washington, DC: IMF/IDA.

IMF, World Bank, EBRD, and OECD. (2013). *Local currency bond markets: A diagnostic framework*. Washington, DC: IMF.

Ismihan, M., and Ozkan, F. G. (2012). Public debt and financial development: A theoretical exploration. *Economics Letters*, 115(3), 348-351.

Jeanne, O., and Guscina, A. (2006). Government debt in emerging market countries: A new data set. *IMF Working Paper*, No. 06/98.

Johansson, P. (2010). Debt relief, investment and growth. *World Development*, 38(9), 1204-1216.

Kaufmann, D., Kraay, A., and Mastruzzi, M. (2010). The Worldwide Governance Indicators: Methodology and analytical issues. *World Bank Policy Research Working Paper*, No. 5430.

Khan, B. (2005). 'Original sin' and bond market development in Sub-Saharan Africa. In: J. J. Teunissen, and A. Akkerman (Eds.), *Africa in the world economy: The national, regional and international challenges* (pp. 67-87). The Hague: FONDAD.

Kose, M. A., Prasad, E., Rogoff, K., and Wei, S.-J. (2009). Financial globalization: A reappraisal. *IMF Staff Papers*, 56(1), 8-62.

Kumhof, M., and Tanner, E. (2005). Government debt: a key role in financial intermediation. *IMF Working Paper*, No. 05/57.

La Porta, R., Lopez-de-Silanes, F., and Shleifer, A. (2008). The economic consequences of legal origins. *Journal of Economic Literature*, 46(2), 285-332.

La Porta, R., Lopez-de-Silanes, F., Shleifer, A., and Vishny, R. W. (1998). Law and finance. *Journal of Political Economy*, 106(6), 1113-1155.

Laeven, L. (2014). The development of local capital markets: Rationale and challenges. *IMF Working Paper*, No. 14/234.

Levin, A., Lin, C.-F., and Chu, C.-S. J. (2002). Unit root tests in panel data: Asymptotic and finite-sample properties. *Journal of Econometrics*, 108(1), 1-24.

Levine, R. (2002). Bank-based or market-based financial systems: Which is better? *Journal of Financial Intermediation*, 11(4), 398-428.

Levine, R. (2005). Finance and growth: Theory and evidence. In: P. Aghion, and S. N. Durlauf (Eds.), *Handbook of economic growth, Volume 1A* (pp. 865-934). Amsterdam: North-Holland.

Marshall, M. G., Gurr, T. R., and Jaggers, K. (2013). *Polity IV project: Political regime characteristics and transitions, 1800-2012. Dataset users' manual*. Vienna, VA: Centre for Systemic Peace.

Mbate, M. (2013). Domestic debt, private sector credit and economic growth in Sub-Saharan Africa. *African Development Review*, 25(4), 434-446.

Mbeng Mezui, C. A., and Hundal, B. (2013). *Structured finance: Conditions for infrastructure project bonds in African Markets*. Tunis: African Development Bank.

Mehl, A., and Reynaud, J. (2005). The determinants of "domestic" original sin in emerging market economies. *ECB Working Paper*, No. 560.

Mehl, A., and Reynaud, J. (2010). Risky public debt composition in emerging economies. *Journal of International Money and Finance*, 29(1), 1-18.

Merotto, D., Stucka, T., and Thomas, M. R. (2014). African debt since HIPC: How clean is the slate? World Bank mimeo.

Miyajima, K., Mohanty, M. S., and Chan, T. (2012). Emerging market local currency bonds: Diversification and stability. *BIS Working Paper*, No. 391.

Mu, Y., Phelps, P., and Stotsky, J. G. (2013). Bond markets in Africa. *Review of Development Finance*, 3(3), 121-135.

Mulligan, C. B., Gil, R., and Sala-i-Martin, X. (2004). Do democracies have different public policies than nondemocracies? *Journal of Economic Perspectives*, 18(1), 51-74.

Ndikumana, L., and Boyce, J. K. (2011). Capital flight from sub-Saharan Africa: Linkages with external borrowing and policy options. *International Review of Applied Economics*, 25(2), 149-170.

Nickell, S. (1981). Biases in dynamic models with fixed effects. *Econometrica*, 49(6), 1417-1426.

Nketcha Nana, P. V., and Samson, L. (2014). Why are banks in Africa hoarding reserves? An empirical investigation of the precautionary motive. *Review of Development Finance*, 4(1), 29-37.

North, D. C., and Weingast, B. R. (1989). Constitutions and commitment: The evolution of institutions governing public choice in seventeenth-century England. *Journal of Economic History*, 49(4), 803-832.

OECD. (2012). *Mapping support for Africa's infrastructure investment*. Paris: OECD.

OECD. (2013). *African central government debt: Statistical yearbook 2003-2012*. Paris: OECD.

Özmen, E., and Arinsoy, D. (2005). The original sin and the blessing trinity: An investigation. *Journal of Policy Modeling*, 27(5), 599-609.

Panizza, U. (2008). Domestic and external public debt in developing countries. *UNCTAD Discussion Paper*, No. 188.

Panizza, U. (2010). Is domestic debt the answer to debt crises? In: B. Herman, J. A. Ocampo, and S. Spiegel (Eds.), *Overcoming developing country debt crises* (pp. 91-108). Oxford: Oxford University Press.

Patrick, H. T. (1966). Financial development and economic growth in underdeveloped countries. *Economic Development and Cultural Change*, 14(2), 174-189.

Peiris, S. J. (2010). Foreign participation in emerging markets' local currency bond markets. *IMF Working Paper*, No. 10/88.

Pomerleano, M. (2010). Local currency bond markets: Will this time be different? Financial Times Economists' Forum, 4 January.

Presbitero, A. F. (2009). Debt-relief effectiveness and institution-building. *Development Policy Review*, 27(5), 529-559.

Presbitero, A. F. (2012). Domestic debt in low-income countries. *Economics Bulletin*, 32(2), 1099-1112.

Rajan, R. G., and Zingales, L. (2003). The great reversals: The politics of financial development in the twentieth century. *Journal of Financial Economics*, 69(1), 5-50.

Richard, B., Roy, A., and Chemonics International. (2010). *Developing government bond markets: Primer, diagnostic checklist, and guidelines for preparing a model scope of work*. Washington, DC/London: USAID/Commonwealth Secretariat.

Roodman, D. (2009a). How to do xtabond2: An introduction to difference and system GMM in Stata. *Stata Journal*, 9(1), 86-136.

Roodman, D. (2009b). A note on the theme of too many instruments. *Oxford Bulletin of Economics and Statistics*, 71(1), 135-158.

Rose, A. K. (2014). The bond market: An inflation-targeter's best friend. *NBER Working Paper*, No. 20494.

Saxegaard, M. (2006). Excess liquidity and effectiveness of monetary policy: Evidence from Sub-Saharan Africa. *IMF Working Paper*, No. 06/115.

Sienaert, A. (2012). Foreign investment in local currency bonds: Considerations for emerging market public debt managers. *World Bank Policy Research Working Paper*, No. 6284.

Söderbom, M., Teal, F., Eberhardt, M., Quinn, S., and Zeitlin, A. (2015). *Empirical development economics*. New York, NY: Routledge.

Song, F., and Thakor, A. V. (2010). Financial systems architecture and the co-evolution of banks and capital markets. *Economic Journal*, 120(547), 1021-1055.

Standard & Poor's. (2014). *Sovereign rating methodology*. New York, NY: Standard & Poor's.

Sy, A. N. R. (2010). Government securities markets in the West African Economic and Monetary Union: A review. *African Development Review*, 22(2), 292-302.

Turner, P. (2012). Weathering financial crisis: Domestic bond markets in EMEs. *BIS Papers*, 63(January 2012), 15-34.

Van Campenhout, B., and Cassimon, D. (2012). Multiple equilibria in the dynamics of financial globalization: The role of institutions. *Journal of International Financial Markets, Institutions and Money*, 22(2), 329-342.

Windmeijer, F. (2005). A finite sample correction for the variance of linear efficient two-step GMM estimators. *Journal of Econometrics*, 126(1), 25-51.

Wooldridge, J. M. (2002). *Econometric analysis of cross section and panel data*. Cambridge, MA: MIT Press.

World Bank, and IMF. (2001). *Developing government bond markets: A handbook*. Washington, DC: World Bank/IMF.

# Chapter 4

# A self-insurance model of optimal reserves and contingent credit lines in a low-income country context


## Abstract

This paper discusses the holding of international reserves as a self-insurance strategy in low-income countries. It builds on the dynamic, two-good, small open economy model of Barnichon (2009) to evaluate the optimal level of reserves in a low-income country faced with terms-of-trade shocks. The original model is adapted in two ways. First, in our baseline model we relax Barnichon's assumption that the country is always a net saver, by allowing for the possibility of negative net foreign assets positions. To reflect the fact that low-income countries' access to international capital markets is asymmetric, a differentiated interest rate is assumed, low on positive net foreign assets (reserves) and high on negative net foreign assets (market borrowing). Numerical calibrations show that optimal net foreign assets are smaller than in Barnichon (2009) but generally still positive, and confirm that optimal reserves are a positive function of the probability, duration and severity of shocks, and of the interest benefits (costs) of positive (negative) net foreign assets. Second, we extend the baseline model by incorporating a mechanism of (subsidised) contingent loans, disbursed to the country only when a terms-of-trade shock hits and with loan size proportional to the balance-of-payments impact of the shock. This mechanism further lowers optimal reserves, and more so when shock-contingent loans cover a larger share of shocks' impact, carry lower interest rates or have longer repayment periods.



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## 1. Introduction

The global financial and economic crisis has revived longstanding academic and policy debates about countries' optimal level of international reserves. Whereas other, non-precautionary motivations matter too, self-insurance against different kinds of shocks is generally believed to be a key objective of reserves accumulation. This conviction is rooted in the observation that, since the 1990s and a string of financial crises, the international reserves of emerging market economies have increased tremendously, much more so than in advanced economies (see Stiglitz, 2006; Jeanne, 2007). The average increase in low-income countries' reserves over the last two decades, while substantial and exceeding standard rules of thumb, has not been equally spectacular (Crispolti *et al.*, 2013).

Unsurprisingly, because of emerging market economies' rapid reserves accumulation and its relation with global imbalances and global financial stability, much of international reserves research has concentrated on this particular country group. There is now a large, growing literature that seeks to assess whether the observed 'war chests' of reserves of emerging market countries can be justified, or are excessive, from self-insurance and/or other perspectives. Typically, theoretical models of emerging market countries' reserves adequacy focus on the risk of sudden stops in private capital inflows as the main driver of self-insurance through reserves (see e.g., Aizenman and Lee, 2007; Jeanne, 2007; Kim, 2008; Durdu *et al.*, 2009; Jeanne and Rancière, 2011). These models have therefore little direct relevance for low-income countries, where access to foreign private capital is typically much more limited and other external, *real sector* shocks, including declines in export demand or abrupt changes in the terms of trade, play a more prominent role (cf. Chapter 2). Only a handful of studies have developed models explicitly tailored to a low-income country context (Drummond and Dhasmana, 2008; Barnichon, 2009; Valencia, 2010; Espinoza, 2014).

This paper builds on the dynamic, two-good, small open economy model of Barnichon (2009) to evaluate the optimal level of reserves in a low-income country faced with terms-of-trade shocks. We adapt and extend the original Barnichon model in two ways. First, we relax Barnichon's rather stringent assumption that, at every point in time, the country needs to be a net saver, by allowing for the possibility of negative net foreign assets positions. To reflect the fact that low-income countries' access to international capital markets is asymmetric, we instead assume a differentiated interest rate, low on positive net foreign assets (reserves) and high on negative net foreign assets (market borrowing). Numerical calibrations of our baseline model for a typical low-income country show that optimal net foreign assets, calculated recursively using value function iteration, are smaller than in Barnichon (2009) but generally still positive. It is also confirmed that optimal reserves are a positive function of the probability, duration and severity of shocks and of the interest benefits on positive net foreign assets and interest costs of negative net foreign assets.

As a second extension, we study the interaction of reserves with alternative insurance-like instruments by adding the idea of contingent credit lines to the model. We assume a mechanism whereby a (subsidised) loan is automatically disbursed, say by the IMF, to the country when (and only when) a terms-of-trade shock hits, with the size of the loan proportional to the balance-of-payments impact of that shock. We believe this model extension, while highly stylised and open for improvement, is helpful in formalising the intuitive substitution effects between self-insurance by reserves accumulation and an idealised contingent credit line.[1] Optimal reserves are found to be

[1] As we will show in Section 4.1 of this paper and in line with the discussion of market insurance-like instruments in Chapter 2, self-accumulated reserves and existing shock-contingent credit facilities (of the IMF)

reduced in the presence of such shock-contingent loans; more so when these loans cover a larger share of the impact of shocks, carry lower interest rates, or are to be repaid over longer periods.

The structure of the remainder of the paper is as follows. Section 2 briefly summarises reserves accumulation trends since the 1990s and critically reviews a selection of the large theoretical and empirical literature on the motives behind emerging market and low-income countries' reserves hoarding. Section 3 starts by laying out our theoretical model, adapted from Barnichon (2009), of the optimal level of reserves as self-insurance against terms-of-trade shocks. We then calibrate and numerically solve a benchmark model, present comparative statics for the model parameters, and conduct dynamic simulations. In Section 4 we discuss the model when extended with a contingent credit line mechanism. Section 5 concludes.

## 2. General setting and literature review

### 2.1. Reserves accumulation trends

Global reserves holdings have risen enormously, by any standard, since the 1990s (cf. Chapter 2). According to figures from the World Bank's World Development Indicators (WDI) the total stock of reserves reached almost US$11 trillion in 2012. This represents a thirteen-fold increase (in nominal terms) from the US$850 billion in 1990.[2]

As shown in panel (a) of Figure 1, most of the increase is accounted for by the accumulation of reserves by emerging market economies classified as 'IBRD' countries, i.e., with per capita incomes sufficiently high to borrow from the World Bank's non-concessional International Bank for Reconstruction and Development, or as 'blend' countries, i.e., poorer countries that are also eligible for IBRD loans because they are considered creditworthy. This group includes large emerging market economies such as China (which held about 30% of the nominal US$ value of global reserves in 2012), Russia, Brazil and Korea (all IBRD), as well as India, Nigeria, Angola and Vietnam (all blend). Also in high-income non-OECD countries reserves have multiplied rapidly; in absolute US$ terms, Saudi Arabia, Hong Kong and Singapore held the largest reserves stocks in this group in 2012. The increase in reserves has been much more modest in high-income OECD countries, i.e., the traditional advanced economies. The reserves holdings of 'IDA-only' countries, low-income countries that borrow concessionally from the World Bank's soft lending arm, the International Development Association, are barely visible when plotted jointly with the reserves of the other country groups (see panel (a)). That notwithstanding, reserves in this last category of countries have increased from a mere US$5 billion in 1990 to more than US$81 billion in 2012 (in current prices). Anno 2012 Bangladesh stood out as the most important IDA-only holder of international reserves, followed, at a distance, by Yemen, Kenya and Ghana.[3]

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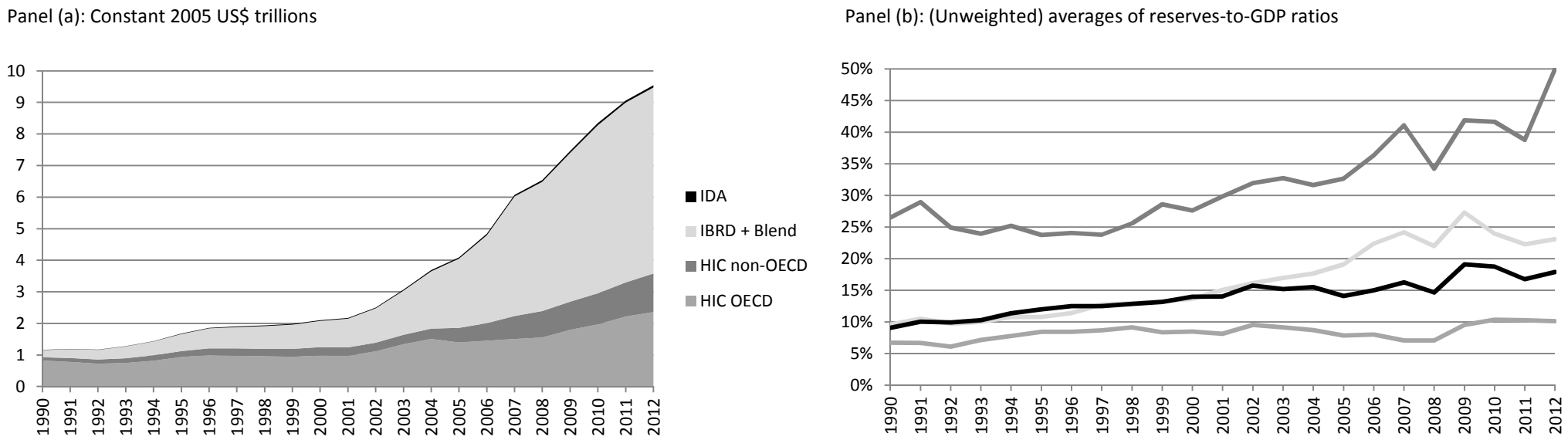
are far from perfect substitutes. Interactions between the two are therefore much more complex in practice than suggested by our stylised model.

[2] These totals are based on WDI reserves figures in current US$ for 163 countries (see notes below Figure 1). International reserves are defined as comprising foreign exchange and SDR holdings under the control of monetary authorities, including IMF quota, but excluding gold. Gold holdings are excluded because of their insignificant size in most developing countries and lower liquidity compared to other reserves assets. Foreign exchange reserves are the dominant category in total reserves portfolios (cf. Bussière *et al.*, 2015).

[3] Note that the country categories used here differ slightly from the IMF classification we adopt in Chapter 2.

*Figure 1. International reserves holdings per country group, 1990-2012*




Source: Calculated from World Bank WDI (indicator FI.RES.XGLD.CD).

Notes: Figures in panel (a) are total reserves in current US$ divided by the US GDP deflator (with base year 2005). Countries with insufficient reserves data are dropped. Remaining countries are grouped as follows:

**IDA-only (46)**: Bangladesh, Benin, Bhutan, Burkina Faso, Burundi, Cambodia, Central African Republic, Chad, Comoros, DR Congo, Côte d'Ivoire, Djibouti, Ethiopia, The Gambia, Ghana, Guinea, Guinea-Bissau, Guyana, Haiti, Honduras, Kenya, Kyrgyz Republic, Lao PDR, Lesotho, Liberia, Madagascar, Malawi, Maldives, Mali, Mauritania, Mozambique, Nepal, Nicaragua, Niger, Rwanda, Samoa, Senegal, Sierra Leone, Sudan, Tajikistan, Tanzania, Togo, Tonga, Uganda, Yemen, Zambia.

**IBRD (57)**: Albania, Algeria, Antigua and Barbuda, Argentina, Azerbaijan, Belarus, Belize, Botswana, Brazil, Bulgaria, Chile, China, Colombia, Costa Rica, Croatia, Dominican Republic, Ecuador, Egypt, El Salvador, Equatorial Guinea, Fiji, Gabon, Guatemala, Indonesia, Iraq, Jamaica, Jordan, Kazakhstan, Republic of Korea, Lebanon, Libya, Macedonia (FYR), Malaysia, Mauritius, Mexico, Morocco, Namibia, Panama, Paraguay, Peru, Philippines, Poland, Romania, Russia, Serbia, Seychelles, South Africa, Suriname, Swaziland, Syria, Thailand, Trinidad and Tobago, Tunisia, Turkey, Ukraine, Uruguay, Venezuela.

**Blend (18)**: Angola, Armenia, Bolivia, Bosnia and Herzegovina, Cameroon, Cape Verde, Republic of Congo, Dominica, Georgia, India, Moldova, Mongolia, Nigeria, Pakistan, Papua New Guinea, Sri Lanka, Vietnam, Zimbabwe.

**High-income, non-OECD (13)**: Bahrain, Cyprus, Hong Kong, Kuwait, Latvia, Lithuania, Macao, Malta, Oman, Qatar, Saudi Arabia, Singapore, United Arab Emirates.

**High-income, OECD (29)**: Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, Luxembourg, Netherlands, New Zealand, Norway, Portugal, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, United Kingdom, United States.

To put things further in perspective, we also consider the evolution of reserves relative to economic size. Panel (b) of Figure 1 presents the unweighted averages of the reserves-to-GDP ratios for each of the aforementioned country groups. Over the full 1990-2012 period, high-income non-OECD countries had, on average, much larger reserves-to-output ratios than the rest. These averages are however skewed by outliers such as Hong Kong, which held reserves worth more than 120% of GDP in 2012. IBRD, blend and IDA-only countries too have had significantly higher average reserves ratios than high-income OECD countries, especially since the start of the new millennium. These averages, however, hide a lot of variation within country groups. Algeria, Lebanon and Botswana (all IBRD) each held reserves in excess of 50% of their 2012 GDP; Bolivia and the Republic of Congo (blend) and Bhutan and Lesotho (IDA-only) had reserves-to-GDP ratios of more than 40%. Conversely, the reserves stocks of Egypt, Venezuela, Ecuador (IBRD), Pakistan (blend), Sudan and Tajikistan (IDA-only) amounted to less than 5% of their respective GDPs in 2012.

Having noted the upward trend in developing countries' absolute and relative levels of reserves, we now turn to an examination of the underlying motives, with a focus on reserves' role as self-insurance against different macroeconomic shocks. We start with a selective review of the theoretical and empirical literature on reserves accumulation in emerging market economies, where the rise has been most impressive, before discussing the more limited body of research on low-income countries' reserves.

### 2.2. Reserves accumulation in emerging market countries

One could think of different reasons why developing countries would want to hold international reserves. Some have argued, often with reference to China and other Asian powerhouses, that the observed reserves accumulation is the by-product of countries pursuing a mercantilist, export-led growth strategy supported by undervalued exchange rates (Dooley *et al.*, 2004; Bar-Ilan and Marion, 2009; Korinek and Servén, 2010; Dooley *et al.*, 2014). Alternatively, it may be that fast-growing developing countries are confronted with a lack of safe and liquid domestic assets in which residents can invest their savings. If capital controls restrict residents from buying these assets abroad directly, capital outflows will take the form of international reserves accumulation by the government or central bank (Caballero, 2006). Large reserves may also help to foster confidence in government policy and reduce external borrowing costs (Hauner, 2006; Levy Yeyati, 2008).

According to another class of arguments, which is at the heart of this paper, reserves hoarding constitutes an insurance strategy against different kinds of macroeconomic shocks, mainly of external origin.[4] Research on the precautionary motive for reserves dates back, at the least, to the seminal work of Heller (1966), who calculated optimal reserves levels in a simple cost-benefit model that takes into account the adjustment costs related to balance-of-payments deficits, the probability of such external imbalances, and the opportunity cost of holding liquid reserves (under the form of forgone capital returns). Frenkel and Jovanovic (1981) later rearticulated similar ideas in a buffer stock set-up where reserves are depleted to accommodate fluctuations in external transactions. Ben-Bassat and Gottlieb (1992) created a model that weighted reserves' opportunity costs against their role as output stabilisers, reducing the risk of costly defaults on external debt.

[4] See Carroll and Jeanne (2009) for a somewhat deviant theoretical model, where a country's reserves follow from the aggregation of individual country residents' precautionary savings to insure themselves against idiosyncratic unemployment risk.

While building on these and other early contributions, the more recent literature on self-insurance through reserves has approached the issue from somewhat different angles. Above all, researchers have sought to test the rationality of the enormous (at first sight, excessive) reserves accumulation in emerging market economies we documented in the previous section. Aizenman and Lee (2007), for example, empirically pit the mercantilist and precautionary motives against each other and find that the latter, proxied by the degree of capital account liberalisation and financial crisis dummies, dominated the former over the 1980-2000 period for most emerging market economies, including China (see also Aizenman and Lee, 2008). Aizenman and Lee (2007) develop a two-period theoretical model consistent with their empirical findings; international reserves protect a representative agent (banker-cum-entrepreneur) against shocks that may force the liquidation of productive investment projects and hence reduce the agent's net income. García and Soto (2006) present evidence that the ratio of reserves to short-term debt is a significant predictor of the probability of large exchange market pressure and current account reversals. Based on a cost-benefit analysis *à la* Ben-Bassat and Gottlieb (1992) they conclude that observed reserves holdings in East Asia and Chile are not out of line with reasonable assumptions about the output costs of crises. Also Obstfeld *et al.* (2010) argue that observed reserves levels may not be unwarranted in emerging market economies, but stress the explanatory power of variables linked to safeguarding domestic financial stability and exchange rate policy.

Delatte and Fouquau (2012) reinvestigate the relative importance of mercantilist versus precautionary purposes using a panel approach with time-varying demand elasticities for international reserves. They confirm that the precautionary motive has been an important driver of the build-up in emerging market country reserves, but also point to a progressive weakening of this motive since 2000, in favour of mercantilism. In a more comprehensive setting and armed with better proxies for mercantilist policies, Ghosh *et al.* (2012) too find shifts in reserves hoarding's underlying determinants. In the 1980s and early 1990s emerging market countries held reserves mainly to defend exchange rate pegs and counter current account shocks, whereas post-1998 the contributions to reserves holdings of insurance against capital account shocks and of undervalued exchange rates gained significance.[5] Likewise, Aizenman *et al.* (2015), who focus on comparing international reserves demand before, during and after the global crisis, demonstrate that patterns of reserves hoarding co-evolve with global economic developments. Quantile regressions by Ghosh *et al.* (2012) moreover suggest that factors driving reserves vary along countries' position in the global reserves distribution; countries with relatively large reserves appear to be motivated more by their vulnerability to capital account shocks and are more sensitive to opportunity costs than low reserves holders.

[5] As alluded to by Ghosh *et al.* (2012), these 'shifting motives' have been mimicked by the different rules of thumb devised by the IMF and others to evaluate reserves adequacy (see IMF, 2000 for more details). In the 1980s and 1990s emerging market economies were advised to hold reserves covering at least three months of import, as a buffer against current account shocks. After a series of financial crises from the mid 1990s onwards, the famous Guidotti-Greenspan rule came to the fore, i.e., at the minimum, reserves should equal short-term external debt. Also indicators based on the ratio of reserves to broad money, which intend to capture the risk of domestic capital flight, began to receive attention. More recently, the IMF has proposed a composite metric to assess emerging market countries' reserves adequacy. This new metric combines short-term debt, other external liabilities, broad money and export earnings, and applies weights reflecting observed outflows during past instances of exchange market pressure (IMF, 2011, 2013a). A review by Aizenman and Genberg (2012) suggests that composite metrics and model-based approaches to reserves adequacy are slowly finding their way into IMF 'Selected Issues' country reports. Traditional rules of thumb and peer comparisons remain dominant, however.

Further theoretical modelling has brought in additional perspectives on what could possibly influence reserves accumulation for precautionary purposes in emerging market countries. Cheung and Qian (2009) expand the model of Aizenman and Lee (2007) to include the idea of 'keeping up with the Joneses', i.e., the adequacy of a particular country's reserves position is evaluated by investors and speculators in comparison to that of the country's peer group. Data on ten major Asian economies is suggestive of the sort of competitive hoarding of reserves predicted by the model, especially in the post-Asian crisis era. Also for Latin America there is some empirical evidence of a Joneses effect in reserves hoarding (Cheung and Sengupta, 2011). Aizenman and Marion (2004) introduce a fiscal dimension, demonstrating that when a country is confronted with output shocks, borrowing limits and costly tax collection, holding liquid reserves (which are beyond the reach of creditors in the event of default) may help smooth consumption intertemporally. In addition, Aizenman and Marion (2004) incorporate political economy considerations. Their model features uncertainty about whether a 'soft' Treasury Minister, which accommodates the fiscal demands of particular interest groups, or a 'tough' one, adhering to the original budgetary plans, will hold power in the next period. Results from such a model indicate that a higher probability of opportunistic behaviour by future policymakers reduces current demand for international reserves and increases external borrowing. This may explain why in some politically unstable or high-corruption countries reserves stocks are too low from a purely economic perspective. Another interesting approach is that of Lee (2004), who quantifies the precautionary value of reserves more generally as the market price of a put option that provides reserves-like insurance under the form of the right to sell an asset against readily available liquidity. The liquidity needs and asset in the model can be flexibly interpreted as either import demand and export value, external debt service and project investment, or otherwise.

The model-based framework most commonly used by the IMF to assess emerging market country reserves levels is that of Jeanne and Rancière (2011) (first published as an IMF Working Paper in 2006). The model considers a small open economy, consisting of a private sector and a government, with a growth path that may be disrupted by sudden stops in capital inflows. In the event of such a sudden stop, output falls below its trend and can no longer be pledged by the private sector to obtain external credit. The government can however prop up domestic consumption with transfers to the private sector by entering into a 'reserves insurance contract' with foreign investors, which, in exchange for premium payments, pays out cash when a sudden stop hits. In an extended version of the model, greater reserves holdings also reduce the probability of a sudden stop. Calibrated with plausible parameter values, the Jeanne and Rancière (2011) model can account for the observed build-up of reserves in most emerging market countries since the 1980s but not for Asia's recent reserves boom, suggesting the importance of other factors and motivations (see before). Jeanne (2007) comes to very similar conclusions based on a simplified model and sees recent reallocations of reserves from Asian central banks to sovereign wealth funds (which typically invest in less liquid, higher-yielding assets) as further evidence of excessive reserves accumulation from a pure self-insurance point of view.[6] Using the same framework as Jeanne (2007) but different calibrations (and noting that large reserves could reduce spreads on private creditor external debt), Ruiz-Arranz and Zavadjil (2008) however argue that, as of 2007, reserves stocks in Asia (barring China) were *not* overtly excessive.

[6] As we pointed out in Chapter 2, the universe of sovereign wealth funds comprises a whole spectrum of mandates (and associated investment strategies), which may or may not include self-insurance against shocks.

Other recent studies have followed Jeanne and Rancière (2011) in developing representative agent models that are numerically calibrated to derive optimal reserves levels. Kim (2008) designs a model in which an emerging market economy faces the risk that its creditors, who receive only noisy signals about the country's available liquidity, do not roll over short-term debt. Applying his framework to data on 15 emerging market countries, Kim (2008) argues that the 1990s were in general marked by under-insurance, and that Asia and Russia have significantly over-insured since the early 2000s. Durdu *et al.* (2009) specify a dynamic stochastic general equilibrium model for a small open economy where precautionary savings are driven by business cycle volatility, financial liberalisation and sudden stop risk. When solved numerically, their model suggests that both financial globalisation and sudden stop risk, but not output variability, explain the observed surges in emerging market countries' reserves. Durdu *et al.* (2009) also find that precautionary reserves accumulation is a slow, gradual process accompanied by persistent current account surpluses and undervalued real exchange rates; which they interpret as reconciling the self-insurance and mercantilist views. Alfaro and Kanczuk (2009) present an alternative model where a representative agent decides jointly on holding reserves and defaultable external debt in the face of technology, interest rate and sudden stop shocks. Calibration of this set-up to a typical emerging market economy indicates that optimal reserves for self-insurance are effectively zero, the main intuition being that reserves reduce the agent's cost of default (as they allow for consumption smoothing in the financial autarky situation that follows a default) and hence render external debt more expensive. In a similar model, Bianchi *et al.* (2013) demonstrate that, once longer-maturity debt and roll-over risk are accounted for, non-zero reserves holdings become more attractive, as insurance against higher future borrowing costs.

### 2.3. Reserves accumulation in low-income countries

From the previous section it is clear that contemporary theoretical and empirical approaches to deriving optimal reserves levels for emerging market economies usually assume sudden stops in private capital inflows as the *raison d'être* of self-insurance through reserves accumulation. Such an assumption makes the just-described models not directly applicable to the context of low-income countries, which typically have much more limited access to international capital markets. This is, however, not to say that low-income countries are less vulnerable to external shocks. On the contrary, numerous studies have documented how low-income countries, largely because of their economic configurations, are routinely subject to external disturbances, such as abrupt changes in their terms of trade or the demand for their exports, natural disasters, and FDI or aid reversals; in fact more so than advanced and emerging market economies (see Perry, 2009; Spatafora and Tytell, 2009; Crispolti *et al.*, 2013 and other references cited in Chapter 2). Not only are these countries highly *exposed* to external shocks, their typically weaker and less flexible domestic institutions also make them less *resilient*, i.e., less able to withstand or adjust quickly from these shocks (Prati *et al.*, 2011; cf. the framework presented in Chapter 2).[7] As a consequence, external shocks tend to translate in larger output and consumption drops and greater output and consumption volatility in low-income countries, with considerable welfare effects (Pallage and Robe, 2003).

[7] For example, low-income countries typically have less flexible exchange rate regimes, less developed domestic financial markets, lower-quality bureaucracies and less stable political systems than advanced and emerging market economies; all of which could operate as shock absorbers (see Céspedes and Velasco, 2012).

A self-insurance strategy of reserves accumulation during 'normal' (or more favourable) economic times and reserves *de*cumulation in the event of negative external shocks, increases low-income countries' resilience against such shocks, by lessening the need to reduce imports and tempering other disruptions to economic activity. An event study analysis by Crispolti *et al.* (2013) indeed indicates that, *ceteris paribus*, low-income countries with reserves above the standard three months of import cover benchmark have historically been much less affected by external demand and terms-of-trade shocks in terms of lower real GDP growth, real consumption per capita growth and (particularly) real absorption per capita growth, compared to those with reserves below this benchmark. According to several studies, reserves also helped low-income countries weather the 2008-2009 Great Recession (see discussion in Chapter 2).

Despite reserves' demonstrated importance for low-income countries, much less academic and policy attention has been devoted to modelling optimal reserves levels for low-income countries than for emerging market economies. One data-driven approach is that of Crispolti *et al.* (2013) (for an earlier version, see Dabla-Norris *et al.*, 2011). In the tradition of Heller (1966), these IMF researchers argue that low-income countries maximise the net benefit of holding reserves, i.e., the avoided adjustment cost due to large negative shocks minus the opportunity cost of reserves. They then go on to empirically estimate the different elements to this net benefit from historical data. First, they identify external shocks and 'crisis' events based on the definitions used in the IMF's Vulnerability Exercise for low-income countries (VE-LIC; see Chapter 2 for a detailed explanation) and calculate unconditional shock probability. Second, the conditional probability and cost (proxied by real absorption loss) of a crisis are estimated with regression models that include reserves levels and other explanatory variables. Third, unit opportunity costs of reserves are approximated by a range of reference values, based on different methodological approaches (see further). Putting the foregoing elements together, Crispolti *et al.* (2013) calibrate optimal reserves levels for different low-income country groups and find that they vary from less than two to more than 12 months of import cover. A comparison with actual holdings end 2008 suggests that most low-income countries' reserves were adequate or even comfortably above the simulated optima, with the exception of some commodity exporters and fragile states.

A survey among IMF low-income country teams reveals that these kinds of cost-benefit exercises and the resulting reserves adequacy metrics have been actively used in discussions with country authorities (IMF, 2013b). Recent work has looked at how to further refine measurements of the cost of holding reserves in low-income countries, which could be quantified on the basis of external funding costs (i.e., as interest rate differentials, in low-income countries with access to international capital markets); costs linked to the domestic issuance of securities for sterilisation purposes (in countries where liquid domestic capital markets exist); or as the marginal productivity of public investment (see IMF, 2013a).

Few studies have tried to adapt the theoretical models described in Section 2.2 to better fit a low-income country context. Drummond and Dhasmana (2008) examine the implications of terms-of-trade and aid shocks in a small open economy model with a representative agent that consumes tradable and non-tradable goods. If a shock occurs, the government transfers its reserves, financed by issuance of long-term securities, to assist the consuming agent. In an extension of the model the consumer herself can also engage in short-term external borrowing, until a shock occurs and all debt becomes due. Drummond and Dhasmana (2008) choose their benchmark model parameters to match an average Sub-Saharan African economy. While their two-good model implies higher optimal reserves than the Jeanne and Rancière (2011) model (with a baseline of around 11-12% of GDP),

most African countries still seemed to have sufficient reserves end 2007 (also when using country-specific parameters). The calibrated optima are however found to be sensitive to parameter choice, not unlike in emerging market country models. Drummond *et al.* (2009) apply the Drummond and Dhasmana (2008) model to East African Community (EAC) member countries Burundi, Kenya, Rwanda, Tanzania and Uganda specifically and reach very similar conclusions. They add that evaluations of reserves adequacy in the EAC could benefit from a forward-looking approach, as member countries are steadily integrating into the regional and global economy. Valencia (2010) considers a more stylised representative agent model where income is impacted by transitory shocks to export volume and the terms of trade, but one that also includes capital goods investment. He calibrates the model to Bolivia and finds that it yields much higher optimal reserves levels than the standard rules of thumb. A recent paper by Espinoza (2014) builds a model where a single agent simultaneously decides on external borrowing, capital investment and reserves, and faces the risk of an exogenous shock that reduces output, makes a share of debt become immediately due and leads to an additional shortfall in foreign exchange. A numerical application of the model shows that reserves are only accumulated if shock probability is sufficiently large. Interestingly, Espinoza (2014) also presents empirical evidence that, both in low-income and emerging market countries, reserves are most typically drawn down during external balance-of-payments shocks, especially to countries' terms of trade, rather than in the context of natural disasters, debt restructurings, domestic/external debt crises or banking crises.

Another notable contribution to modelling self-insurance through reserves in low-income countries, and main inspiration for the current paper, is Barnichon (2009). He specifies a dynamic, two-good, small open economy model subject to various possible shocks where a representative agent with limited access to foreign capital maximises utility by choosing an appropriate level of international reserves. Whereas Barnichon (2009)'s model is originally designed and calibrated to evaluate optimal reserves with respect to natural disasters (hurricanes and droughts) and terms-of-trade shocks in the Caribbean and Sahel regions, it is sufficiently flexible to be adapted to other low-income country contexts. Tereanu (2010), for example, uses the model to derive optimal reserves measures for The Gambia, which in 2008 experienced a commodity price shock followed by a slowdown in remittances, tourism receipts and re-exports. Other advantages of the model are its explicit dynamic nature, which allows for countries to experience multiple shocks over time, and its clear focus on the current account side of the balance of payments (rather than assuming sudden stops, default or roll-over risk; all capital account phenomena). This last feature seems most relevant for the typical low-income country (cf. Crispolti *et al.*, 2013; Espinoza, 2014).

In the next section we lay out in detail our Barnichon-inspired baseline model. Section 4 presents an extended version of the model where we incorporate a stylised (and largely hypothetical) shock-contingent credit line mechanism.

## 3. Baseline model

### 3.1. Model set-up

Our low-income country of interest is a small open economy populated by a single representative agent that consumes two types of non-storable goods: domestically produced home goods $C_H$ and imported foreign goods $C_F$. At the start of each period $t$, the agent receives an endowment $Y_t$ of

home goods that is partially consumed and partially exported. This endowment is variable over time, both because of larger shocks and smaller fluctuations (see further), but otherwise grows at a constant trend rate of $g$.[8] To pay for imports, the country needs foreign exchange, which can come from various sources. We assume that at each time $t$ the agent is bounded by the following balance-of-payments constraint:

$$c_{F,t} = \varepsilon_t \hat{c}_{F,t} - (1+g)R_{t+1} + (1+r_t)R_t + T \tag{1}$$

where all variables are defined as shares of 'normal' output, i.e., the expected endowment level that prevails when no shock occurs, and expressed in imported foreign good units at time $t$. As such, $c_{F,t}$ is the imports-to-output ratio; $\hat{c}_{F,t}$ is the exports-to-output ratio (or ratio to output of home good consumption by the rest of the world); $\varepsilon_t$ are the terms of trade[9]; $R_t$ is the ratio to output of the net foreign assets that are under direct control of the agent; $r_t$ is the one-period interest rate on these net foreign assets; and $T$ are time-invariant net foreign transfers, which may include remittances and/or official aid grants, again scaled to output.[10] The above balance-of-payments constraint simply says that consumption of the foreign good is financed by (the import value of) export earnings, exogenous transfers, and the net foreign assets available at the beginning of period $t$ (including interest), minus the end-of-period net foreign assets (which become available at the start of the next period, $t$+1, and are multiplied by the expected gross growth rate to be converted into a share of output at the start of period $t$).

Importantly, our definition of $R_t$ is different than that of Barnichon (2009), who imposes that it should be positive at all times, thereby forcing the low-income country to always be a net saver. In contrast, we allow net foreign assets to be negative (up to a certain limit, see further); the agent can decide to borrow externally if she wants to. However, to reflect the fact that low-income countries' access to capital markets is asymmetric, i.e., saving and borrowing do not take place on equal terms, we adopt a differentiated interest rate: $r_t = r_L$ if $R_t \geq 0$ and $r_t = r_H$ if $R_t < 0$ with $r_L < r_H$. We thus assume that the return on positive net foreign assets is low and time-invariant, as reserves are invested in

[8] Our modelling of output as an exogenously determined endowment (which is received by the agent as 'manna from heaven') follows Barnichon (2009) and many others, including Jeanne and Rancière (2011). The latter argue that adding productive capital and investment to their model would have an *a priori* ambiguous effect on optimal reserves: domestic investment is an alternative channel through which the agent may smooth consumption over time (reducing the need for reserves), but reserves may also be used to smooth investment itself. We acknowledge that the lack of investment behaviour is a drawback to the current model and limits its use as a normative tool.

[9] The terms of trade are here defined conventionally, as the ratio of export prices to import prices (measuring how many units of imported foreign good can be obtained per unit of exported home good). We assume $\varepsilon_t$ as given, out of the influence sphere of our small low-income country. Moreover, we make abstraction of independent real exchange rate movements, through changes in nominal exchange rates or relative prices, between the low-income country and the rest of the world.

[10] We assume there are no capital flows in the model (apart from those captured by differences between $R_t$ and $R_{t+1}$; see further). The different net transfers included in $T$ need not be all time-invariant. Some elements, like remittances or humanitarian assistance, may be countercyclical to shocks in the recipient country, while other items, like more traditional aid, could be procyclical (cf. Chapter 2). Without loss of generality, we just assume that, on the whole, counter- and procyclical transfers cancel each other out and, moreover, that $T$ is completely exogenous to the agent. The model can be easily extended to one where $T$ is either countercyclical or procyclical (see Tereanu, 2010) or where it includes capital/financial account items over which the agent has also no control (such as FDI or official aid loans, which may or may not be subject to sudden stops). The latter extension would require, at the least, differentiating between new inflows $T_t$ and principal and interest repayments on previous inflows $T_{t-1}$.

liquid, low-yielding fixed-income instruments like US Treasury bonds, and that access to external market borrowing is always available at a fixed but (punitively) high interest rate.[11]

Note that the opportunity costs of reserves, an important element in both theoretical and empirical work on reserves accumulation (see Sections 2.2 and 2.3) are introduced implicitly rather than explicitly in our model; we do so by assuming a low return $r_L$ on positive net foreign assets and, at the same time, modelling the representative agent's preferences as being characterised by a sufficiently high discount rate (or low discount factor; see further). Hence, in our set-up holding positive net foreign assets (reserves) can be considered costly because the agent's impatience to consume is higher than the remuneration received on reserves assets (cf. Alfaro and Kanczuk, 2009; Valencia, 2010). Here we deviate from Barnichon (2009), who translates opportunity costs into a 'real' cost payable in home goods, and includes them in the agent's budgetary constraints.[12]

Given that the agent consumes both imported foreign goods and home goods, the overall resource constraint can be written as:

$$c_{H,t} + \frac{1}{\varepsilon_t} c_{F,t} = y_t - \frac{1}{\varepsilon_t}((1+g)R_{t+1} - (1+r_t)R_t - T) \tag{2}$$

where $y_t$ denotes the endowment at time $t$ as a share of normal output and everything is expressed in home good terms. This second constraint implies that total consumption (whereby foreign good consumption is converted into home good units using the terms of trade) must equal the endowment of home goods minus the accumulation of net foreign assets (or, plus net foreign assets *de*cumulation) and plus transfers (the latter two again converted with the terms of trade).

To bring in the possibility of exogenous shocks and the self-insurance motive of reserves accumulation we further assume, in line with Barnichon (2009), that the economy's terms of trade and its endowment follow a two-state Markov (i.e., 'memoryless') process with time-invariant probabilities of between-state transitions. In the 'normal' or 'non-shock' state, the terms of trade are given by $\varepsilon^n$ and the endowment equals $Y_t^n$, which follows a uniform distribution on the interval $[(1 - \mu)Y^n, (1 + \mu)Y^n]$, centred around its expected value of $Y^n$ and with $0 < \mu << 1$.[13] This output variability can be interpreted as mild random fluctuations induced by, say, temporary changes in productivity (although production is not explicitly modelled in our endowment economy). Beyond these 'normal' fluctuations and with probability $\pi^{ns}$, a severe external shock hits the economy and disrupts both the terms of trade and output, so that $\varepsilon^s = \eta_\varepsilon \varepsilon^n$ and $Y^s = \eta_Y Y^n$, with $0 < \eta_\varepsilon, \eta_Y < 1$. To focus on pure terms-of-trade shocks we assume no additional direct impact of the shock on export volumes. Furthermore,

[11] Negative net foreign assets can be thought of in our model as (expensive) international bank loans or bond financing that the agent can access at any time and that provide the exact same liquidity as a drawdown in international reserves (so not FDI or aid loans, from which we make abstraction). To keep our set-up simple (and in line with most other studies) we do not model gross foreign assets and liabilities as separate choice variables and assume away roll-over and interest rate risk. Relaxing these assumptions could provide interesting avenues for further research (see Section 5).

[12] Other studies model opportunity costs as the interest rate spread between liquid short-term reserves assets and longer-term, risky liabilities (e.g., Drummond and Dhasmana, 2008; Jeanne and Rancière, 2011; Bianchi *et al.*, 2013) or as the difference in returns between reserves and illiquid domestic investment (e.g., Lee, 2004; Jeanne, 2007). This is not possible in the simple model presented here as we do not consider (gross) debt as a separate variable and foresee no role for domestic investment.

[13] Unlike Barnichon (2009) we assume that non-shock output in itself has a distribution, to incorporate into the model the use of net foreign assets for 'normal' consumption smoothing, next to its role in countering more severe shocks.

we do not allow the agent to shift her endowment of home goods between consumption and export (for example in a reaction to relative price changes). In other words, at all times a fixed proportion of output is exported, $\hat{C}_{F,t} = \delta Y_t$ with $0 < \delta < 1$.[14] Once in a 'shock' state, the economy returns to 'normal' with probability $\pi^{sn}$. This implies the expected duration of the shock equals $1/\pi^{sn}$ periods and the two-by-two Markov transition matrix with time-invariant transition probabilities between normal and shock states is given by[15]:

$$\pi = \begin{bmatrix} 1-\pi^{ns} & \pi^{ns} \\ \pi^{sn} & 1-\pi^{sn} \end{bmatrix} \tag{3}$$

The representative agent seeks to maximise expected utility derived from the consumption of home and foreign goods. Her preferences are assumed to be intertemporally additive:

$$U_0 = E_0 \sum_{t=0}^{\infty} \beta^t \, u\left(c_{H,t}, c_{F,t}\right) \tag{4}$$

with $0 < \beta < 1$ the subjective discount factor, measuring the agent's patience to consume[16]; and $E$ the expectations operator. The period utility function is increasing and concave in both its arguments and takes the same form as in Barnichon (2009):

$$u\left(c_{H,t}, c_{F,t}\right) = \frac{\sigma}{\sigma-1}\left[\theta^{\frac{1}{\gamma}}\left(c_{H,t} - \underline{c}_H\right)^{1-\frac{1}{\gamma}} + (1-\theta)^{\frac{1}{\gamma}}\left(c_{F,t} - \underline{c}_F\right)^{1-\frac{1}{\gamma}}\right]^{\frac{1-1/\sigma}{1-1/\gamma}} \tag{5}$$

where $1/\sigma > 0$ is the coefficient of relative risk aversion (with higher values implying greater curvature of utility over consumption and a greater desire for consumption smoothing; $\sigma$ being the *inter*temporal elasticity of substitution); $\gamma > 0$ is the *intra*temporal elasticity of substitution between home and foreign goods (where higher values signify more substitutability/less complementarity); $\theta$ is the preference for home goods; and $\underline{c}_H$ and $\underline{c}_F$ are the output-scaled subsistence consumption levels of home and foreign goods, respectively. In case $\underline{c}_H$ and $\underline{c}_F$ are both zero, the period utility function reduces to its standard two-goods constant-elasticity-of-substitution (CES)/constant-relative-risk-aversion (CRRA) form (see, e.g., Obstfeld and Rogoff, 1996, p. 324). As noted by Barnichon (2009), Stone-Geary preferences are particularly relevant when calibrating a model to low-

[14] Again, the set-up can easily be adapted to allow the export share to decline in case of a shock. This seems useful for modelling exogenous supply shocks that directly affect the low-income country's export capacity, like natural disasters (Barnichon, 2009), or external demand shocks, e.g., due to an economic recession in the country's export destinations. In this paper we restrict ourselves to terms-of-trade shocks only.

[15] Of course, the just-described Markov process (and the accompanying transition matrix) can be generalised to more than two states in a model where the country faces different types of shocks (or shocks with different intensities).

[16] The subjective discount factor basically captures the time preferences of the representative agent; the larger it is, the more the agent values her future utility (and therefore future consumption) and the more willing she is to relinquish some consumption now to save for future contingencies. The subjective discount factor $\beta$ plays a key role in our model since, together with the remuneration rate on positive net foreign assets $r_L$, it determines the opportunity costs of reserves. Indeed, reserves assets bear high opportunity costs if the agent has a great desire for immediate gratification (low $\beta$) and, at the same time, gets only compensated marginally for holding reserves/delaying gratification (low $r_L$).

income countries whose consumption may be close to subsistence levels. Under such preferences, risk aversion increases (or, equivalently, intertemporal elasticity of substitution decreases) with declining consumption levels; an assumption which has received strong support by a wide range of empirical work (see, e.g., Ogaki and Zhang, 2001; and other studies cited in Temple *et al.*, 2014).[17]

After simple manipulation and substitution of the information about the effects of terms-of-trade shocks into the earlier-defined constraints, one can write the agent's optimisation problem at date $t$ recursively by means of the following stochastic Bellman equation, with control variable $R_{t+1}$:

$$V(R_t) = max_{R_{t+1}} \{u(c_{H,t}, c_{F,t}) + E_t \beta V(R_{t+1})\}$$

$$s.t. \begin{cases} c_{F,t} = \varepsilon_t \, \delta y_t - (1+g)R_{t+1} + (1+r_t)R_t + T \\ c_{H,t} = (1-\delta)y_t \\ y_t = y_t^n - (y_t^n - \eta_Y)I_s \\ y_t^n \sim unif(1-\mu, 1+\mu) \\ r_t = r_L \; if \; R_t \geq 0 \\ r_t = r_H \; if \; R_t < 0 \\ c_{H,t} \geq \underline{c}_H; \; c_{F,t} \geq \underline{c}_F \end{cases} \tag{6}$$

where again all variables are scaled to the expected output in the non-shock state ($Y^n$), and $I_s$ is an indicator function that equals zero in a normal state and one in a shock state. By applying Bellman's principle that an agent who plans to behave optimally in the future can do no better than to optimise today and take future optimal plans as given, the infinite horizon problem is effectively broken down into a sequence of optimisation problems, each covering just two periods, $t$ and $t$+1.

If we would simplify our problem and assume a symmetric, time-invariant interest rate ($r_t = r_L = r_H = r$) and no output trend growth ($g = 0$), it would yield the standard stochastic Euler equation for foreign good consumption: $u'(c_{F,t}) = (1 + r)\beta E_t[u'(c_{F,t+1})]$ (cf. Obstfeld and Rogoff, 1996, pp. 79-80).[18] Here we are however more interested in the differentiated interest rate model with Stone-Geary preferences. As this model has no closed-form analytical solution we move to solving it numerically in the next section.[19]

[17] For other macroeconomic studies that use Stone-Geary preferences in their modelling (of low-income country growth dynamics), see, e.g., King and Rebelo (1993), Steger (2000) and Kraay and Raddatz (2007). Stone-Geary preferences imply that at very low consumption levels, near subsistence, the agent becomes extremely risk averse and unwilling to shift consumption over time.

[18] If, furthermore, the model is stripped from all variability in output and the terms of trade, one obtains the deterministic Euler equation $u'(c_{F,t}) = (1 + r)\beta u'(c_{F,t+1})$, which only allows for a sustainable (and constant) path of foreign good consumption and net foreign assets under the condition that $\beta = 1/(1 + r)$, i.e., if the subjective and market discount factor are equal (see Obstfeld and Rogoff, 1996). If $\beta > 1/(1 + r)$ in the deterministic model, consumption and net foreign assets would grow infinitely (as the agent is patient enough to provide foreigners with ever-increasing loans); If, alternatively, $\beta < 1/(1 + r)$ consumption and net foreign assets would shrink forever (as the agent is sufficiently impatient to borrow ever-increasing sums from abroad). Note that in our stochastic set-up with asymmetric interest rates such restrictions are not necessary to obtain sustainable paths and steady-state solutions. In fact, as already indicated, we will deliberately model $\beta < 1/(1 + r_L)$ to bring in the idea of opportunity costs of positive net foreign assets (in terms of foregone consumption).

[19] Barnichon (2009) derives a (very roughly) approximated closed-form solution for his related model, in the special case where the period utility function is of the log Cobb-Douglas form (with $\underline{c}_H = \underline{c}_F = 0$ and $\sigma = \gamma = 1$).

### 3.2. Numerical calibration and comparative statics

We solve Bellman Equation (6) recursively by simple value function iteration on a discretised grid where net foreign assets can vary between -15% and +15% of normal output. The codes used to perform the dynamic optimisation of the baseline model are provided in Boxes A.1 and A.2 in Appendix, together with additional explanations.

The upper bound of the grid corresponds with reserves, here defined as positive foreign assets net of (perfectly liquid) foreign liabilities, of approximately five months of import in the steady state (calculated using benchmark values for $\delta$ and $T$; see further). The solutions to our benchmark model and sensitivity tests do not change by increasing the upper bound of the grid, however. We set the lower limit to net foreign assets at -15% of output to allow for a fair degree of (net) external market borrowing while, at the same time, keeping sufficient degrees of freedom in choosing our other parameter values (like, for example, the interest rate $r_H$ on those net foreign assets). Indeed, our parameterisation only yields a valid numerical solution to the problem defined in Section 3.1 as long as it satisfies the subsistence consumption constraints at all times and in all possible states. From the first constraint of the optimisation problem in Equation (6) it follows that permitting larger negative net foreign assets positions (i.e., a lower minimum bound of the grid) limits the range of possible values of other parameters that are consistent with above-subsistence foreign good consumption.[20] Mainly a pragmatic choice, a maximum indebtedness of 15% of output may seem unrealistically low for the low-income countries that are the subject of our calibration. Note however that, strictly speaking, the -15% should be interpreted in the model as a *net* measure of perfectly liquid market borrowing, with (equally liquid) reserves deducted. As indicated before, other (more illiquid, longer-term) forms of debt over which the agent has arguably less control, such as multilateral and bilateral concessional loans, are absent from our simple model.

Table 1 lists the key parameter values in our benchmark calibration of the model, as well as their sources and the range of variation we use in our sensitivity tests. Where possible, we match our terms-of-trade shock parameters to (unbalanced) data over 1980-2013 for the 60 countries that were classified as 'IDA-only' by the World Bank at the moment of writing (cf. Figure 1) and adopt preference parameters in line with other low-income country studies. Because of the simplicity of the model and its sensitivity to changes in some (hard-to-estimate) parameters (see further), we do not expect nor attempt to closely mimic reality. Rather, we want to get an idea of the order of magnitude of net foreign assets our model is able to generate under reasonable calibrations and test prior intuitions about the factors influencing reserves (or better: net foreign assets) accumulation for self-insurance purposes. Since the terms-of-trade data we use is only available at yearly intervals, calibration is done at yearly frequency.[21] As noted above, we make sure our parameterisation (in combination with grid boundaries) does not violate the subsistence consumption constraints of the model (see Box A.1).

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[20] To see why, note that if current-period net foreign assets $R_t$ are at their minimum level $R_{min}$ (< 0), the maximum foreign good consumption the agent can attain in the shock state is given by $c_F = \eta_\varepsilon \varepsilon^n \delta \eta_Y - (1 + g)R_{min} + (1 + r_H)R_{min} + T$; any other admissible level of next-period net foreign assets $R_{t+1}$ (> $R_{min}$), holding $R_t = R_{min}$, will imply lower $c_F$. Therefore, if even this maximum $c_F$ is below subsistence level $\underline{c}_F$, the parameterisation is not compatible with the import subsistence constraint and the policy function is not defined for $R_t = R_{min}$. One can avoid this problem by adapting the parameterisation, for example, adopting a lower $r_H$, higher $g$, larger $T$, less severe shocks or a lower $\underline{c}_F$, but the room to do so (and still achieve an overall plausible calibration of the model) shrinks with a lower minimum bound for net foreign assets.

[21] Barnichon (2009) adopts a monthly frequency instead, focusing on short-lived natural disaster events.

*Table 1. Benchmark model calibration*

| **Parameter** | | **Benchmark** | **Range of variation** | **Source/motivation** |
|---|---|---|---|---|
| Subjective discount factor | $\beta$ | 0.95 | [0.92, 0.98] | Standard value |
| Risk aversion | $1/\sigma$ | 5 | [2, 10] | Barnichon (2009) |
| Elasticity of substitution between goods | $\gamma$ | 0.3 | [0.1, 0.9] | Agénor *et al.* (2008); Barnichon (2009) |
| Output trend growth | $g$ | 0.02 | [0, 0.04] | WDI |
| Exports-to-output ratio | $\delta$ | 0.25 | [0.1, 0.5] | WDI |
| Preference for home goods | $\theta$ | 0.75 | / | $1 - \delta$ |
| Transfers-to-output ratio | $T$ | 0.1 | [0.08, 0.3] | WDI |
| Interest rate on positive net foreign assets | $r_L$ | 0.03 | [0, 0.05] | FRED |
| Interest rate on negative net foreign assets | $r_H$ | 0.1 | [0, 0.14] | Above recent Eurobond yields-at-issue |
| Shock probability | $\pi^{ns}$ | 0.1 | [0.05, 0.25] | UNCTAD; Crispolti *et al.* (2013) |
| Probability of return to normal state | $\pi^{sn}$ | 1 | [0.7, 1] | UNCTAD |
| Terms-of-trade loss due to shock | $1 - \eta_\varepsilon$ | 0.2 | [0.1, 0.22] | UNCTAD |
| Output loss due to shock | $1 - \eta_Y$ | 0.01 | [0, 0.04] | UNCTAD; WDI |
| Normal output variability | $\mu$ | 0.005 | / | Smaller than output loss due to shock |
| Subsistence imports (ratio to normal imports) | $\underline{c}_F$ | 0.8 | [0, 0.8] | Barnichon (2009) |
| Lower boundary of net foreign assets grid | $R_{min}$ | -0.15 | [-0.20, 0] | Feasibility in combination with other parameters |
| **Optimal net foreign assets (ratio to normal output)** | **R*** | **0.04** | | |

In the benchmark calibration we set the subjective discount factor to 0.95, a standard value in the literature which implies an annual discount rate of about 5%. The coefficient of relative risk aversion is set to five, in line with Barnichon (2009) but somewhat higher than the values used by Drummond and Dhasmana (2008) and Espinoza (2014) (two and four, respectively). The intratemporal elasticity of substitution between home and foreign consumption goods is fixed at 0.3, following again Barnichon (2009) and Agénor *et al.* (2008). This intratemporal elasticity is relatively low, but for our purposes we make the assumption that import and domestic goods are of a very different nature and therefore poor substitutes (which seems reasonable for most low-income countries). We take an expected output trend growth of 2%, close to both the average and median growth rate of real GDP per capita of IDA-only countries over 2000-2013 in the WDI data.

Exports are modelled as a constant 25% of output, which matches more or less the median exports-to-GDP ratio of IDA-only countries over 1980-2013 according to the WDI. At 75% the preference for home good consumption is set equal to the non-exported share of output ($1 - \delta$). Since transfers are defined in our model as providing the resources to finance the difference between imports and exports (assuming net foreign assets are at their steady-state level and making abstraction of interest costs/benefits and growth, which are of second order; see Equation (1)), we calibrate them as such. The imports-to-output ratio of the median IDA-only country is close to 35% in the WDI data, and so benchmark transfers are set at 10%.

The interest on positive net foreign assets is fixed at 3%, close to the 1980-2013 average annual real return on ten-year US Treasury bonds, calculated from the Federal Reserve Economic Data (FRED) repository maintained by the Federal Reserve Bank of St. Louis. Therefore, under benchmark calibration, reserves carry opportunity costs; their return (3%) is lower than the agent's implied discount rate (about 5%). Interest rates on negative net foreign assets are much harder to pin down. In theory at least, countries might access different sources of (expensive) market borrowing when affected by a shock. Absent good proxies, we set the high interest rate at 10%, sufficiently above the yields-at-issue of recent Eurobonds of a number of low-income countries (issued when they did not experience large external shocks).[22]

In line with Crispolti *et al.* (2013) (and the IMF's VE-LIC; see Chapter 2), we define large external shock events as negative changes in countries' terms of trade that fall below the tenth percentile of the country-specific distribution of such changes; so that the implied shock probability equals 10%. As we calibrate our model at yearly frequency we need to set the expected duration of shocks at one year or more. We choose an expected shock duration of one year (or, equivalently an annual return-to-normal probability of 100%). UNCTAD terms-of-trade data on IDA-only countries indicates that shock events (as just defined) typically do not occur in two successive years, although we will consider shock persistence when testing the sensitivity of our results. The data further shows that the average annual terms-of-trade loss during shocks was around 20% over 1980-2013. The terms of trade in the non-shock state ($\varepsilon^n$) are normalised to one. An event analysis on our IDA-only UNCTAD and WDI data, similar to that of Crispolti *et al.* (2013) and Drummond and Dhasmana (2008), suggests, on average, limited impact of terms-of-trade shocks on economic growth.[23] Larger-than-average shocks are, however, found to have a more pronounced impact, to the tune of one to two percentage point lower growth. We decide to adopt a benchmark value of 1% for the output loss

[22] For example, maiden Eurobonds by low-income countries Rwanda (April 2013, US$400 million), Kenya (June 2014, US$500 million + US$1 billion) and Ethiopia (December 2014, US$1 billion) yielded about 6.9%, 5.9-6.9% and 6.6%, respectively, at issuance (according to various financial news reports).

[23] The detailed results of this event analysis are available from the authors upon request.

due to a shock. With respect to non-shock output variability, it is further assumed that in the normal state output takes one of three possible values (with equal probability): 0.995, 1, or 1.005 (i.e., $\mu$ = 0.5%). We thus model limited fluctuations whereby normal output, although variable, is always above output in the shock state (which is fixed at 0.99). Lastly, subsistence consumption levels are difficult to calibrate. We follow Barnichon (2009) in setting subsistence foreign good consumption at 80% of normal imports, which in our benchmark case equals 28% of normal output.[24] The subsistence level of home good consumption is assumed zero.

Estimated optimal net foreign assets are at 4% of output in the steady state under the benchmark calibration of parameters, or about 1.4 months of import cover. At first sight, this seems low, especially in view of the 15-20% average reserves-to-output ratio in IDA-only countries over the past few years (cf. Figure 1). However, again remember that the latter are *gross* figures, while our model solution should be interpreted as *net* reserves (after subtraction of liquid market borrowing). Also, as pointed out in Section 2, many motives and factors other than self-insurance against the terms-of-trade shocks modelled here may underlie net foreign assets accumulation. Our benchmark of 1.4 months of import cover is also below Barnichon (2009)'s estimate of 2.4 months for Sahel countries experiencing terms-of-trade shocks, in a model that requires low-income countries to always be net savers. Interestingly, even when we allow for access to market borrowing (be it at high interest rates), a utility-maximising low-income country agent with rational expectations still decides to hold a positive level of net foreign assets, at least in our benchmark set-up.

In Figure 2 we explore the sensitivity of the model solution to changes in individual parameter values, holding all other parameters at their benchmark calibration. Everything else constant, the optimal reserves-to-output ratio increases when the subjective discount factor grows and when risk aversion rises (or, equivalently, the intertemporal elasticity of substitution declines) and decreases with higher intratemporal elasticity of substitution between home and foreign good consumption. Indeed, this is what we would expect. The agent's optimal net foreign assets position is larger if she is more patient, as this lowers the implicit opportunity costs of positive net foreign assets; if she desires strong consumption smoothing; and if home and foreign goods are seen less as substitutes than as complements. Note that the solution to the model is very sensitive to the first two of these particular, hard-to-measure parameters, which cautions against drawing too strong policy conclusions from simple calibration exercises as ours. For example, with a discount factor of 0.92 optimal net foreign assets are close to zero, whereas they approach 16% of output when the discount factor is 0.98.

Because higher output trend growth lowers the need to save for the future, it reduces the optimal net foreign assets position of the low-income country. The comparative statics further indicate a positive relation of optimal net foreign assets with the export share of output (since larger exports facilitate net foreign assets accumulation and aggravate the impact of shocks on export earnings) and a negative relation with transfers (which are close substitutes for net foreign assets in our model). Figure 2 also shines some light on the impact of changes in our differentiated interest rates. When the high interest rate on negative net foreign assets is kept at its 10% benchmark, optimal reserves appear to increase exponentially with greater interest benefits on positive net

[24] Barnichon (2009) argues that the 2008 food price riots in a number of African countries were the result of consumption reaching subsistence levels. His 80% back-on-the-envelope estimate of subsistence foreign good consumption rests on the assumptions that the riots were triggered by a 50% increase in food prices over the course of a single year and that the food basket represents about 40% of total imports in African countries. Clearly, further work is needed to produce better approximations of subsistence imports.

foreign assets. Again, for a given degree of patience (discount factor) of the agent, a higher remuneration of reserves lowers opportunity costs and makes them more attractive. Similarly, with the interest rate on positive net foreign assets fixed at 3%, larger interest costs on negative net foreign assets lead to higher steady-state reserves. Only when the latter interest rate slips below about 5.5%, the agent will decide to hold negative net foreign assets, i.e., engage in market borrowing, in the steady state.

Further in line with intuition, Figure 2 shows that optimal net foreign assets are larger when shocks are more frequent, longer-lasting and more severe. If the benchmark terms-of-trade shocks are expected to occur every five rather than every ten years (i.e., shock probability changes from 10% to 20%), we find optimal reserves levels of about 10.5% of output (more than 3.5 months of imports). A similar reserves target is obtained if we set the expected duration of shocks at one year and four months instead of just one year (i.e., the annual return probability changes from 100% to 75%). Conversely, if we replace the benchmark terms-of-trade loss of 20% by 10%, optimal net foreign assets are less than 1% of output. Optimal net foreign assets ratios are also positively correlated with the output loss caused by shocks, although even when there is no impact at all on output we obtain a reserves target of 3.7%, very close to the benchmark solution. This can be explained by the fact that, under the calibrations we present here, the lion share of the (expected) decline in export earnings, which triggers net foreign assets accumulation, is not due to the shock's impact on output but on the terms of trade.

Our results are also sensitive to changes in the subsistence level of imports. Subsistence needs to be set sufficiently high in our model, at about 56% of normal imports (19.6% of output) or higher under benchmark calibration, in order to generate strictly positive net foreign assets in the steady-state optimum. Lower subsistence levels make the agent want to target a zero net foreign assets position; in such cases there is no short-term lending or borrowing between the low-income country and the rest of the world in steady state. In other words, only under assumptions of sufficient risk aversion our model yields non-zero reserves.[25]

Next, we study the impact of choosing a different lower boundary for net foreign assets in our grid search. It turns out that the steady-state solution of the model does not deviate significantly from its benchmark value as long as minimum net foreign assets vary between -20% and -5% of output.[26] Once negative net foreign assets are restricted to 5% of output or less, the optimal net foreign assets position of the agent starts to rise more rapidly. If, like Barnichon (2009), we exclude the possibility of external market borrowing altogether, steady-state optimal reserves are about 8.3% of output (nearly three months of import cover). The varying sensitivity of optimal net foreign assets to changes in the lower boundary of the grid can be understood as follows. When borrowing limits are sufficiently lax they do not affect the behaviour of the optimising agent very much, as it would be very unlikely that she would ever have to borrow such large sums; whereas if borrowing limits are more restrictive, they bind the agent, and small changes to those limits will have greater impact on her optimal net foreign assets position.

[25] We have tested that with higher coefficients of relative risk aversion $1/\sigma$ the model returns positive optimal net foreign assets at lower import consumption subsistence thresholds than the 56% of normal output under benchmark calibration.

[26] The lowest boundary for net foreign assets which, in combination with the other benchmark parameters, guarantees that the subsistence constraint on imports is always satisfied lies at -22.5% of output.

*Figure 2. Optimal net foreign assets (ratio to normal output): comparative statics of baseline model*

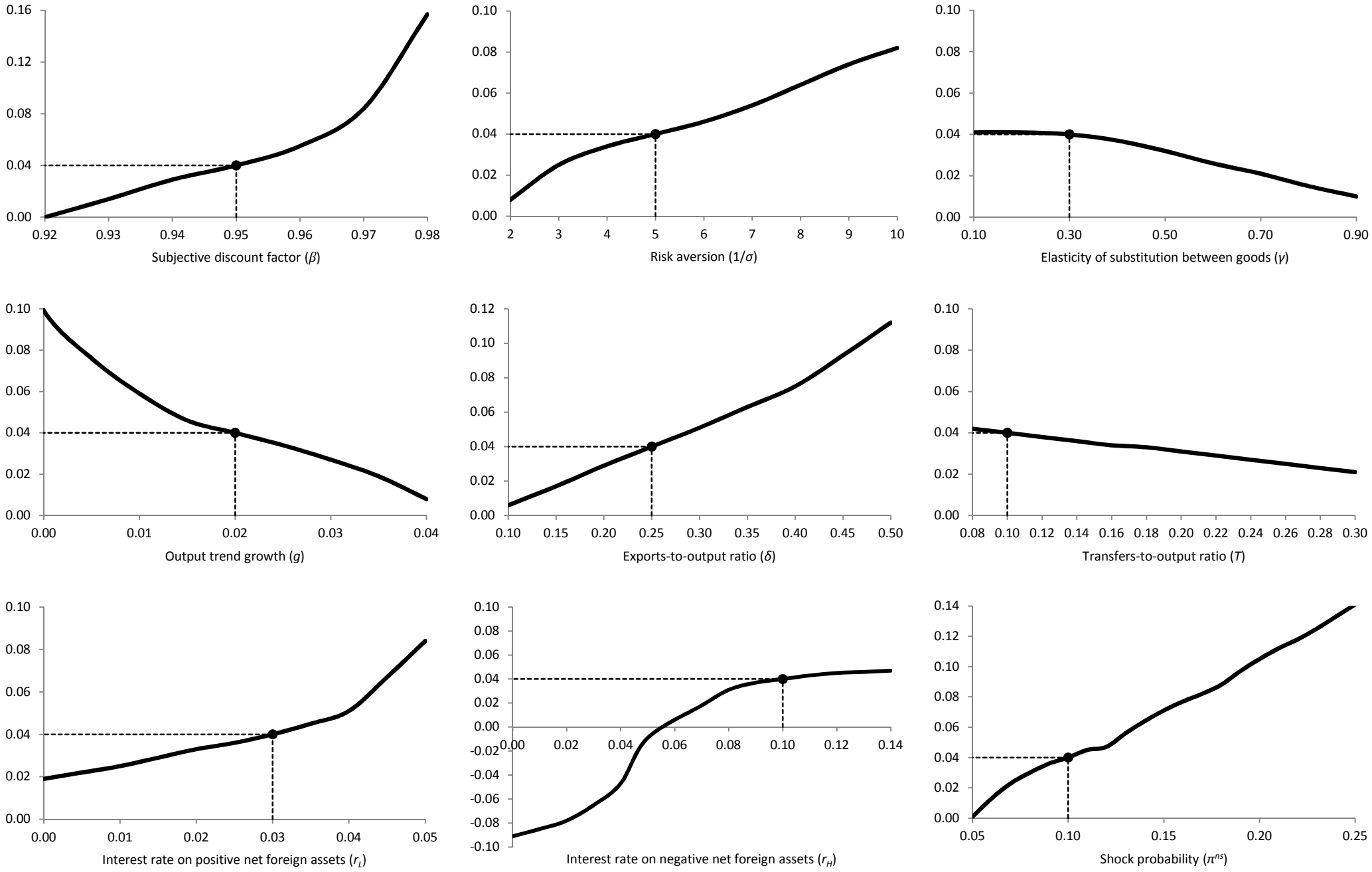
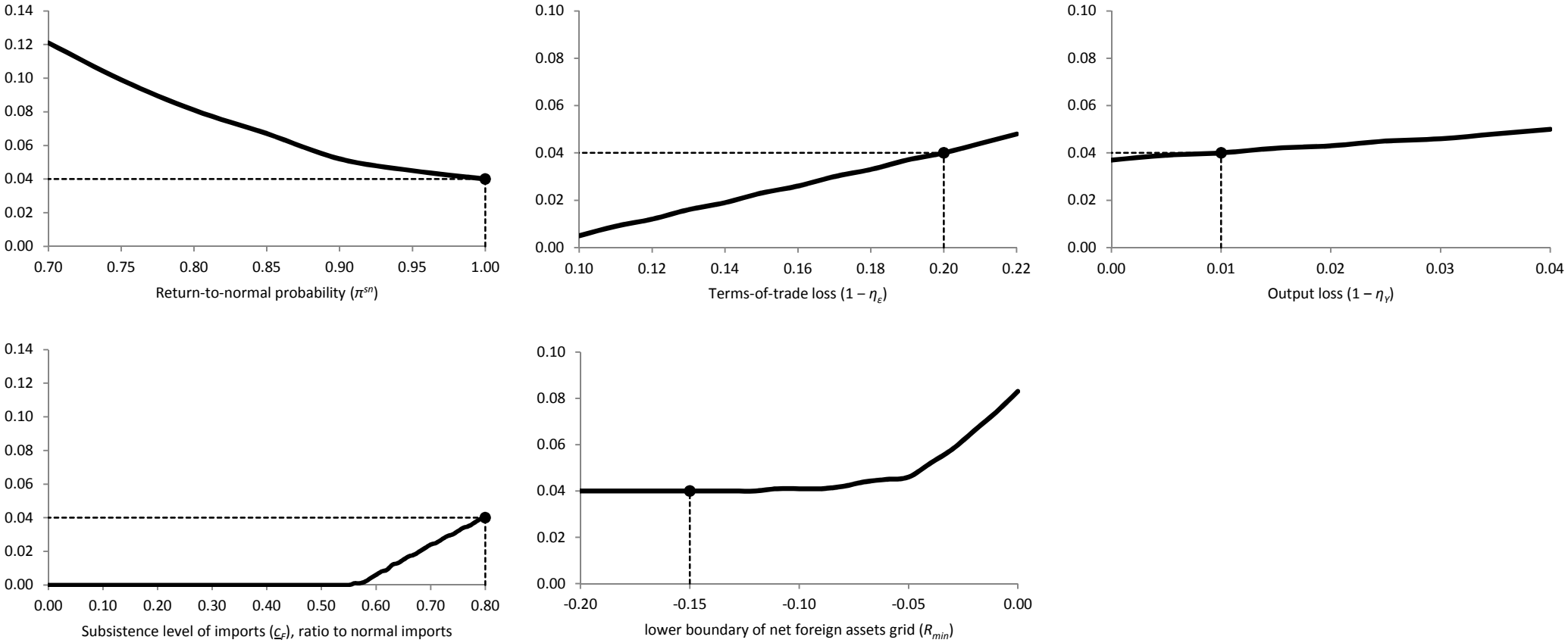


*Figure 2* (Continued)




Note: Dots indicate benchmark calibration of the baseline model.

Finally, we have experimented with the calibration of more pessimistic shock scenarios by increasing shock probability and severity parameters simultaneously. Figure A.1 in Appendix shows (by means of surface plots) how optimal net foreign assets react when we let the terms-of-trade losses due to shocks vary between 20% and 30% and output losses from 5% to 10%, both for shock probabilities of 10% (panel (a)) and 20% (panel (b)). All other parameters are again kept at their benchmark values, with the exception of the ratio of subsistence to normal imports, which is lowered from its benchmark of 80% to 70% (or 24.5% of normal output) to allow for more severe shocks while respecting the foreign good subsistence constraint (cf. above and footnote 20). As before, it is clear that the two shock severity effects work in the same direction. Panel (a) of Figure A.1 indicates that with a shock probability of 10% and terms-of-trade and output losses of 30% and 10% respectively, the agent chooses to hold positive net foreign assets amounting to almost 9% of output; if shock probability is 20% instead, optimal net foreign assets climb to more than 23% of output (panel (b)).[27]

### 3.3. Dynamic simulations

To better grasp the dynamics of our model we also run a number of simulations, where we track the evolution of the main variables of interest over a sequence of normal and shock years (using the model's optimised policy function for net foreign assets).

Figure 3 presents a 30-year scenario where the low-income country is faced with a terms-of-trade shock in year 4 and again in year 13; we assume there are no further shocks over the 17 years thereafter. When the economy is in a normal, non-shock state the value of output is randomly drawn from its discrete uniform distribution. In panel (a) of Figure 3 we study the dynamics of our model under benchmark calibration when the low-income country agent starts at the beginning of year 1 with net foreign assets equal to -10% of output, much below the steady-state optimum of 4%, possibly because of a series of severe negative shocks preceding year 1. Conversely, in panel (b) the net foreign assets starting position is 10% of output, significantly above the steady state. This could be interpreted as an economy that has just experienced positive windfalls in its export earnings.

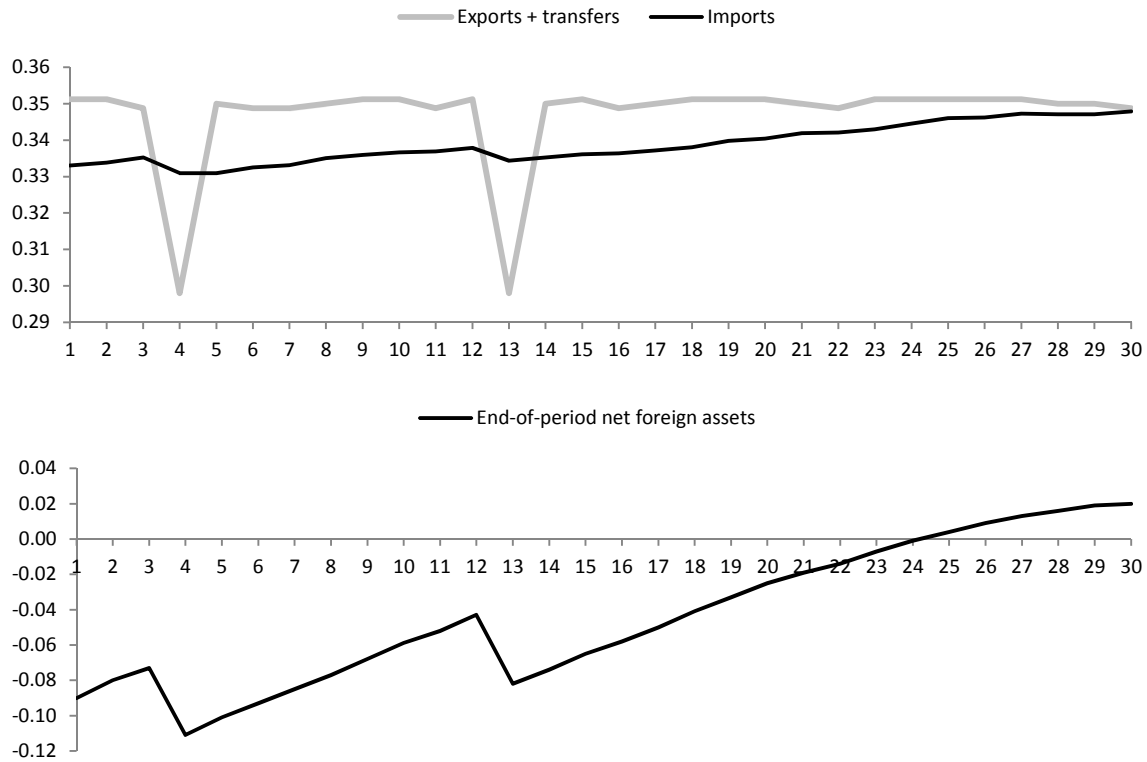
First of all, both panels of Figure 3 show that imports decline much less than the sum of exports and transfers when a terms-of-trade shock hits the country. A drawdown of net foreign assets allows the agent to keep her consumption of foreign goods during a shock close to normal-state levels. After a shock the country rebuilds its net foreign assets position. Next to the impact of large shocks, also the smaller output variations in the normal state influence how much is imported and how rapidly net foreign assets are accumulated every year.[28]

[27] One could introduce greater uncertainty into the baseline model by assuming whole distributions for the terms-of-trade and/or output impacts of shocks (possibly with extreme tails), rather than the fixed declines $1 - \eta_\varepsilon$ and $1 - \eta_Y$ that occur with probability $\pi^{ns}$. Solving such stochastic models is however relatively expensive in computer time. We leave this for future research.

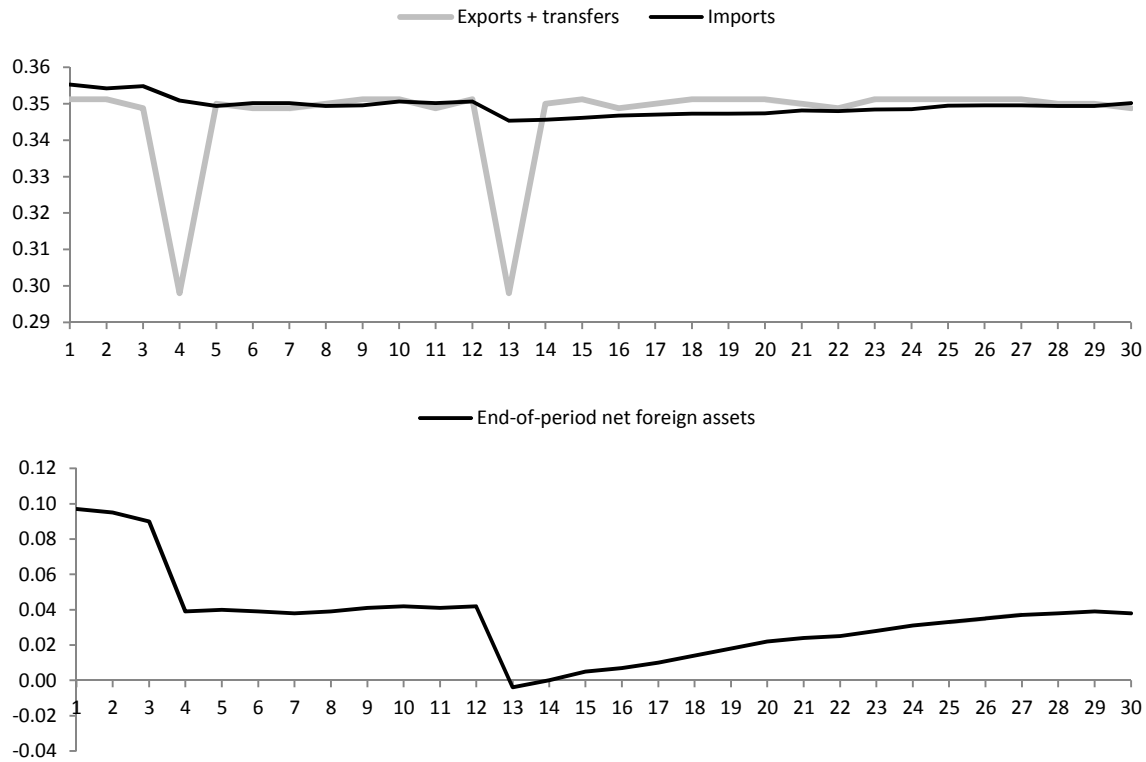
[28] This explains why the lines in Figure 3 are 'wavy' rather than straight. When output is above its expected level, net foreign assets accumulation is somewhat larger than it would otherwise have been (with the endowment at or below expectations).

*Figure 3. Time evolution of key variables (ratio to normal output): simulation of baseline model under benchmark calibration*

Panel (a): Initial net foreign assets position below steady-state level (-10%)




Panel (b): Initial net foreign assets position above steady-state level (10%)



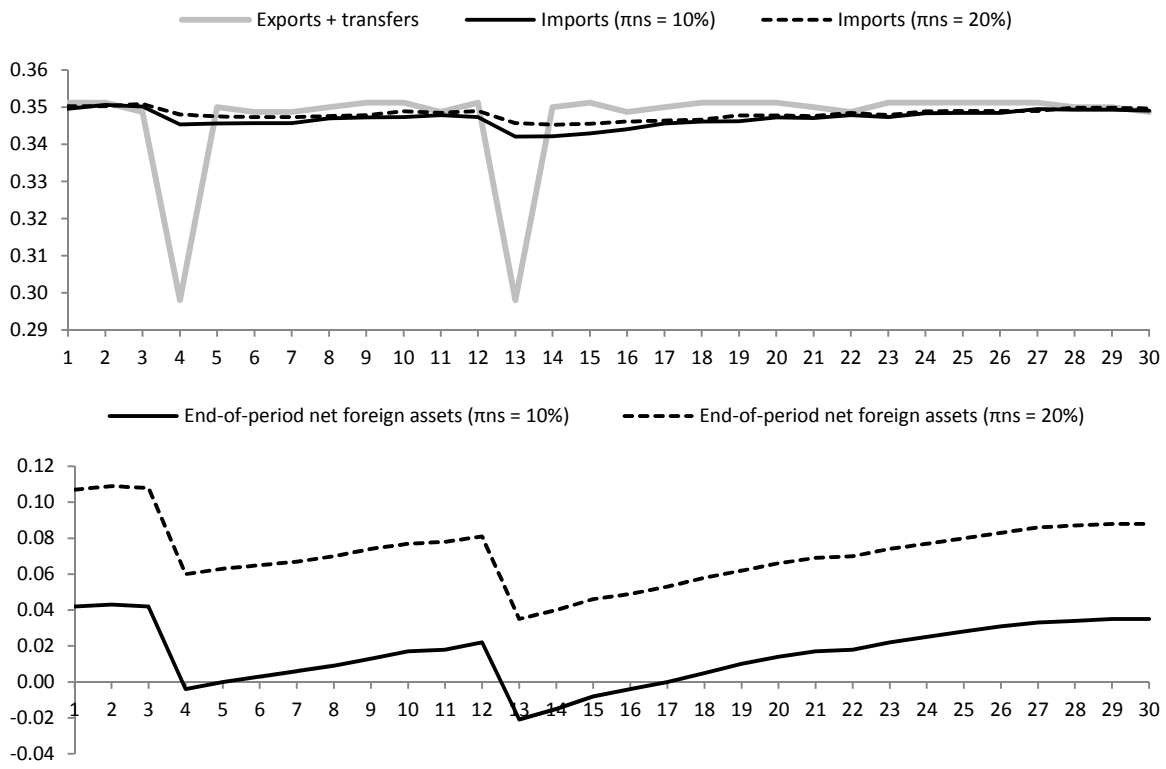
Moreover, comparing panels (a) and (b), we clearly see that net foreign assets accumulation and decumulation are influenced by where the agent finds herself relative to her steady state. In panel (a), net foreign assets accumulation during non-shock years is much faster, and decumulation in shock years more limited, as the agent aims to improve her net foreign assets position. This of course comes at the expense of lower foreign good consumption. Only after a long shock-free period the agent attains positive net foreign assets holdings and an import consumption that is close to exports plus transfers. Panel (b) indicates that when reserves are higher than warranted the agent will more eagerly draw on them to prop up imports. Between the two shocks the country's net foreign assets position remains almost flat, since it is close to the steady-state level of 4%. After the second shock, reserves are slowly rebuilt.

Figure 4 compares the benchmark calibration of the model (solid lines) to a calibration where shock probability is 20% instead of the benchmark 10% (dashed lines). For the dynamic simulations we let both models start from their respective steady-state levels of net foreign assets (4% vs. 10.5%). We do so to neutralise the influence of different starting positions vis-à-vis the steady state (cf. Figure 3) and to focus solely on the effect of shock parameters on model dynamics.

Like Barnichon (2009) we observe that the optimal reserves level in steady state is not necessarily a good proxy of the 'typical' net foreign assets position of the country over time, even when taking the steady state as the point of departure. Average reserves over the full 30-year period are 1.6% and 7.2% of normal output in the two models, significantly less than optimal steady-state levels. Even after 17 years without a shock, net foreign assets are still somewhat below their steady-state optima.

Comparison of the two models in Figure 4 shows that, relative to the benchmark, consumption smoothing is stronger in the higher-shock-probability model. Since under the second parameterisation the agent expects terms-of-trade shocks to occur more frequently, she is better prepared when shocks hit. The drawdown of net foreign assets is slightly larger under the second calibration, more so even at the time of the second shock (which follows the first shock earlier than anticipated by the agent of the first model but later than anticipated in the second model).

*Figure 4. Time evolution of key variables (ratio to normal output): simulation of baseline model under different calibrations*




## 4. Extended model: Contingent credit lines

### 4.1. Model set-up

We now formulate an extended version of the baseline model outlined in the previous sections. More specifically, we consider the presence of a contingent credit line mechanism that provides balance-of-payments support when the low-income country is hit by a terms-of-trade shock.

A recent IMF (2013a) survey indicates that a large majority of emerging market country authorities believes central bank swap lines and precautionary credit lines provided by the IMF (or other international financial institutions) to have reserves-like features. Indeed, at first sight, central bank swaps and IMF precautionary credit lines serve the same basic purpose as reserves (held for self-insurance), i.e., they constitute international liquidity which can be drawn upon in case of an unexpected capital or current account shock, at the discretion of the affected country. This is not to say that existing swaps or IMF credit lines are good substitutes for reserves.

During the global financial and economic crisis the US Federal Reserve was quick to make available temporary US dollar swap lines, mostly to other advanced country central banks but also to Brazil, Mexico, Korea and Singapore.[29] Aizenman and Pasricha (2010) and Aizenman *et al.* (2011), however, show that the provision of swap lines by large central banks is chiefly explained by strong

[29] Other major central banks operated similar programmes. For example, between December 2008 and March 2009 the People's Bank of China entered into RMB swap arrangements with Korea, Hong Kong, Malaysia, Belarus, Indonesia and Argentina.

trade and financial linkages (such as the exposure of US banks to particular emerging market countries). This selectivity means that access to swap lines cannot be counted on by most emerging market economies, let alone by low-income countries. Extending swap lines to a wider range of countries could moreover be seen as clashing with central banks' domestic mandates of price and financial stability, and would expose them to credit risk (IMF, 2013a). In addition, most of the swap arrangements (with emerging market countries) established during the crisis were later unwound, when global market stress subsided. Even for the select club of countries that benefited from swap lines in the wake of the Lehman bankruptcy, future access to such arrangements is far from secured. Regional reserves pooling and/or swaps, such as the Chiang Mai Initiative Multilateralization (CMIM) and the Latin American Reserve Fund (FLAR), possibly hold more potential as directly accessible emergency sources of foreign exchange for a greater number of countries in Asia and Latin America, but are currently still insufficiently developed or attractive to its members (cf. Chapter 2).

Ultimately, the IMF seems best-placed to provide contingent financing that fulfils similar functions to countries' own reserves, due to the organisation's global membership, mandate and experience, as well as its large capital base (Fischer, 1999; Cordella and Levy Yeyati, 2006). Traditionally, however, IMF balance-of-payments support has been far from purely shock-contingent, meaning automatic, certain and unconditional. Indeed, the exact size and terms of IMF financing are the outcome of negotiations between the authorities of the shock-affected country and IMF staff, and further subject to IMF Executive Board approval. Typical IMF support moreover comes with *ex post* conditionality that restricts countries in how they can use the obtained funds, by imposing a set of macroeconomic and (now less than before) structural policy reforms to be implemented during adjustment.[30]

In the wake of the global crisis the IMF has significantly overhauled its emergency lending toolkit. New instruments such as the Flexible Credit Line (FCL), Precautionary and Liquidity Line (PLL), Rapid Financing Instrument (RFI) and Rapid Credit Facility (RCF) bear closer resemblance to contingent financing than traditional IMF support (as we have argued in Chapter 2), primarily because of their switch from *ex post* conditionality towards pre-qualification criteria (i.e., *ex ante* conditionality). That said, even these revamped credit lines are only very imperfect substitutes for reserves. First, unlike self-accumulated reserves, availability of the above instruments is not permanent and certain. The assessment of whether a country is eligible for an upfront, precautionary credit line like the FCL (based on the pre-qualification criteria) needs to be renewed periodically and, similarly to all other IMF support, confirmed by the IMF's Executive Board. Second, access to these instruments is generally capped at a certain percentage of recipient countries' IMF quotas, whereas the stock of self-accumulated reserves has (theoretically) no limits. Third, there is the remaining conditionality attached to the instruments and, more generally, the stigma associated with requesting IMF financing.[31] Even when leaving aside its practice of periodic reviewing (and stigma problems), the FCL, which does not have strictly defined access limits and is free from *ex post* conditionality, can only be expected to substitute for reserves in the most established of emerging market countries. Essentially, its stringent *ex ante* qualification criteria preclude the access of others,

[30] The basic rationale for such *ex post* conditionality (in combination with tranched lending) has been to commit countries to undertake crisis resolution efforts that do not harm national or international welfare and to ensure repayment to the IMF (see Jeanne *et al.*, 2008).

[31] The stigma can be both political (linked to the *ex post* conditionality of IMF support, which is often considered 'intrusive') and economic (because a request for IMF financing signals that the country may be in serious trouble). See IMF (2014) for evidence suggesting problems of political stigma with the FCL and PLL.

low-income countries in particular. Of course, we acknowledge that, because of moral hazard among other concerns, it would not be feasible or desirable to abolish all (*ex ante*) conditionality from the IMF's contingent financing facilities.

In the end, it is highly unlikely that even if better-designed and more advantageous contingent credit lines (with minimal conditionality and large, longer-term access) would exist, they would fully displace countries' own reserves; not the least because of the role of non-precautionary motives in holding reserves (see Section 2). But perhaps they would help central banks redirect part of their reserves portfolio to longer-term and higher yielding assets, external or domestic (Fernández Arias and Levy Yeyati, 2012).

There are different ways in which the notion of contingent credit lines could be specified and incorporated in our terms-of-trade shock model. We limit ourselves here to a very stylised representation that makes abstraction of the issues surrounding conditionality, stigma and uncertainty of access we just discussed. Our principal aim is not to approach the actual contingent financing facilities of the IMF, but rather to formalise the intuitive substitution effects between self-insurance by reserves accumulation and an 'idealised' shock-contingent credit line mechanism.

Perhaps the most straightforward way to demonstrate the substitution is to assume a foreign exchange loan that is automatically disbursed to our low-income country agent if (and only if) she experiences a shock. This leads us to adapt the balance-of-payments constraint of the baseline model (Equation (1)) as follows:

$$c_{F,t} = \varepsilon_t \hat{c}_{F,t} - (1+g)R_{t+1} + (1+r_t)R_t + T + L_t - s\frac{1+x}{1+g}L_{t-1} - (1-s)\left(\frac{1+x}{1+g}\right)^2 L_{t-2} \qquad (7)$$

where $L_t$ is the shock-contingent loan scaled to normal output; $0 \leq s \leq 1$ is the share of the loan that needs to be repaid in the period following the shock; and $x$ is the fixed one-period interest rate on the loan. To keep notation simple and short, we adopt a loan that is repaid over two periods at the maximum. Repayment can however be easily modelled to run over longer periods (see Section 4.3). We further assume that the contingent loan covers a fixed proportion of the balance-of-payments impact of the shock:

$$L_t = \lambda_t\left(\varepsilon^n \delta - \varepsilon_t \hat{c}_{F,t}\right) = \lambda_t \delta(\varepsilon^n - \varepsilon_t y_t) \qquad (8)$$

where the term between the first parentheses is the (output-scaled) difference between expected normal-state exports and actual export earnings, or in other words, the foreign exchange shortfall caused by the deviation of exports from their expected level; and $0 \leq \lambda_t \leq 1$ is the proportion of this foreign exchange loss covered by the loan. To further simplify, we impose that $\lambda_t = \lambda$ when a shock hits at time $t$ and $\lambda_t = 0$ otherwise. Hence, we do not allow for the mild fluctuations in normal (non-shock) output to be covered by the contingent credit line mechanism (again, an assumption which can be easily relaxed). The modifications to our original balance-of-payments constraint give rise to a new, slightly adapted optimisation problem:

$$V(R_t) = max_{R_{t+1}} \{u(c_{H,t}, c_{F,t}) + E_t \beta V(R_{t+1})\}$$

$$s.t. \begin{cases} c_{F,t} = \varepsilon_t \, \delta y_t - (1+g)R_{t+1} + (1+r_t)R_t + T + \lambda_t \delta(\varepsilon^n - \varepsilon_t y_t) \\ - s\frac{1+x}{1+g}\lambda_{t-1}\delta(\varepsilon^n - \varepsilon_{t-1}y_{t-1}) - (1-s)\left(\frac{1+x}{1+g}\right)^2 \lambda_{t-2}\delta(\varepsilon^n - \varepsilon_{t-2}y_{t-2}) \\ c_{H,t} = (1-\delta)y_t \\ y_t = y_t^n - (y_t^n - \eta_Y)I_s \\ y_t^n \sim unif(1-\mu, 1+\mu) \\ \lambda_t = \lambda I_s \\ r_t = r_L \; if \; R_t \geq 0 \\ r_t = r_H \; if \; R_t < 0 \\ c_{H,t} \geq \underline{c}_H; \; c_{F,t} \geq \underline{c}_F \end{cases} \tag{9}$$

**4.2. Numerical calibration and comparative statics**

The extended model can be solved using the same value function iteration techniques as those applied to the baseline model. The codes can be found in Boxes A.3 and A.4 in Appendix. From the new balance-of-payments constraint (Equation 7) we can see that the control variable $R_{t+1}$ no longer only depends on whether or not a shock occurs at time *t* but also on the state of the economy at times *t*-1 and *t*-2, as previous-period shocks determine current repayments of earlier-disbursed loans. It is still possible, however, to frame this as a simple Markov process with time-invariant transition probabilities. One can think of the agent as finding herself in one of eight possible 'scenarios', at every point in time:

1) no shock at time *t*, no shock at time *t*-1, no shock at time *t*-2;
2) no shock at time *t*, no shock at time *t*-1, shock at time *t*-2;
3) no shock at time *t*, shock at time *t*-1, no shock at time *t*-2;
4) no shock at time *t*, shock at time *t*-1, shock at time *t*-2;
5) shock at time *t*, no shock at time *t*-1, no shock at time *t*-2;
6) shock at time *t*, no shock at time *t*-1, shock at time *t*-2;
7) shock at time *t*, shock at time *t*-1, no shock at time *t*-2;
8) shock at time *t*, shock at time *t*-1, shock at time *t*-2.

This basic insight allows us to construct a new eight-by-eight Markov transition matrix, replacing the two-by-two matrix of the baseline model:

$$\pi = \begin{bmatrix} 1-\pi^{ns} & 0 & 0 & 0 & \pi^{ns} & 0 & 0 & 0 \\ 1-\pi^{ns} & 0 & 0 & 0 & \pi^{ns} & 0 & 0 & 0 \\ 0 & 1-\pi^{ns} & 0 & 0 & 0 & \pi^{ns} & 0 & 0 \\ 0 & 1-\pi^{ns} & 0 & 0 & 0 & \pi^{ns} & 0 & 0 \\ 0 & 0 & \pi^{sn} & 0 & 0 & 0 & 1-\pi^{sn} & 0 \\ 0 & 0 & \pi^{sn} & 0 & 0 & 0 & 1-\pi^{sn} & 0 \\ 0 & 0 & 0 & \pi^{sn} & 0 & 0 & 0 & 1-\pi^{sn} \\ 0 & 0 & 0 & \pi^{sn} & 0 & 0 & 0 & 1-\pi^{sn} \end{bmatrix} \tag{10}$$

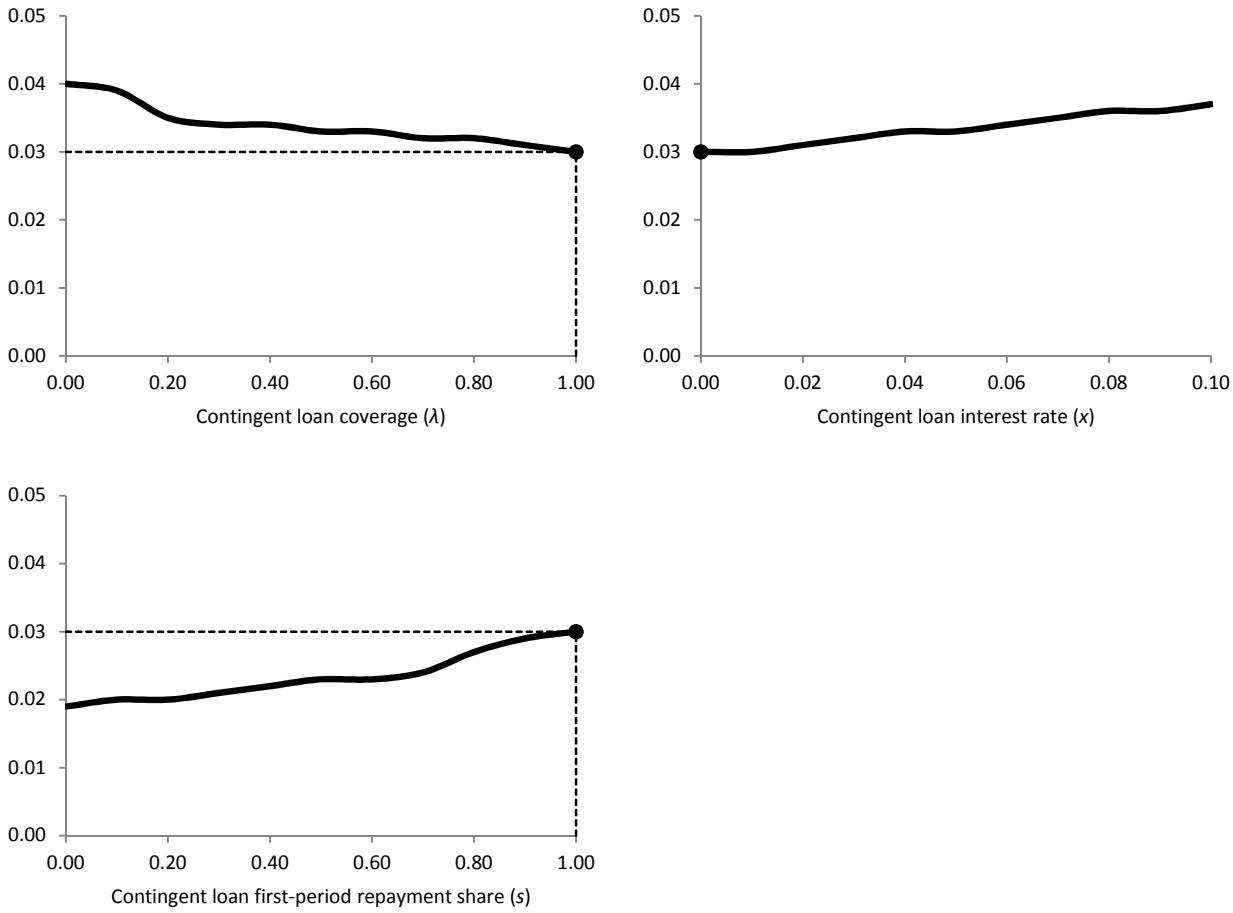
where the zeros correspond with transitions that are logically impossible. For example, we can exclude the possibility that the agent moves from scenario 1 to scenario 2, as 'no shock at time *t*-1' in one period cannot be followed by 'shock at time *t*-2' in the next period.[32]

Using the same benchmark calibration as in Section 3.2 (Table 1) and assuming in addition that the contingent loan provides full coverage ($\lambda$ = 1) and is to be repaid entirely in the period following the shock ($s$ = 1) at zero interest ($x$ = 0), the steady-state optimum of the extended model yields net foreign assets of 3% of output, or just over one month of import. We find that the low-income country agent again decides to hold some reserves, but less so than in the baseline model without the contingent credit line mechanism. As expected, there is (partial) substitution between self-insurance through net foreign assets accumulation and a perfectly automatic, shock-contingent loan as modelled here. As we make abstraction of issues like conditionality, the difference in optimal net foreign assets between the baseline and extended model is driven by the implied interest rate subsidy on borrowing in the latter (here: zero interest on the contingent loan vs. 10% interest rate on negative net foreign assets) and distinct repayment modalities (here: proportional contingent loans that are to be repaid over two periods vs. a net foreign assets position that the agent can adapt as she wishes, within certain boundaries). In the dynamic simulations of the next section it is shown more clearly that in the extended set-up the agent uses the remaining reserves not to counter the impact of shocks directly (as this is fully absorbed by the contingent loan), but rather to pay back the loan when it becomes due.

In Figure 5 we test the sensitivity of our solution for the extended model to changes in the three additional parameters we have introduced, again keeping all other parameters at their benchmark values. We find that optimal net foreign assets decrease with greater contingent loan coverage of the balance-of-payments impact of shocks, with lower interest rates on the loan, and when the share of the loan to be repaid in the first period after the shock declines. When coverage is zero, the optimal steady-state level of reserves reverts back to 4% of output, as the model collapses to the baseline model. As evident from Figure 5, the changes to optimal net foreign assets are relatively small, especially when compared with the sensitivity analysis presented in Figure 2. This is however partly due to our limiting of the loan repayment to maximum two periods. The longer the repayment is postponed, the lower optimal net foreign assets will be. In principle, one could also model the contingent support as a (partial) grant by setting the interest rate $x$ below zero. For example, a model with full coverage where only three quarters of the contingent loan is to be repaid in the first post-shock period ($\lambda$ = 1; $x$ = -0.25; $s$ = 1) yields optimal steady-state reserves of just 1.2% of output.

[32] This approach can be generalised to models with more than two repayment periods. The total number of possible scenarios (and row/column dimensions of the associated Markov transition matrix) is given by $2^{n+1}$, where $n$ is the number of repayment periods.

*Figure 5. Optimal net foreign assets (ratio to normal output): comparative statics of extended model*




Note: Dots indicate benchmark calibration of the extended model.

### 4.3. Dynamic simulations

In this section we present two more dynamic model comparisons. As in Section 3.3 we simulate a 30-year scenario where the low-income country is hit by terms-of-trade shocks in years 4 and 13 and not anymore thereafter. First, we compare the baseline model, where no contingent credit line mechanism operates (solid lines), with an extended model where there is full coverage of the balance-of-payments impact of shocks by interest-free loans that require repayment in the next period (dashed lines). Both models are calibrated using our benchmark parameters and start from their respective steady states at the beginning of year 1.

Figure 6 indicates that consumption smoothing is similarly strong in both models but timed slightly differently. This becomes clearer when we inspect net foreign assets use. In the second model the agent continues to build her reserves when the shock occurs as she anticipates the drawdown in the post-shock period, necessary to repay the contingent loan. The absence of a contingent credit line in the first model implies that net foreign assets re-accumulation after a drawdown is marginally faster.

*Figure 6. Time evolution of key variables (ratio to normal output): simulation of baseline vs. extended model under benchmark calibration*

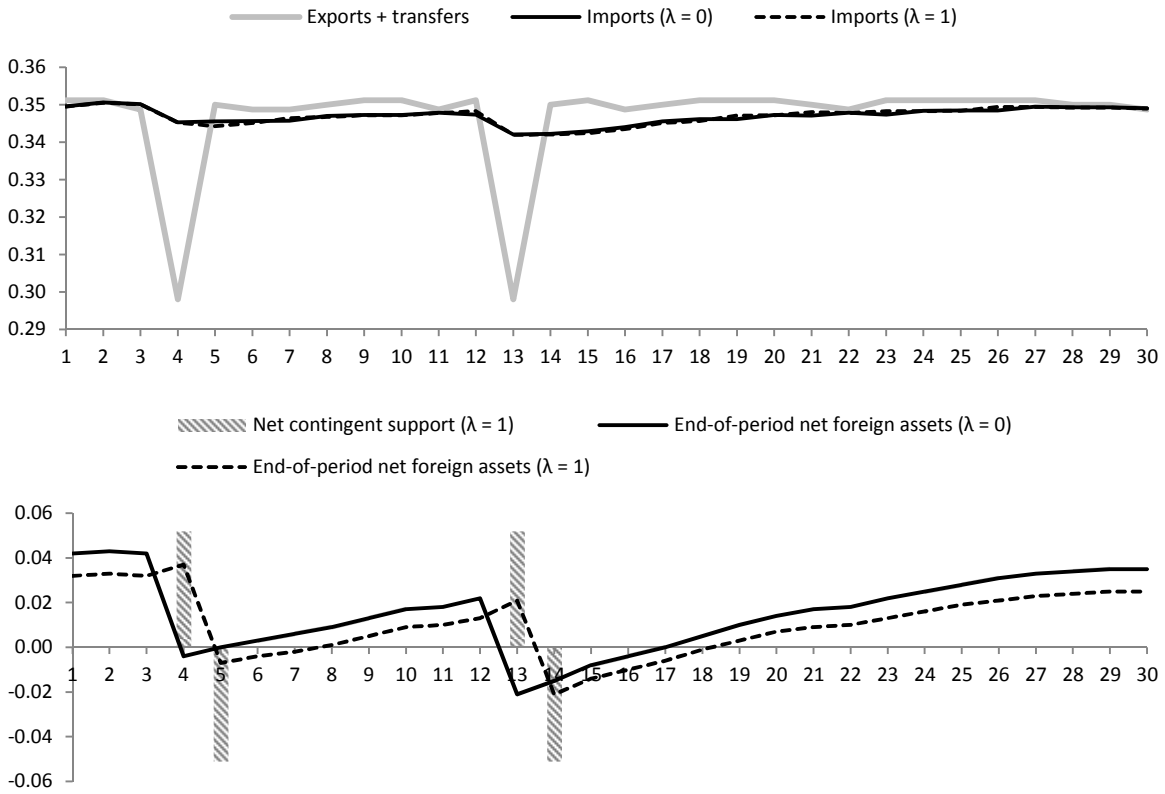
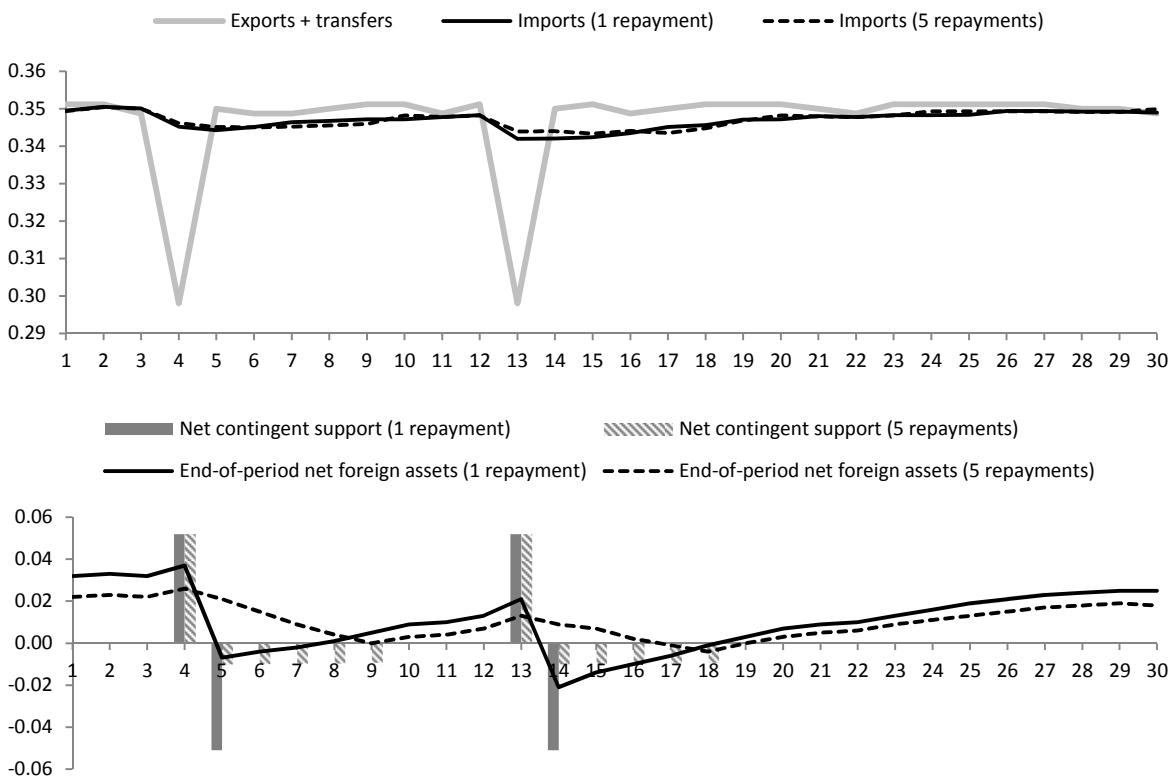



Figure 7 makes another dynamic comparison, between a full-coverage contingent loan model with a single repayment period (solid lines) and one where the loan needs to be repaid over five years, in equal instalments (dashed lines). Clearly, consumption smoothing is stronger in the second model. When the contingent loan can be repaid over five periods, the decumulation of net foreign assets (which starts in the first period after the shock in both models) is much more gradual and overall smaller in size. After the first shock, in the one-repayment-period model the agent during year 5 draws down her reserves of 3.7% of output to market borrowing of 0.7%, which makes for a total decline in net foreign assets of 4.4 percentage points. The cumulative use of net foreign assets amounts to only 2.6 percentage points over five years in the second model, from reserves of 2.6% at the start of year 5 to zero net foreign assets at the end of year 9.

*Figure 7. Time evolution of key variables (ratio to normal output): simulation of extended model under different calibrations*




## 5. Concluding remarks

Whereas various motivations and factors may explain international reserves accumulation by developing countries, self-insurance against different sorts of shocks has always been a key driver (and, arguably, will continue to be so in the foreseeable future). This paper has studied the self-insurance motive in low-income countries more particularly. We have observed that the typical external shocks experienced by such countries, such as terms-of-trade or external demand shocks, do not yet occupy an important place in the growing theoretical literature on optimal reserves; unlike the sudden stops in capital inflows that many emerging market economies are faced with. One notable exception is the framework of Barnichon (2009), which explicitly models current account shocks in a dynamic, low-income country context.

The paper has built upon this representative agent, small open economy model in two ways. First of all, in our baseline model we have relaxed Barnichon's assumption that the country is always a net saver, by allowing for the possibility of negative net foreign assets positions, i.e. market borrowing, at interest rates higher than those that apply to positive net foreign assets, i.e., reserves. We have also deviated from Barnichon's practice of modelling the opportunity costs of reserves as having real direct budgetary implications, and have instead introduced implicit opportunity costs that derive from differences between the agent's (im)patience to consume and the remuneration of reserves. Numerical calibration of our baseline model with historical terms-of-trade shock data for low-income countries has indicated that, under most parameterisations, a utility-maximising agent with rational expectations still decides to hold a positive level of net foreign assets in steady state.

Largely because the agent in our model has the possibility to take her net foreign assets position into negative territory if needed (subject to a certain borrowing limit and at high cost), the optimal net foreign assets levels we find are below similar calibrations for the ever-saving low-income countries in Barnichon (2009). That said, if we assume sufficiently low subsistence levels of imports in the agent's Stone-Geary preferences, making extreme risk aversion less likely, optimal net foreign assets are reduced to zero. Low interest rates on market borrowing could even give rise to a *negative* optimal net foreign assets position in steady state, although such an assumption may not be appropriate for low-income countries.

Sensitivity tests on the baseline model have corroborated that optimal reserves are a positive function of the probability, duration and severity of shocks, and of the interest benefits (costs) of positive (negative) net foreign assets. This is, of course, conform with reserves being an instrument of insurance, of which one should hold more when downside risks are greater and when it is cheaper to do so.

In second instance, we have tried to further our understanding of reserves' interaction with alternative insurance-like instruments by incorporating into our Barnichon-inspired baseline model the notion of a contingent credit line mechanism. To the best of our knowledge, previous modelling of optimal reserves, including for emerging market countries, has not considered such interactions. More specifically, we have assumed automatic, shock-contingent loans with a subsidised interest rate, disbursed to the country when (and only when) a terms-of-trade shock hits and proportional in size to the balance-of-payments impact of the shock. We believe this second model extension, while highly stylised, is helpful in formalising the intuitive substitution between self-insurance by means of reserves accumulation and (an idealised form of) contingent support by an organisation like the IMF. The presence of contingent credit lines indeed lowers steady-state optimal reserves. Again in line with our priors, the reduction in optimal reserves increases when contingent loans are more advantageous to the agent, i.e., when they cover a larger share of shocks' impact on the balance of payments, carry lower interest rates, or are to be repaid over longer periods. Dynamic simulations have revealed that, with full shock impact coverage by the contingent credit line mechanism, the agent uses her remaining reserves only indirectly, to pay back the contingent loans when they become due.

There are several ways in which the ideas developed in the current paper could be further extended. First, follow-up work should investigate and compare the welfare implications of different models, i.e., with or without particular contingent credit line arrangements.[33] Second, low-income countries' asymmetric access to international capital markets could perhaps be modelled in a less rudimentary way, for example by limiting the roll-over of negative net foreign assets in the aftermath of a shock, by endogenising interest rates, and/or by modelling gross foreign assets and liabilities (reserves and external debt) as separate choice variables (cf. Alfaro and Kanczuk, 2009; Espinoza, 2014). Third, we may bring our simple contingent loan mechanism closer to reality by assuming more

[33] Most of the related literature seems to adopt a consumption-equivalence approach to welfare analysis, in the tradition of Lucas (1987). The welfare cost of macroeconomic fluctuations is thereby calculated as the percentage increase in consumption, across all dates and possible states, required to leave the representative agent indifferent between a certain level of consumption volatility and a perfectly smooth consumption path. In a simple model calibrated using US data, Lucas (1987) finds the welfare cost of consumption volatility to be extremely small. These conclusions however very much hinge on the choice of preferences and the underlying model economy (see e.g., Obstfeld, 1994; van Wincoop, 1994). Pallage and Robe (2003) simulate welfare costs of consumption fluctuations for a sample of developing countries (in various model settings) and estimate such costs to be large multiples of those in the US.

active roles for its provider (the IMF), which attempts to avoid moral hazard and ensure repayment by attaching *ex ante* and/or *ex post* conditionality to its support (de Resende, 2007; Jeanne *et al.*, 2008); and for the beneficiary country, which dislikes these conditions and may choose to opt out of the mechanism. Indeed, it would be interesting to try to capture the impression that, for some countries, reserves may not only provide self-insurance against shocks but also insurance against having to turn to the IMF for support (Wyplosz, 2007). Fourth, comparing simulated optimal reserves with actual reserves levels of individual low-income countries may be helpful in better understanding which dimensions are, as of now, not adequately captured by our and other theoretical models.

Certainly, any optimisation model, no matter how sophisticated it would be made, will have important drawbacks. Our own and others' sensitivity analyses and dynamic simulations have shown that steady-state model solutions need to be interpreted cautiously. Model solutions are very sensitive to alternative parameterisations (including some difficult-to-measure parameters like the subjective discount factor or risk aversion). Moreover, optimal reserves are a dynamic concept, influenced by countries' shock history as well as their expectations about the future, that cannot be easily summarised in a single number. Representative agent models will also never be able to account for all aspects of the economic structure of individual countries. And, especially in low-income countries, data availability and data quality may be an issue for country-specific calibration exercises (Drummond *et al.*, 2009; Tereanu, 2010). But because of their flexibility and stronger theoretical foundations, we believe optimisation models are a welcome complement to simple, one-size-fits-all rules of thumb for reserves adequacy that are still dominant in policymaking.

## Appendices

Boxes A.1-A.4 present the Matlab codes used to solve numerically, under the benchmark calibration, the baseline and extended model discussed in the main text.

As can be seen from Box A.1, we start by defining all model parameters (cf. Table 1), including Markov transition matrix $\pi$ (lines 24-25) and a matrix $\omega$ for the equally likely transitions between normal (non-shock) substates (lines 26-28). The normalised output matrix indicates that when there is no shock, output can take one of three values from a uniform distribution, and that output loss is always 1% in case of a shock (lines 29-30; cf. Section 3.2). Subsistence imports are modelled as a fixed 80% of normal imports in steady state; the latter can be approximated by $\delta + T$ if one makes abstraction of the interest benefits/costs of net foreign assets and trend growth, which are of second-order magnitude (line 36; cf. first constraint in Equation (6)). The discretised grid over which the optimisation is performed takes the form of a column vector ranging from -15% to 15% and a 0.1 percentage point distance between vector elements (lines 39-43). Before starting the actual value function iteration, we check whether the particular parameterisation of the model satisfies the subsistence foreign good consumption constraint for the whole grid and, if not, display a warning message. As explained in Section 3.2 (footnote 20), it is necessary and sufficient to evaluate the subsistence constraint in the shock state and with both current and next-period net foreign assets at the minimum level $R_{min}$ (i.e., the lower boundary of the grid) (lines 46-49). If parameterisation passes this test (as it does under our benchmark and sensitivity calibrations), above-subsistence imports are guaranteed at all times and in all possible states of the model.

The optimisation methodology used is recursive in nature and relies on solving the problem backwards, from the future to the present (in analogy with Bellman's principle). The value function iteration algorithm (lines 52-68) begins with an initial guess of the value function $V_0 = 0$ (a matrix of zeros) and a stopping criterion of $\varphi = 10^{-5}$. We have verified that other starting values and a smaller stopping criterion yield the exact same results. Each iteration returns updated value and policy functions ($V_1$ and $R_{next}$ in the code, respectively), based on an optimisation of the functional (Bellman) equation (i.e., Equation (6)) and given our previous best guess of the value function (see further for optimisation algorithm). The new value function $V_1$ obtained from one iteration replaces the old value function $V_0$ in the next. Since the dynamic optimisation problem is formulated over an infinite horizon, the iteration procedure continues until changes in the value functions obtained in two subsequent iterations are negligibly small, more precisely until the maximum absolute difference between the elements of the old and new value function matrices (the so-called 'sup norm') is smaller than $\varphi$; with a maximum of 1000 iterations. Once the value function has converged we use the latest policy function $R_{next}$, which gives the optimal next-period net foreign assets position for each possible current level of net foreign assets and in each possible (sub)state, to find and report the numerical steady-state solution to the model when the agent currently finds herself in the expected normal, non-shock state (lines 71-76). We thereby define the steady state as a situation where the optimal level of next-period net foreign assets equals current net foreign assets.

*Box A.1. Code for benchmark parameterisation and value function iteration in baseline model*

```
%%%%%%%%%%%%%%%%%%
% BASELINE MODEL %
%%%%%%%%%%%%%%%%%%

% asymmetric interest rate (high on negative NFAs, low on positive NFAs)
% normal output has uniform distribution with expected value of 1
% no contingent loans

close all
clear all

tic % start timer

% globals
global beta sigma gamma delta theta T pi omega y g e rl rh cf_ ch_ n m1 m2

% model parameters
beta=0.95; % subjective discount factor
sigma=1/5; % intertemporal elasticity of substitution
gamma=0.3; % elasticity of substitution between home and foreign goods
delta=0.25; % exports-to-output ratio
theta=1-delta; % preference for home goods
T=0.1; % transfers-to-output ratio
pi=[0.9 0.1;
    1   0 ]; % transition matrix between normal and shock states
omega=[1/3 1/3 1/3;
       1/3 1/3 1/3;
       1/3 1/3 1/3]; % transition matrix between normal substates
y=[0.995 1    1.005;
   0.99  0.99 0.99]; % output in normal and shock (sub)states
[m1,m2]=size(y); % dimensions of output matrix
g=0.02; % output trend growth rate
e=[1 0.8]; % terms of trade in normal and shock states
rl=0.03; % low interest rate on positive NFAs
rh=0.10; % high interest rate on negative NFAs
cf_=0.8*(delta+T); ch_=0; % subsistence consumption-to-output ratios

% grid for NFAs
step=0.001; % density of grid
Rmin=-0.15; % minimum NFAs-to-output ratio
Rmax=0.15; % maximum NFAs-to-output ratio
R=(Rmin:step:Rmax)'; % NFAs-to-output range (column vector)
n=length(R); % grid size

% check whether parameterisation is feasible
if e(2)*delta*y(2,1)-(1+g)*Rmin+(1+rh)*Rmin+T<cf_
   disp('WARNING: parameterisation implies below-subsistence foreign good
   consumption')
end

% VALUE FUNCTION ITERATION
v0=zeros(n,m1,m2); % initial guess for value function
phi=0.00001; % stopping criterion
i=1;
while i>=1
      disp(i) % display iteration number
```

```
57        [v1,Rnext]=function_base(v0,R); % summon file that performs
58  optimisation and returns new value function and NFA policy function
59        if max(abs(v1-v0))<=phi
60           break % stop iteration when difference between old and new value
61  function is smaller than or equal to stopping criterion
62        end
63        v0=v1; % make new value function old value function in next iteration
64        i=i+1;
65        if i>1000
66           break % maximum of 1000 iterations
67        end
68  end
69
70  % find numerical solution
71  Rstar_loc=find(Rnext(:,1,2)==R,1); % find earliest grid location where
72  next-period NFAs equal current NFAs in expected normal state
73  Rstar=R(Rstar_loc); % retrieve optimal NFAs-to-output ratio from location
74
75  % report numerical solution
76  disp(horzcat('Optimal NFAs-to-output ratio:  ',num2str(Rstar)));
77
78  toc % stop timer
```

The optimisation algorithm itself, embedded as 'function_base' in the value function iteration (line 57), is further specified in Box A.2.

Each single iteration runs through a quadruple loop. Starting from the inner loop (lines 21-35), we calculate for each possible choice of next-period net foreign assets a new value, stored in temporary value function matrix $V_{tmp}$, that is constructed as the sum of current utility (based on the period utility function of Equation (5)) and the discounted expected old value function (where expectations are derived from the matrices $\pi$ and $\omega$ of transition probabilities between normal and shock states and between normal substates). The maximum out of these values is saved in the new value function matrix $V_1$, and the associated optimal next-period net foreign assets position in the policy function matrix $R_{\text{next}}$. This procedure is repeated by looping over each possible level of current net foreign assets, thereby taking into account whether net foreign assets are positive or negative (lines 15-44); over each possible normal substate (lines 13-45); and over each possible state, i.e., normal or shock (lines 12-46). The results of such integrated loops are fully specified and updated value and policy functions, $V_1$ and $R_{next}$ (lines 36-38). As indicated above in our discussion of the value function iteration algorithm, $V_1$ is then compared to $V_0$ and, if still significantly different, used as an update for $V_0$ in the next iteration (which again involves the just-described quadruple loop). In other words, the present (represented by optimised value function $V_1$) becomes the future (value function $V_0$) as one moves back in time.

In each iteration and for all admissible current-period net foreign assets positions and all states, we can test whether the consumption levels of foreign goods implied by the optimised policy function are indeed above subsistence (lines 39-43). Such tests are however superfluous (and for this reason have been commented out in the code) in the presence of the earlier-described parameterisation check (Box A.1, lines 46-49).

*Box A.2. Code for optimisation of functional equation in baseline model*

```
1   function [v1,Rnext]=function_base(v0,R)
2
3   % globals
4   global beta sigma gamma delta theta T pi omega y g e rl rh cf_ ch_ n m1 m2
5
6   % create empty matrices
7   vtmp=NaN(n,n,m1,m2); % temporary value function
8   v1=NaN(n,m1,m2); % new value function
9   Rnext=NaN(n,m1,m2); % policy function
10
11  % OPTIMISATION ALGORITHM
12  for k=1:m1 % for each state (normal/shock)
13      for p=1:m2 % for each normal substate
14          ch=(1-delta)*y(k,p); % calculate home good consumption
15          for i=1:n % for each possible NFA level in current period
16              if R(i)<0 % check sign of NFAs
17                 r=rh; % high interest on negative NFAs
18              else
19                 r=rl; % low interest on positive NFAs
20              end
21              for j=1:n % for each possible NFA level in next period
22                  cf=e(k)*delta*y(k,p)-(1+g)*R(j)+(1+r)*R(i)+T; % calculate
23  foreign good consumption
24                  if cf>cf_ && ch>ch_ % check subsistence constraints
25                     u=sigma/(sigma-1)...
26                     *(theta^(1/gamma)*(ch-ch_)^(1-1/gamma)...
27                     +(1-theta)^(1/gamma)*(cf-cf_)^(1-1/gamma))...
28                     ^((1-1/sigma)/(1-1/gamma)); % calculate utility
29                     vtmp(i,j,k,p)=u+beta...
30                     *(pi(k,1)*(omega(p,1)*v0(j,1,1)+omega(p,2)*v0(j,1,2)...
31                     +omega(p,3)*v0(j,1,3))...
32                     +pi(k,2)*v0(j,2,1)); % calculate new (temporary) value
33  function based on utility and old value function
34                  end
35              end
36              [v1(i,k,p),loc]=max(vtmp(i,:,k,p)); % retain maximum value and
37  locate corresponding next-period NFAs
38              Rnext(i,k,p)=R(loc); % construct policy function
39  %           cfopt=e(k)*delta*y(k,p)-(1+g)*Rnext(i,k,p)+(1+r)*R(i)+T;
40  %           if cfopt<cf_
41  %              disp('WARNING: optimal foreign good consumption below
42  %              subsistence')
43  %           end
44          end
45      end
46  end
```

We have used the same value function iteration techniques to solve our extended model, which incorporates a contingent credit line mechanism. Boxes A.3 and A.4 show that our codes are overall very similar to those of the baseline model. In what follows we highlight a few alterations and extensions that may require further explanation.

The most important difference between Box A.1 and Box A.3 is the greater matrix dimension of a number of key variables in the latter. In the main text we explain how a model with a maximum of two contingent loan repayment periods can be approached in the same way as the baseline model, but with eight possible non-shock/shock 'scenarios' rather than just two (lines 10-18). The

increase in scenarios is due to the fact that in the extended model, optimal next-period net foreign assets depend on the occurrence of a shock in the current period as well as in the two periods before (cf. Equation (7)). As a result, the Markov transition matrix $\pi$ becomes an eight-by-eight matrix (lines 35-42; cf. Equation (10)). The dimensions of the current-period output and terms-of-trade matrices also increase (lines 47-54, 76). In addition, if we want to keep the recursive methodology we applied earlier (which involves moving, in an iterative manner, from future to present), we need to define one- and two-period lagged variables that do not feature in the baseline model: lagged output (lines 56-72), lagged terms of trade (lines 78-80), and coverage of the shock impact by current and lagged contingent loans (lines 85-89). One can observe that the way in which current and lagged variable matrices are defined reflects the different scenarios. For example, the third rows of the different output matrices correspond to what happens to current and lagged output under the third scenario, i.e., no shock in the current period, a shock in the previous period, and no shock two periods ago. The same goes for the terms-of-trade and coverage vectors. As before, the columns of the output matrices represent the different uniformly distributed output substates in the absence of a shock.

To guarantee above-subsistence foreign good consumption at all times and in all possible states of the model, again a parameterisation test is performed before the actual iteration procedure. We now evaluate if the subsistence constraint is satisfied under scenario eight (i.e., the worst possible scenario, with three consecutive shocks), once more with both current and next-period net foreign assets at their lowest possible level, $R_{min}$ (lines 102-108). Like in the baseline model, if parameterisation is deemed feasible according to this test, below-subsistence imports will be avoided and loop-specific checks can be skipped (cf. Box A.4, lines 50-58).

The only real change in Box A.4 compared to Box A.2 lies in the more complex formula for the calculation of the updated value function, because of the need to take into account the more extensive set of possible future scenarios (lines 33-45).

*Box A.3. Code for benchmark parameterisation and value function iteration in extended model*

```
1   %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
2   % CONTINGENT CREDIT LINE MODEL %
3   %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
4
5   % asymmetric interest rate (high on negative NFAs, low on positive NFAs)
6   % normal output has uniform distribution with expected value of 1
7   % contingent loan upon occurrence of shock, repayable after maximum two
8   periods
9
10  % 8 possible 'scenarios', i.e., no shock/shock sequences:
11  % no shock t + no shock t-1 + no shock t-2
12  % no shock t + no shock t-1 + shock t-2
13  % no shock t + shock t-1 + no shock t-2
14  % no shock t + shock t-1 + shock t-2
15  % shock t + no shock t-1 + no shock t-2
16  % shock t + no shock t-1 + shock t-2
17  % shock t + shock t-1 + no shock t-2
18  % shock t + shock t-1 + shock t-2
19
20  close all
21  clear all
22
23  tic
```

```
% globals
global beta sigma gamma delta theta T pi omega y y_b y_bb g e e_b e_bb...
rl rh cf_ ch_ lambda lambda_b lambda_bb x s n m1 m2

% model parameters
beta=0.95;
sigma=1/5;
gamma=0.3;
delta=0.25;
theta=1-delta;
T=0.10;
pi=[0.9 0   0  0  0.1 0   0  0;
    0.9 0   0  0  0.1 0   0  0;
    0   0.9 0  0  0   0.1 0  0;
    0   0.9 0  0  0   0.1 0  0;
    0   0   1  0  0   0   0  0;
    0   0   1  0  0   0   0  0;
    0   0   0  1  0   0   0  0;
    0   0   0  1  0   0   0  0]; % 8*8 transition matrix between 2^3
possible 'scenarios'
omega=[1/3 1/3 1/3;
       1/3 1/3 1/3;
       1/3 1/3 1/3];
y=[0.995 1    1.005;
   0.995 1    1.005;
   0.995 1    1.005;
   0.995 1    1.005;
   0.99  0.99 0.99;
   0.99  0.99 0.99;
   0.99  0.99 0.99;
   0.99  0.99 0.99]; % current output for different 'scenarios' and
substates
y_b=[0.995 1    1.005;
     0.995 1    1.005;
     0.99  0.99 0.99;
     0.99  0.99 0.99;
     0.995 1    1.005;
     0.995 1    1.005;
     0.99  0.99 0.99;
     0.99  0.99 0.99]; % one-period lagged output for different 'scenarios'
and substates
y_bb=[0.995 1    1.005;
      0.99  0.99 0.99;
      0.995 1    1.005;
      0.99  0.99 0.99;
      0.995 1    1.005;
      0.99  0.99 0.99;
      0.995 1    1.005;
      0.99  0.99 0.99]; % two-period lagged output for different
'scenarios' and substates
[m1,m2]=size(y);
g=0.02;
e=[1 1 1 1 0.8 0.8 0.8 0.8]; % current terms of trade for different
'scenarios'
e_b=[1 1 0.8 0.8 1 1 0.8 0.8]; % one-period lagged terms of trade for
different 'scenarios'
e_bb=[1 0.8 1 0.8 1 0.8 1 0.8]; % two-period lagged terms of trade for
different 'scenarios'
rl=0.03;
rh=0.10;
cf_=0.8*(delta+T); ch_=0;
```

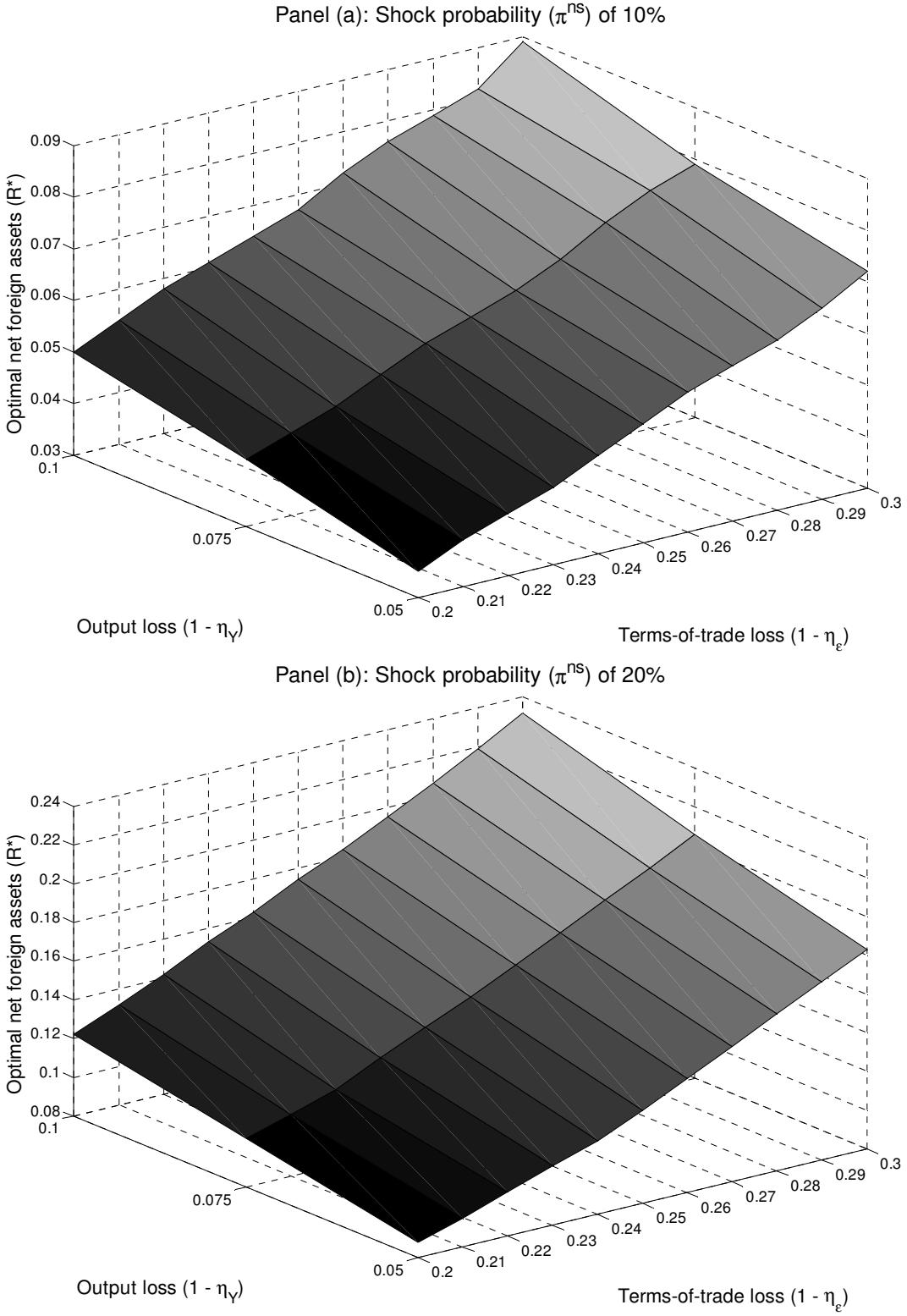
```
lambda=[0 0 0 0 1 1 1 1]; % coverage by current contingent loan for
different 'scenarios'
lambda_b=[0 0 1 1 0 0 1 1]; % coverage by one-period lagged contingent loan
for different 'scenarios'
lambda_bb=[0 1 0 1 0 1 0 1]; % coverage by two-period lagged contingent
loan for different 'scenarios'
x=0; % annual interest rate on contingent loan
s=1; % share of contingent loan to be repaid in first period after shock

% grid for NFAs
step=0.001;
Rmin=-0.15;
Rmax=0.15;
R=(Rmin:step:Rmax)';
n=length(R);

% check whether parameterisation is feasible
if e(8)*delta*y(8,1)-(1+g)*Rmin+(1+rh)*Rmin+T...
   +lambda(8)*delta*(e(1)-e(8)*y(8,1))...
   -s*(1+x)/(1+g)*lambda_b(8)*delta*(e(1)-e_b(8)*y_b(8,1))...
   -(1-s)*((1+x)/(1+g))^2*lambda_bb(8)*delta*(e(1)-e_bb(8)*y_bb(8,1))<cf_
   disp('WARNING: parameterisation implies below-subsistence foreign good
   consumption')
end

% VALUE FUNCTION ITERATION
v0=zeros(n,m1,m2);
phi=0.00001;
i=1;
while i>=1
      disp(i)
      [v1,Rnext]=function_loan(v0,R);
      if max(abs(v1-v0))<=phi
         break;
      end
      v0=v1;
      i=i+1;
      if i>1000;
         break;
      end
end

% find numerical solution
Rstar_loc=find(Rnext(:,1,2)==R,1);
Rstar=R(Rstar_loc);

% report numerical solution
disp(horzcat('Optimal NFAs-to-output ratio:  ',num2str(Rstar)));

toc
```

*Box A.4. Code for optimisation of functional equation in extended model*

```
function [v1,Rnext]=function_loan(v0,R)

% globals
global beta sigma gamma delta theta T pi omega y y_b y_bb g e e_b e_bb...
rl rh cf_ ch_ lambda lambda_b lambda_bb x s n m1 m2

% create empty matrices
vtmp=NaN(n,n,m1,m2);
v1=NaN(n,m1,m2);
Rnext=NaN(n,m1,m2);

% OPTIMISATION ALGORITHM
for k=1:m1
    for p=1:m2
        ch=(1-delta)*y(k,p);
        for i=1:n
            if R(i)<0
               r=rh;
            else
               r=rl;
            end
            for j=1:n
                cf=e(k)*delta*y(k,p)-(1+g)*R(j)+(1+r)*R(i)+T...
                +lambda(k)*delta*(e(1)-e(k)*y(k,p))...
                -s*(1+x)/(1+g)*lambda_b(k)*delta*(e(1)-e_b(k)*y_b(k,p))...
                -(1-s)*((1+x)/(1+g))^2*lambda_bb(k)*delta...
                *(e(1)-e_bb(k)*y_bb(k,p));
                if cf>cf_ && ch>ch_
                   u=sigma/(sigma-1)...
                   *(theta^(1/gamma)*(ch-ch_)^(1-1/gamma)...
                   +(1-theta)^(1/gamma)*(cf-cf_)^(1-1/gamma))...
                   ^((1-1/sigma)/(1-1/gamma));
                   vtmp(i,j,k,p)=u+beta...
                   *(pi(k,1)*(omega(p,1)*v0(j,1,1)+omega(p,2)*v0(j,1,2)...
                   +omega(p,3)*v0(j,1,3))...
                   +pi(k,2)*(omega(p,1)*v0(j,2,1)+omega(p,2)*v0(j,2,2)...
                   +omega(p,3)*v0(j,2,3))...
                   +pi(k,3)*(omega(p,1)*v0(j,3,1)+omega(p,2)*v0(j,3,2)...
                   +omega(p,3)*v0(j,3,3))...
                   +pi(k,4)*(omega(p,1)*v0(j,4,1)+omega(p,2)*v0(j,4,2)...
                   +omega(p,3)*v0(j,4,3))...
                   +pi(k,5)*v0(j,5,1)...
                   +pi(k,6)*v0(j,6,1)...
                   +pi(k,7)*v0(j,7,1)...
                   +pi(k,8)*v0(j,8,1));
                end
            end
            [v1(i,k,p),loc]=max(vtmp(i,:,k,p));
            Rnext(i,k,p)=R(loc);
%           cfopt=e(k)*delta*y(k,p)-(1+g)*Rnext(i,k,p)+(1+r)*R(i)+T...
%           +lambda(k)*delta*(e(1)-e(k)*y(k,p))...
%           -s*(1+x)/(1+g)*lambda_b(k)*delta*(e(1)-e_b(k)*y_b(k,p))...
%           -(1-s)*((1+x)/(1+g))^2*lambda_bb(k)*delta...
%           *(e(1)-e_bb(k)*y_bb(k,p));
%           if cfopt<cf_
%              disp('WARNING: optimal foreign good consumption below
%              subsistence')
%           end
```

```
        end
    end
end
```

*Figure A.1. Optimal net foreign assets (ratio to normal output): comparative statics of baseline model with more severe shocks*




Note: To allow for more severe shocks and still satisfy the import subsistence constraint, a value of 0.7 is adopted for $\underline{c}_F$, the ratio of subsistence imports to normal imports (lower than the benchmark value of 0.8).

## References

Agénor, P.-R., Bayraktar, N., and El Aynaoui, K. (2008). Roads out of poverty: Assessing the links between aid, public investment, growth, and poverty reduction. *Journal of Development Economics*, 86(2), 277-295.

Aizenman, J., Cheung, Y.-W., and Ito, H. (2015). International reserves before and after the global crisis: Is there no end to hoarding? *Journal of International Money and Finance*, 52(April 2015), 102-126.

Aizenman, J., and Genberg, H. (2012). Research on the demand for international reserves: Developments in academia, the contribution of IMF researchers, and influence on IMF surveillance. *IEO Background Paper*, No. 12/01.

Aizenman, J., Jinjarak, Y., and Park, D. (2011). International reserves and swap lines: Substitutes or complements? *International Review of Economics and Finance*, 20(1), 5-18.

Aizenman, J., and Lee, J. (2007). International reserves: Precautionary versus mercantilist views, theory and evidence. *Open Economies Review*, 18(2), 191-214.

Aizenman, J., and Lee, J. (2008). Financial versus monetary mercantilism: Long-run view of large international reserves hoarding. *World Economy*, 31(5), 593-611.

Aizenman, J., and Marion, N. (2004). International reserve holdings with sovereign risk and costly tax collection. *Economic Journal*, 114(497), 569-591.

Aizenman, J., and Pasricha, S. K. (2010). Selective swap arrangements and the global financial crisis: Analysis and interpretation. *International Review of Economics and Finance*, 19(3), 353-365.

Alfaro, L., and Kanczuk, F. (2009). Optimal reserve management and sovereign debt. *Journal of International Economics*, 77(1), 23-36.

Bar-Ilan, A., and Marion, N. (2009). A macroeconomic perspective on reserve accumulation. *Review of International Economics*, 17(4), 802-823.

Barnichon, R. (2009). The optimal level of reserves for low-income countries: Self-insurance against external shocks. *IMF Staff Papers*, 56(4), 852-875.

Ben-Bassat, A., and Gottlieb, D. (1992). Optimal international reserves and sovereign risk. *Journal of International Economics*, 33(3-4), 345-362.

Bianchi, J., Hatchondo, J. C., and Martinez, L. (2013). International reserves and rollover risk. *IMF Working Paper*, No. 13/33.

Bussière, M., Cheng, G., Chinn, M. D., and Lisack, N. (2015). For a few dollars more: Reserves and growth in times of crises. *Journal of International Money and Finance*, 52(April 2015), 127-145.

Caballero, R. J. (2006). The macroeconomics of asset shortages. *NBER Working Paper*, No. 12753.

Carroll, C. D., and Jeanne, O. (2009). A tractable model of precautionary reserves, net foreign assets, or sovereign wealth funds. *NBER Working Paper*, No. 15228.

Céspedes, L. F., and Velasco, A. (2012). Macroeconomic performance during commodity price booms and busts. *IMF Economic Review*, 60(4), 570-599

Cheung, Y.-W., and Qian, X. (2009). Hoarding of international reserves: Mrs Machlup's wardrobe and the Joneses. *Review of International Economics*, 17(4), 824-843.

Cheung, Y.-W., and Sengupta, R. (2011). Accumulation of reserves and keeping up with the Joneses: The case of LATAM economies. *International Review of Economics and Finance*, 20(1), 19-31.

Cordella, T., and Levy Yeyati, E. (2006). A (new) country insurance facility. *International Finance*, 9(1), 1-36.

Crispolti, V., Dabla-Norris, E., Kim, J. I., Shirono, K., and Tsibouris, G. (2013). Assessing reserve adequacy in low-income countries. *IMF Occasional Paper*, No. 276.

Dabla-Norris, E., Kim, J. I., and Shirono, K. (2011). Optimal precautionary reserves for low-income countries: A cost-benefit analysis. *IMF Working Paper*, No. 11/249.

de Resende, C. (2007). IMF-supported adjustment programs: Welfare implications and the catalytic effect. *Bank of Canada Working Paper*, No. 2007-22.

Delatte, A.-L., and Fouquau, J. (2012). What drove the massive hoarding of international reserves in emerging economies? A time-varying approach. *Review of International Economics*, 20(1), 164-176.

Dooley, M. P., Folkerts-Landau, D., and Garber, P. M. (2004). The revived Bretton Woods system. *International Journal of Finance and Economics*, 9(4), 307-313.

Dooley, M. P., Folkerts-Landau, D., and Garber, P. M. (2014). The revived Bretton Woods system's first decade. *NBER Working Paper*, No. 20454.

Drummond, P., and Dhasmana, A. (2008). Foreign reserve adequacy in Sub-Saharan Africa. *IMF Working Paper*, No. 08/150.

Drummond, P., Mrema, A., Roudet, S., and Saito, M. (2009). Foreign exchange reserve adequacy in East African Community countries. *IMF African Departmental Paper*, No. 09/1.

Durdu, C. B., Mendoza, E. G., and Terrones, M. E. (2009). Precautionary demand for foreign assets in sudden stop economies: An assessment of the new mercantilism. *Journal of Development Economics*, 89(2), 194-209.

Espinoza, R. (2014). A model of external debt and international reserves. IMF mimeo.

Fernández Arias, E., and Levy Yeyati, E. (2012). Global financial safety nets: Where do we go from here? *International Finance*, 15(1), 37-68.

Fischer, S. (1999). On the need for an international lender of last resort. *Journal of Economic Perspectives*, 13(4), 85-104.

Frenkel, J. A., and Jovanovic, B. (1981). Optimal international reserves: A stochastic framework. *Economic Journal*, 91(362), 507-514.

García, P., and Soto, C. (2006). Large hoardings of international reserves: Are they worth it? In: R. Caballero, C. Calderón, and L. F. Céspedes (Eds.), *External vulnerability and preventive policies* (pp. 171-206). Santiago: Central Bank of Chile.

Ghosh, A. R., Ostry, J. D., and Tsangarides, C. G. (2012). Shifting motives: Explaining the buildup in official reserves in emerging markets since the 1980s. *IMF Working Paper*, No. 12/34.

Hauner, D. (2006). A fiscal price tag for international reserves. *International Finance*, 9(2), 169-195.

Heller, H. R. (1966). Optimal international reserves. *Economic Journal*, 76(302), 296-311.

IMF. (2000). *Debt- and reserve-related indicators of external vulnerability*. Washington, DC: IMF.

IMF. (2011). *Assessing reserve adequacy*. Washington, DC: IMF.

IMF. (2013a). *Assessing reserve adequacy: Further considerations*. Washington, DC: IMF.

IMF. (2013b). *Assessing reserve adequacy: Further considerations - Supplementary info*. Washington, DC: IMF.

IMF. (2014). *Review of Flexible Credit Line, the Precautionary and Liquidity Line, and the Rapid Financing Instrument*. Washington, DC: IMF.

Jeanne, O. (2007). International reserves in emerging market countries: Too much of a good thing? *Brookings Papers on Economic Activity*, 38(1), 1-55.

Jeanne, O., Ostry, J. D., and Zettelmeyer, J. (2008). A theory of international crisis lending and IMF conditionality. *IMF Working Paper*, No. 08/236.

Jeanne, O., and Rancière, R. (2011). The optimal level of international reserves for emerging market countries: A new formula and some applications. *Economic Journal*, 121(555), 905-930.

Kim, J. I. (2008). Sudden stops and optimal self-insurance. *IMF Working Paper*, No. 08/144.

King, R. G., and Rebelo, S. T. (1993). Transitional dynamics and economic growth in the neoclassical model. *American Economic Review*, 83(4), 908-931.

Korinek, A., and Servén, L. (2010). Undervaluation through foreign reserve accumulation: Static losses, dynamic gains. *World Bank Policy Research Working Paper*, No. 5250.

Kraay, A., and Raddatz, C. (2007). Poverty traps, aid, and growth. *Journal of Development Economics*, 82(2), 315-347.

Lee, J. (2004). Insurance value of international reserves: An option pricing approach. *IMF Working Paper*, No. 04/175.

Levy Yeyati, E. (2008). The cost of reserves. *Economic Letters*, 100(1), 39-42.

Lucas, R. E. B. (1987). *Models of business cycles*. Oxford: Basil Blackwell.

Obstfeld, M. (1994). Evaluating risky consumption paths: The role of intertemporal substitutability. *European Economic Review*, 38(7), 1471-1486.

Obstfeld, M., and Rogoff, K. (1996). *Foundations of international macroeconomics*. Cambridge, MA: MIT Press.

Obstfeld, M., Shambaugh, J. C., and Taylor, A. M. (2010). Financial stability, the trilemma, and international reserves. *American Economic Journal: Macroeconomics*, 2(2), 57-94.

Ogaki, M., and Zhang, Q. (2001). Decreasing relative risk aversion and tests of risk sharing. *Econometrica*, 69(2), 515-526.

Pallage, S., and Robe, M. A. (2003). On the welfare cost of economic fuctuations in developing countries. *International Economic Review*, 44(2), 677-697.

Perry, G. (2009). *Beyond lending: How multilateral banks can help developing countries manage volatility*. Washington, DC: Center for Global Development.

Prati, A., Ricci, L. A., Christiansen, L., Tokarick, S., and Tressel, T. (2011). External performance in low-income countries. *IMF Occasional Paper*, No. 272.

Ruiz-Arranz, M., and Zavadjil, M. (2008). Are emerging Asia's reserves really too high? *IMF Working Paper*, No. 08/192.

Spatafora, N., and Tytell, I. (2009). Commodity terms of trade: The history of booms and busts. *IMF Working Paper*, No. 09/205.

Steger, T. M. (2000). Economic growth with subsistence consumption. *Journal of Development Economics*, 62(2), 343-361.

Stiglitz, J. E. (2006). *Making globalization work*. New York, NY: W.W. Norton & Company.

Temple, J. R. W., Ying, H., and Carter, P. (2014). Transfers and transformations: Remittances, foreign aid and growth. *University of Bristol Department of Economics Discussion Paper*, No. 14/649.

Tereanu, E. (2010). International reserve adequacy in The Gambia. *IMF Working Paper*, No. 10/215.

Valencia, F. (2010). Precautionary reserves: An application to Bolivia. *IMF Working Paper*, No. 10/54.

van Wincoop, E. (1994). Welfare gains from international risksharing. *Journal of Monetary Economics*, 34(2), 175-200.

Wyplosz, C. (2007). The fuss about foreign exchange reserves accumulation. VoxEU.org Column, 27 April.

# Chapter 5

# Democracy and developing country growth during the global financial and economic crisis


## Abstract

Studies attempting to explain the observed heterogeneity in developing countries' economic growth during the 2008-2009 global financial and economic crisis have paid little attention to politico-institutional differences between countries. This paper aims to bridge that hiatus by gauging empirically the effect of democracy on developing country growth during the crisis. Based on a large cross-country sample and controlling for an extensive set of macroeconomic, financial and standard institutional factors and pre-crisis trends, we find a statistically and economically significant negative correlation between democratic features and crisis growth rates, which is robust to changes in the set of control variables, using different country subsamples, and alternative democracy and crisis growth measures. Controlling for endogeneity by means of instrumental variable estimation, however, this negative correlation disappears and, in our preferred specifications, makes way for a positive, seemingly causal relation between democracy and crisis growth, in line with the majority part of the literature. Additional research is needed to more precisely estimate the size of the democracy effect and to better understand the mechanisms behind our results.



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## 1. Introduction

> *What is likely to dominate as an idea in the developing world following the crisis is that China was succeeding before the crisis and succeeded in managing the pressures of the crisis very well indeed. Whether the right lesson or not, that will be associated with its ability to get things done without the perceived complications of more accountable political systems*
>
> Nancy Birdsall (2011, p. 14)

Financial sector problems in advanced economies, triggered by the bursting of the US housing bubble and subsequent increases in subprime mortgage default rates in the summer of 2007, eventually transformed into a full-fledged global economic crisis late 2008. The crisis, in retrospect labelled the 'Great Recession', continued into 2009, which saw by many standards the most severe and synchronised global downturn of the past 50 years (see IMF, 2009). While outside the crisis epicentre, developing countries shared in the pain, as they were engulfed by a wave of external financial and real sector shocks, most importantly a decline in world trade and reduced private capital inflows (see Chapter 2). According to IMF estimates overall real GDP growth in the developing world was around 2.8% in 2009, down from 6.0% a year earlier and 8.9% in 2007. However, these aggregate growth figures mask large variation across developing countries. Whereas China kept growing at more than 9% in 2009 (in real terms), Latvia's economy shrunk by almost 18% in the same year. For low-income Zambia and Cambodia, growth rates of more than 6% and nearly -2%, respectively, were recorded in 2009 (again, see Chapter 2 for a more systematic overview).

A series of papers have attempted to explain the observed heterogeneity of growth during the 2008-2009 global crisis by linking it to pre-crisis macroeconomic and financial conditions (see Blanchard *et al.*, 2010; Claessens *et al.*, 2010; Llaudes *et al.*, 2010; Berg *et al.*, 2011; Cecchetti *et al.*, 2011; Giannone *et al.*, 2011; Lane and Milesi-Ferretti, 2011; Rose and Spiegel, 2011; Berkmen *et al.*, 2012; Didier *et al.*, 2012; Frankel and Saravelos, 2012; Rose and Spiegel, 2012). Somewhat surprisingly, these studies have largely overlooked the role of various types of institutions. There is now a copious literature which emphasises that these 'rules of the game' matter for economic performance, although most research considers only longer-run effects (see North, 1990; Knack and Keefer, 1995; Hall and Jones, 1999; Acemoglu *et al.*, 2001; Rodrik *et al.*, 2004; Acemoglu and Robinson, 2012, to name just a few seminal references).[1] Higher institutional quality, for example under the form of a less corrupt, more accountable and more efficient government bureaucracy, could possibly be an important dimension of countries' *resilience* to different kinds of shocks (cf. the vulnerability framework in Chapter 2). In fact, none of the mentioned studies on the crisis have considered the potential importance of *political* institutions, i.e., the rules and regulations that are believed to shape the incentives of, and policy sets available to, a country's decision makers (see further for theoretical perspectives and empirical evidence).

The current paper aims at bridging this hiatus by gauging empirically the effect of democracy, or its defining characteristics, on the growth of developing countries over the most acute phase of the global crisis. To the best of our knowledge, the paper represents the first attempt to do so in an earnest manner. As the opening quote from Center for Global Development President Nancy Birdsall

[1] There is, however, no general consensus on the importance of institutions for growth. See, for example, the critiques voiced by Glaeser *et al.* (2004) and Chang (2006).

demonstrates, China's accomplishments during the global crisis could be expected to serve as an example of how autocracies, next to achieving impressive growth during booms, may also have advantages over more accountable regimes in withstanding the negative impact of external shocks on economic performance. We believe it is an interesting undertaking to see whether such inductive reasoning finds any resonance in cross-country data around the time of the Great Recession.

Previewing our conclusions, for a sample of about 100 developing countries, we find evidence that, indeed, democracy is *negatively* correlated with growth during the global crisis. The negative correlation is both statistically and economically significant and surprisingly robust across various different specifications, country samples and alternative key variable definitions. These first results are compatible with theoretical arguments about autocracies' greater decisiveness and insulation from populist demands. However, once we control for endogeneity issues with instrumental variable estimators, the negative correlation between democracy and crisis growth disappears and, in our preferred specifications, turns positive. This brings our conclusions closer to most of the literature on cross-country growth differences during earlier episodes of (external) shocks and crises, in particular Rodrik (1999). Direct causality remains of course difficult to establish in our cross-country set-up and the credibility of our results largely hinges on the validity of the language and primary schooling instruments we propose. We hope that future research will be helpful in estimating more precisely the democracy effect and in tracing out the channels through which democracy and its different aspects have influenced developing countries' growth throughout the global crisis.

The structure of the paper is as follows. Section 2 reviews the body of empirical studies that have sought to explain cross-country differences in GDP growth during the crisis. Section 3 is devoted to the relevant theoretical and empirical political economy literature on the links between democracy on the one hand, and economic growth, volatility and shocks on the other. Our methodological approach and data are introduced in Section 4. Section 5 presents the baseline results, subjects them to a series of robustness tests and looks deeper into endogeneity issues. Section 6 concludes and highlights some of the remaining caveats and avenues for further research.

## 2. Explaining developing country growth during the global crisis

Large disparities in developing countries' GDP growth rates during the global financial and economic crisis of 2008-2009 have spawned a growing literature attempting to link initial, pre-crisis conditions to such cross-country variation.[2] As will be made clear below, these empirical studies vary substantially in terms of their country samples, methodological set-up, explanatory variables included, crisis measures and timeframes.

Most of the analyses that include non-advanced economies have focused on a small group of well-integrated emerging market economies only, which were more directly exposed to the crisis (and for which data availability is less of a problem). Blanchard *et al.* (2010) identify trade and financial exposure as well as external demand growth as having much explanatory power for

[2] Other, related empirical research on developing countries inspired by the global crisis includes studies that consider between-country linkages and channels of crisis contagion (e.g., Drummond and Ramirez, 2009; Rose and Spiegel, 2010); examine output synchronisation for country pairs (e.g., Imbs, 2010; Abiad *et al.*, 2013); or place countries' experiences of the crisis in historical perspective (e.g., Reinhart and Rogoff, 2009; Gourinchas and Obstfeld, 2012).

differences between actual GDP growth during the zenith of the crisis (2008Q4 to 2009Q1) and earlier IMF forecasts. Similarly, Llaudes *et al.* (2010) show that higher external sector vulnerability, proxied by a subindex of the IMF's Vulnerability Exercise for emerging market economies (VEE; see Chapter 2), is positively correlated with (country-specific) peak-to-through percentage declines in quarterly GDP. Claessens *et al.* (2010) suggest that the larger the increase in domestic credit to the private sector and current account deficits in advanced and emerging market economies before the crisis, the greater the *duration*, *severity* and *adversity* of the crisis, defined as the number of consecutive quarters of negative growth; the cumulative decline in GDP from start to end of the recession; and the difference in average growth between 2003-2007 and 2008-2009, respectively. The importance of pre-crisis domestic credit growth and the current account balance are confirmed by Cecchetti *et al.* (2011) and Berkmen *et al.* (2012). Frankel and Saravelos (2012) conclude that the two leading indicators extracted from the 'early warning' literature, i.e., the international reserves position and real exchange rate overvaluation, again stand out as most useful in explaining the incidence of the crisis (as measured by drops in GDP and industrial production, among other indicators). Tsangarides (2012), which looks at the role of exchange rate regimes in more detail, finds that emerging market economies with pegged regimes did not fare worse than those with floats during the crisis, although the former appear to have recovered more slowly than the latter in subsequent years. In a rare attempt to incorporate institutional factors, Giannone *et al.* (2011) establish a negative link between market-friendly credit regulation and crisis growth, using Bayesian model averaging techniques. They suggest that the detrimental impact of credit market liberalisation may capture unobserved risk-taking behaviour, especially that associated with foreign and privately owned banks.

Other cross-country research on emerging market countries exhibits a much more conservative stance. Most notably, Rose and Spiegel (2012) contend that, out of more than 60 candidate crisis correlates, not one presents itself as a robust predictor of crisis incidence, with the possible exception of pre-crisis equity market appreciation. These sobering results may, however, be due the authors' particular choice of trying to explain GDP growth jointly with other indicators and the use of (premature) data estimates. However, in an extensive update, Rose and Spiegel (2011) largely corroborate their earlier findings; they show that almost none of the variables found to be statistically significant crisis predictors by other researchers survive simultaneous inclusion in regressions or sample changes.

Only a few recent studies have widened their scope to non-emerging, lower-income developing countries. Employing samples of up to 162 economies, Lane and Milesi-Ferretti (2011) trace back lower output and domestic demand growth during the crisis to prior domestic credit growth, current account deficits and trade openness, much in line with Didier *et al.* (2012), who examine relative declines in GDP growth between 2007 and 2009. Lastly, Berg *et al.* (2011) focus on growth collapses during the crisis in non-fuel exporting low-income countries. They find such collapses to be correlated with changes in external demand growth and, again, domestic credit growth in the boom years.

Our paper is most closely related to the three latter studies in terms of methodology, sample and explanatory variables (see Section 4.1 for more details). We will rely on simple multivariate regressions to study the determinants of cross-country differences in annual real GDP per capita growth over the 2008-2009 global crisis for a large sample of developing countries, both emerging and non-emerging (but excluding advanced economies). We complement existing research by bringing political institutions, one potentially important but so far neglected dimension of countries'

resilience, into the analysis. In particular, the paper investigates whether democracy, or typical features thereof, can explain part of developing country variation in economic growth during the Great Recession.

So, what should one expect *a priori*? Holding constant other factors, would democratic countries be more successful than their autocratic counterparts in keeping up growth during a global economic crisis? It seems, as the following section will show, that the new political economy literature, both in its theoretical and empirical guises, does provide some pointers but no conclusive answers. Overall, however, democracies seem to be given somewhat more acclaim than autocracies.

## 3. Democracy, growth, volatility and shocks

The enquiry on how political constraints, embodied by different regime types and other politico-institutional arrangements, influence feasible policy sets and policy choice, and ultimately determine economic outcomes, constitutes the heart of the new political economy research agenda (Drazen, 2000, pp. 3-19). Here we briefly highlight three particular subareas that could inform our expectations about the relation between democracy and developing countries' economic growth during the global crisis. First, by means of introduction, the contentious and much-debated general democracy-growth nexus is explicated. Second, we devote some attention to the links between democracy and growth volatility. The emphasis will be on a third political economy subfield, logically closest to the paper's research question, i.e., democracy's relation to (the management of) various shocks and crises.

### 3.1. Democracy and growth

The existence and precise nature of a democracy-growth nexus have been the subject of a vast theoretical and empirical literature whose results are, on the whole, remarkably *in*conclusive (see e.g., Doucouliagos and Ulubasoglu, 2008 for a recent overview and meta-analysis). An oft-cited survey by Przeworski and Limongi (1993) summarises the classic arguments that relate political regime types to long-term growth as follows: first, the idea that democracies are more successful in protecting property rights, which in turn is necessary to foster growth; second, the view that democracies give rise to pressures for immediate consumption, thereby deterring investment and, ultimately, growth; and third, the claim that autocratic regimes are predatory, obtain no gain from acting according to general interest, and hence allocate resources inefficiently. Przeworski and Limongi (1993) show that each of these arguments contains loopholes and conclude that, while politics may indeed matter for growth, thinking in terms of 'regimes' does not fully capture political diversity (see also, e.g., Persson and Tabellini, 2006; Khan, 2010).

Another important issue, which complicates interpreting a positive correlation between democracy and long-term growth (if any) as causal, is the possibility that some level of economic development may also be a necessary condition for democracy to sprout (and persist). This is in fact one of the central tenets of the post-war modernisation literature that has followed the seminal work of Lipset (1959) on the requisites for democracy (see Barro, 1999; and more recently, Benhabib *et al.*, 2013 for empirical evidence). Alternatively, Acemoglu *et al.* (2008) and Acemoglu *et al.* (2009) argue that per capita income and democracy evolve in tandem, driven by underlying historical factors.

### 3.2. Democracy and growth volatility

Somewhat less contentious is the relation between democracy and growth volatility. Contrasting Lee Kwan Yu's Singapore and Chung Hee Park's South Korea with Idi Amin's Uganda, Sah (1991) famously noted that, because of 'human fallibility', centralised societies (like those marked by autocratic regimes) will typically have more volatile economic performances. In societies where many parties are involved in decision-making (like democracies) the risks of such fallibility are much better diversified. Likewise, Rodrik (2000) asserts that participatory political regimes induce greater willingness for cooperation and conciliation, translating into economic stability.

Almeida and Ferreira (2002) corroborate Sah (1991)'s and Rodrik (2000)'s conjectures empirically, by showing that autocracies exhibit greater growth volatility than democracies, both in cross-country and within-country dimensions. Further evidence comes from Mobarak (2005), who demonstrates that democracy lowers growth volatility, which indirectly increases average long-term growth (cf. Ramey and Ramey, 1995). He argues that a negative direct effect of democracy on growth offsets the positive impact of lower volatility, hence rendering the net effect on growth insignificant. Klomp and de Haan (2009) also find a robust negative effect of democracy on *relative* growth volatility, taking into account mean growth differences between countries. Yang (2008) further tests the heterogeneity of the democracy-stability link; the dampening effect of democracy on growth volatility is found to be apparent only in ethnically fragmented societies, where reaching compromise is harder because of collective action problems (cf. Rodrik, 2000).

While the foregoing literature helps to better grasp the complex relation between democracy and economic performance, it does not deal explicitly with how different political regimes are expected to perform when faced with (external) shocks, like those triggered by a global economic downturn, or other forms of economic adversity. This is the subject of the remainder of this section.

### 3.3. Democracy and shocks

In theory, democracy could be either growth-*retarding* or growth-*enhancing* in times of economic turbulence. We identify at least five arguments touted in the political economy literature on crises and shocks, of which the first two seem to speak in favour of autocratic regimes and the latter three are in support of democracy.[3]

First of all, almost by definition, democracies have more checks and balances in place, which could slow down (or block) their reaction to an unfolding economic crisis. Autocracies may exhibit more flexibility and decisiveness in crisis management, due to a greater concentration of legislative and executive power. Such reasoning is, for example, implicit in the work of George Tsebelis on 'veto players', individual or collective actors whose agreement is necessary for changing the status quo in policy. Tsebelis (1995, p. 294) contends that the potential for policy change decreases with the number of veto players (greater in democracies), and that this could be harmful when 'an exogenous shock disturbs a desirable process'. Comparable propositions can be deducted, albeit more indirectly, from Alesina and Drazen (1991)'s famous 'war-of-attrition' model. This model suggests that countries with political institutions limiting the veto rights of groups that could oppose policy changes face less

[3] Most of the following arguments make the (we believe, plausible) assumption that the content and actual implementation of policy responses to various crises and shocks are conditioned by a country's politico-institutional set-up (see e.g., Tommasi, 2004; Stein *et al.*, 2005; Foresti *et al.*, 2011; Ha and Kang, 2015). For a contrary view on the importance of political institutions for public policy, see Mulligan *et al.* (2004).

delays in the adoption of (perhaps urgently needed) reforms. Similarly, Aghion *et al.* (2004) show theoretically that the optimal degree of 'insulation' of a country's leadership, defined as the threshold majority of individuals required to block reform, is higher during crises.

Second, the same mechanisms credited with avoiding policy stalemates also enable autocracies to overrule populist demands that are likely to arise when the economy comes under pressure. To the extent that these populist demands would lead to the adoption of suboptimal reforms weakening economic growth (much in the same way as argued in the classic literature on democracy and *long-term* growth; see before), autocracies may more successfully adjust. Democracies, where politicians are held accountable by their electorate (and seek re-election), might be unable to counter the general public's antagonism to tough decisions; especially so when there is *ex ante* uncertainty about the identity of winners and losers from a particular reform (see Fernández and Rodrik, 1991).

Other arguments point in the opposite direction. First, it has often been contended that the above arguments neglect the importance of 'credibility' for the actual implementation and maintenance of reform efforts (see, e.g., Pitlik, 2005). Only when a regime can credibly commit to a proposed reform programme (including compensations schemes for prospective losers), it will be able to get its citizens to cooperate and convince other (product or financial) market participants.[4] Autocracies are generally assumed to have a harder time than democracies in building such credibility, as the lack of checks and balances in the former undermines the belief that previous (reform) commitments will not be reneged on (North and Weingast, 1989). This may put autocracies at a disadvantage in dealing with crises. Cox and McCubbins (2001) hence see a trade-off between decisiveness, which *decreases* with the number of veto players, and the credibility of commitment to policy (what they call 'resoluteness'), which *increases* in the number of potential vetoes. Pitlik (2005) thinks such a trade-off may be overstated; he theorises that a situation of more veto players (and thus greater credibility) also increases decisiveness, since regimes that know in advance that their commitments are not credible may shy away from policy changes in the first place.

A second important argument in favour of, or at least not against democracy, is that autocratic leaders may not be as enlightened and growth-promoting as hoped for in their (possibly more determined) reaction to shocks or crises. Easterly (2011) explains that the nowadays popular narrative of the 'benevolent autocrat' naively assumes its omniscience about which policies drive growth, next to its omnipotence in translating these into practice. He forcefully argues there is no reason why autocrats would hold the magic formula to economic growth.[5] Certainly, democracies suffer from similar knowledge gaps, but at least they ensure that the room for arbitrary decisions is restricted (Sah, 1991).[6]

Third, while not (or less) accountable to the general public, autocracies are not immune to rent-seeking by interest groups. Research on political survival by Bueno de Mesquita *et al.* (2002) puts forward the size of the 'winning coalition', i.e., the number of people whose support is needed

[4] We have invoked this credibility of democracy argument in our discussion of local currency bond market development in Chapter 3 of the dissertation.

[5] In line with this argument and using an empirical growth accounting approach, Easterly and Pennings (2014) find that very little of the total growth variation in autocracies can be ascribed to national leader effects. Their findings are in contrast with an earlier study by Jones and Olken (2005), who use the natural deaths of leaders in office and changes in growth around the associated leadership transitions as quasi-experimental evidence to claim that leaders do matter for economic performance; especially in autocracies, where executive power is less constrained.

[6] Simply put, one could think of this as the popular dictum that 'many know more than one'.

to keep the executive in office, as one of the distinguishing features of political regimes, and demonstrates that it matters for policy. The theory goes that regimes with small coalitions, such as most autocracies, will focus on serving the desires of their narrow clique of supporters, at the expense of public goods provision. When the demands of that clique do not coincide with those of the economy at large, autocracies may end up with policies that are harmful for growth. For the specific context of a financial crisis, Keefer (2007) presents a model where the existence of multiple veto players reduces the pay-offs to rent-seeking by interest groups, thereby offsetting any delays in crisis response these extra checks and balances may cause.

Given that, from a theoretical point of view, the relation between democracy and growth during shocks or crises could go either way, what has the available evidence shown? Empirical cross-country research on democracy and the evolution of growth under (globally synchronised) external shocks or crises is scant. One notable exception is Rodrik (1999), who uses the turbulent second half of the 1970s as a test case to probe why some countries suffer greatly from the volatility in their external environment, while others do not. Above all, Rodrik (1999)'s study emphasises the interplay between terms-of-trade shocks and 'latent social conflict', proxied by measures of income inequality and ethno-linguistic fragmentation, as well as the interaction of shocks with domestic institutions of conflict management. Included in the latter category are composite indices of the institutional quality of government and democracy. Rodrik (1999) finds that countries with stronger democratic systems were more successful in fending off economic troubles brewing in the world economy during the 1970s. Similarly, for the 1970-1997 period Acemoglu *et al.* (2003) show that when the world economy decelerated, countries with fewer executive constraints tended to grow slower than other, more democratic societies. An explorative 1960-2004 panel study of growth and various measures of exposure and resilience to a range of external (and domestic) shocks by Collier *et al.* (2006) reveals that democracy has a mixed effect. It reduces the consequences of both favourable and unfavourable export price shocks (much like the hedging mechanisms discussed in Chapter 2), but amplifies oil import shocks.

Extending our scope to shocks that are not purely exogenous, we find further empirical evidence on the role of political institutions in crisis management coming from three related strands of literature: first, applied research on idiosyncratic banking crises, currency crises and growth collapses (all of which may have domestic and/or external origins) (e.g., Keefer, 2002; Montinola, 2003; Keefer, 2007; Cavallo and Cavallo, 2010; Bluhm *et al.*, 2014); second, 'small-N' studies of regional crises such as the Latin American debt crisis of the 1980s (Remmer, 1990) and the late-1990s East Asian crisis (Haggard and MacIntyre, 1998); and third, the literature on structural adjustment and stabilisation (Haggard and Webb, 1993; Lindenberg and Devarajan, 1993; Alesina *et al.*, 2006). In general terms (glossing over many nuances), most of these accounts seem to suggest that countries with well-established democratic features have been more, or at least not less, resilient to various shocks and crises.[7] Lastly, and only very recently, a number of papers have analysed large panel datasets on structural reforms in various sectors, including trade, banking, domestic capital markets, and regulatory reforms related to the overall business climate (Giuliano *et al.*, 2013; Prati *et al.*, 2013; Amin and Djankov, 2014). These studies tend to show that democracies are more likely to adopt (and effectively implement) such reforms than autocracies. This may call into question autocracies' presumed advantage in pushing through policy changes.

[7] The study of Alesina *et al.* (2006), which finds that countries with less executive constraints stabilise more rapidly and drastically from inflation and budgetary crises, stands out as an exception.

China's growth experience during the 2008-2009 Great Recession might leave one with quite a different impression of the relative strengths and weaknesses of autocratic governance in times of economic stress. Without downplaying macroeconomic and financial factors such as China's comfortable current account position, relatively closed capital account, the large fiscal space available, and its huge 'war chest' of foreign exchange reserves, many commentators have stressed the extraordinary size and swiftness of fiscal and monetary policy measures taken by Chinese authorities in response to the global crisis (see e.g., Schmidt and Heilmann, 2010; Pei, 2011; Vincelette *et al.*, 2011; Lardy, 2012).[8] There are indications that already in July 2008 the Chinese leadership engaged in discussions on measures to mitigate the unfolding global crisis. Early November 2008 the government announced a two-year fiscal stimulus package amounting to CNY4 trillion (or nearly US$590 billion, about 13% of China's 2008 GDP), consisting predominantly of both new and front-loaded infrastructure investment. In parallel, a radical easing of Chinese monetary policy, with a lifting of credit quotas and a repeated slashing of interest rates from September 2008 onwards, led to an enormous increase in bank lending. Arguably, some of these bold actions would have been much harder to pull off in a multi-party state with fully accountable policymakers.

Of course, whether democracy, on average, has helped or hindered growth during the Great Recession in a larger sample of developing countries remains to be empirically tested. Do the actual data from around 2008-2009 support the findings of Rodrik (1999) and others on previous shock episodes, or are they more in line with popular interpretations of China's flexible and decisive handling of the crisis? The next section outlines our methodological approach to tackle this question and describes the data used.

## 4. Methodology and data

### 4.1. Baseline model set-up, sample and variables

To evaluate the effect of democracy on growth during the 2008-2009 global crisis we use simple OLS to estimate a cross-sectional model of the following form:

$$\Delta Y_{i,09} - \Delta \hat{Y}_{i,09} = \beta_0 + \beta_1 Y_{i,07} + \beta_2 \Delta Y_{i,0407} + \beta_3 \Delta Y_{i,trend} + \beta_4 X_i + \beta_5 Democ_i + \varepsilon_i \quad (1)$$

where the left-hand side, dependent variable is the percentage point difference between observed real GDP per capita growth in 2009 and the IMF's pre-crisis (April 2008) forecast of 2009 growth for country *i*, hereafter referred to as 'unexpected crisis growth'[9]; $Y_{i,07}$ is log GDP per capita in 2007 (in

[8] For example, Schmidt and Heilmann (2010, pp. 6-7) note: 'In battling the crisis, the Chinese government has distinctive mechanisms and means at its disposal that are rooted in the political system, such as a distinctive, and historically recurrent, emergency mode of policy-making which is characterized by swift centralization of decision-making and acceleration of cross-sectoral policy implementation through Communist Party command and campaign mechanisms that extend to all major financial institutions and government-linked companies. The CCP [Chinese Communist Party] hierarchy can therefore be used as a distinctive channel to communicate emergency decisions made by the central government and push these decisions through the administrative and economic system'.

[9] $\Delta Y_{i,09}$ is defined as *log*((*2009 GDP per capita in constant LCU*)/(*2008 GDP per capita in constant LCU*)) × 100, and $\Delta \hat{Y}_{i,09}$ similarly but using forecasted GDP per capita values from the April 2008 IMF World Economic Outlook instead. We use these pre-Lehman growth forecasts as a proxy for the counterfactual, i.e., what growth would

current US$); $\Delta Y_{i,0407}$ is average real GDP per capita growth over 2004-2007, a measure of the growth run-up in the period preceding the crisis; $\Delta Y_{i,trend}$ is average real GDP per capita growth over 1990-2007 (or 1995-2007 in the case of some Central and Eastern European and former Soviet countries with missing data; see Lane and Milesi-Ferretti, 2011); $X_i$ is a vector that includes a range of macroeconomic, financial and institutional control variables (further explained below); $Democ_i$ is a measure of democracy; and $\varepsilon_i$ is a well-behaved error term. To reduce endogeneity concerns we take 2007 values for our control and democracy variables (thereby following the majority of studies reviewed in Section 2).[10]

Our initial sample consist of all 145 non-advanced economies classified by the IMF as 'emerging and developing countries' in its World Economic Outlook (WEO) database, at the time of writing, for which unexpected growth in 2009 could be constructed. We exclude the group of advanced economies from our analysis, as the crisis impacted most of these countries in very particular ways (for example, through real estate booms/busts and cross-holdings of impaired mortgage-backed securities), which would complicate the comparison with developing countries. Indeed, for many advanced economies, the Great Recession cannot be treated as an exogenous shock event (see Chapter 2). For 124 of these 145 developing countries 2007 democracy measures were available; the final number of countries included in our regressions is further reduced because of additional missings for other baseline variables (see Table A.1 in Appendix for a list of sample countries by income group).

Figure 1 shows the distribution of our dependent variable. Around 77% of developing countries experienced real GDP per capita growth in 2009 that was zero to ten percentage points lower than forecasted by the IMF before the global crisis. The growth of 12% of countries was more than ten percentage points below earlier forecasts, and only 11% saw real GDP per capita growth exceed forecasts. Also within the -10 to zero percentage point interval there appears to be substantial variation.

The selection of pre-crisis macroeconomic, financial and institutional controls in our model (i.e., vector $X_i$ in Equation (1)) is informed by the relevant literature (in particular Berg *et al.*, 2011; Lane and Milesi-Ferretti, 2011; Didier *et al.*, 2012) as well as data availability for our sample: domestic credit to the private sector, cumulative growth of domestic credit over 2000-2007, trade openness, financial openness, the current account balance (all of which are expressed as percentages of GDP and multiplied by 100), the 2007-2009 change in external demand growth (i.e., the percentage point change in real GDP growth of a country's trading partners, weighted by bilateral export shares and scaled by the 2007 exports-to-GDP ratio), and a composite index of overall

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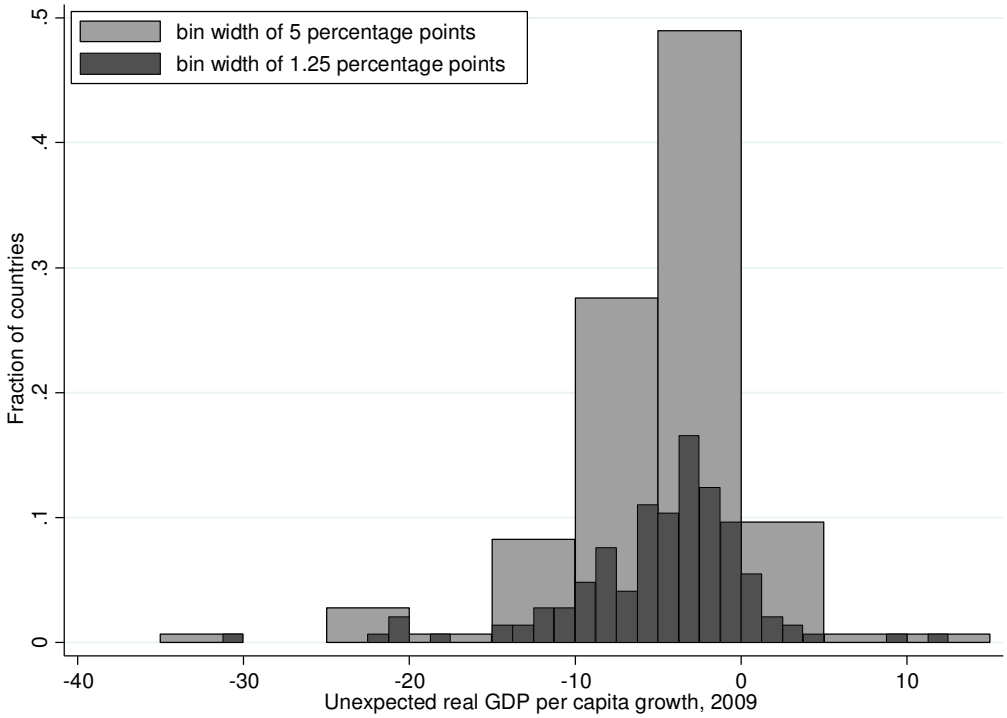
have been or, better, was expected to be in the absence of the crisis (cf. Blanchard *et al.*, 2010). We do not explicitly take into consideration forecast biases (but assume forecast errors to be randomly distributed). Since we focus on developing countries, where population growth is often substantial, we take per capita growth as our preferred output measure. We aim at explaining changes in growth rather than growth per se, to take into account that countries were growing at very different rates before the crisis (Didier *et al.*, 2012). We follow Berg *et al.* (2011) in choosing 2009 as our crisis year. 2007 is arguably the last year where developing countries were not majorly affected by the crisis originating in the US and other advanced countries. By the second half of 2008 the crisis had already spread to many developing countries, especially the most globally integrated, but it was not until 2009 that the largest effects on overall developing country growth were recorded (see Chapter 2). To make our sample of developing countries as large as possible, we use annual rather than quarterly GDP figures (which are only available for a limited number of emerging market economies).

[10] We take up issues of potential endogeneity in much greater detail in Section 5.2.4.

institutional quality based on the Worldwide Governance Indicators (WGI).[11] Detailed definitions and sources of these variables, together with the basic descriptive statistics, are provided in Table A.2 in Appendix.

*Figure 1. Distribution of unexpected crisis growth*




Note: Sample countries and unexpected crisis growth as defined in the text and Tables A.1-A.2 in Appendix.

For the paper's main variable of interest, the extent or strength of democracy, we use an index based on the 2007 *(revised) combined Polity score* (or *polity2* variable) from the Polity IV Project database (see Marshall *et al.*, 2013). The Polity score is a broad summary measure of democracy that is widely used in the political economy and international relations literature. It is created from five expert-coded ordinal variables: (1) *competitiveness of executive recruitment*, indicating whether chief executives are elected or rather selected; (2) *openness of executive recruitment*, measuring the degree to which chief executive (s)election is open to the politically active population and/or governed by clear regulations; (3) *constraints on the chief executive*, the extent of institutionalised constraints on the decision-making powers of chief executives, be it individuals or collective bodies; (4) *regulation of participation*, the extent of binding rules on whether, when and how political preferences can be expressed; and (5) *competitiveness of participation*, which quantities the degree to which alternative preferences for policy and leadership can be pursued in the political arena.[12] The codings for these five variables are aggregated additively into non-overlapping *institutionalised autocracy* and *institutionalised democracy* indicators (both ranging from zero to ten), according to two separate weighting schemes. The final Polity score is computed by subtracting the first

[11] This list of variables includes both proxies of *exposure* (e.g., trade and financial openness) and *resilience* (e.g., institutional quality), in terms of the framework we presented in Chapter 2. Arguably, the external demand growth variable can be treated as exogenous for our sample of developing countries (except perhaps for the largest economies among them).

[12] The exact coding guidelines for these variables can be found in Marshall *et al.* (2013).

institutionalised indicator from the latter and therefore ranges from -10 (strongly autocratic) to +10 (strongly democratic). The index we will use for our baseline estimations converts the original Polity score to an equivalent 21-point scale from zero to one.

Despite its widespread use in empirical research, the Polity score is not free from criticism. Gleditsch and Ward (1997) and Cheibub *et al.* (2010), among others, have criticised the Polity variables for adopting unclear coding rules with respect to intermediate categories of some Polity subdimensions (which may introduce subjectivity) and rather arbitrary aggregation rules. They argue that because of these rules, the Polity data are, in essence, categorical and that the different categories are not precise. The same overall Polity scores can be arrived at through very different combinations of subscores (on the underlying dimensions), which complicates comparison across countries. Furthermore, although there is an enormous variety of theoretically possible coding patterns, only a fraction of subscore combinations is actually observed in the data. Cheibub *et al.* (2010) also find that the Polity score has a bimodal distribution, with many countries concentrated around the lowest and highest possible scores and few in the middle. This leads them to claim that polychotomous measures like Polity have little informational advantage over binary classifications of political regimes. Treier and Jackman (2008) rightly argue that democracy is a latent variable that is only imperfectly captured by observable characteristics. Using an ordinal item response model (a technique similar to factor analysis) they find considerable measurement error in the latent democratic traits underlying the Polity scores.

In light of these and other reservations with Polity variables, we will employ other, narrower measures of democracy from alternative sources when testing the robustness of our baseline results (see Section 5.2.3).

### 4.2. Bivariate correlations

Before moving to the regression results, we first examine bivariate correlations between the regressand and regressors, and in second instance between pairs of regressors, of the model specified in Equation (1).

Figure A.1 in Appendix brings together a series of bivariate scatter plots where our measure of unexpected crisis growth is set out against individual explanatory variables. For presentation purposes we have excluded extreme outliers. The correlation between log GDP per capita in 2007 and unexpected growth in 2009 is clearly negative (panel (a)), which reflects the fact that (middle-income) emerging market economies typically suffered larger (unexpected) growth collapses than low-income countries during the crisis (Didier *et al.*, 2012).[13] Countries that had relatively large banking sectors in 2007, proxied by domestic credit (as a percentage of GDP), and that experienced higher average pre-crisis and trend economic growth and faster cumulative domestic credit growth also did visibly worse (panels (b)-(e)). The latter relations seem to point to the vulnerabilities of an overheating economy and (excessive) build-ups in domestic credit.[14] Panels (f) and (g) suggest that

[13] In Chapter 2 we have documented the differences in growth during the crisis between emerging market economies and low-income countries. Richer emerging markets, which include a number of large oil exporters, tend to be more integrated globally and with advanced economies, the epicentre of the crisis. GDP per capita is arguably also correlated with the size and complexity of a country's financial sector.

[14] Arguably, the negative association between actual pre-crisis growth and unexpected crisis growth also proxies for certain country features, such as export concentration in products with a favourable pre-crisis price evolution (most notably oil and other commodities) or large inflows of external finance, that accounted for

trade openness was another factor of exposure to the crisis, as expected in view of the breakdown in world trade starting end 2008 (cf. Chapter 2), and that countries faced with large declines in external demand also contracted more sharply (relative to forecasts). Bivariate relations between unexpected crisis growth, on the one hand, and financial openness and the current account balance, on the other, appear hard to pin down (panels (h) and (i)). Conversely, overall institutional quality, which is expectedly highly correlated with GDP per capita, is again negatively associated with unexpected growth (panel (j)).

Of special interest for the purpose of this paper is Figure 2, which plots unexpected crisis growth against the 2007 Polity-based democracy index for all 124 developing countries with both kinds of data available. There appears to be an overall negative (linear) relation between our baseline measures of unexpected crisis growth and democracy, although the slope coefficient is marginally insignificant at the 5% level. A quadratic relation fits the data somewhat better, but this may be due to certain outliers. Some democracies, most notably the Baltic states, Ukraine and Armenia, did fare very badly indeed during the crisis, in contrast with more autocratic Uzbekistan, Myanmar, Eritrea, Bhutan and Equatorial Guinea, which grew *faster* in 2009 than forecasted. Clearly, however, there are also a number of countries whose crisis experiences defy the apparent negative democracy-unexpected crisis growth relation; Nepal, Malawi, Guinea-Bissau and Lebanon, all classified as relatively democratic, saw their actual economic growth exceed forecasted growth, whereas autocratic oil-exporting Kuwait, Libya and Bahrain did surely not. This illustrates the obvious: i.e., there is much more to growth differences during the crisis than the type of political regime in place. Moreover, some of the variables we and others have suggested as impacting crisis growth may be correlated with democracy. For starters, democracies were perhaps better integrated into the world economy when the crisis hit and therefore more exposed to the resulting external shocks, such as the collapse in international trade and reduced availability of external private capital.

To get a first idea of the relations between the main exploratory variables used in our model, Table A.3 in Appendix gives the Pearson correlation matrix. The coefficients suggest that only institutional quality is significantly correlated with the Polity-based democracy measure.[15] Other notable positive correlations are those between log GDP per capita, trade openness, financial openness, domestic credit and institutional quality; the change in external demand growth is negatively correlated with these variables. In the next section we will examine the correlation of democracy with unexpected crisis growth in a multivariate setting.

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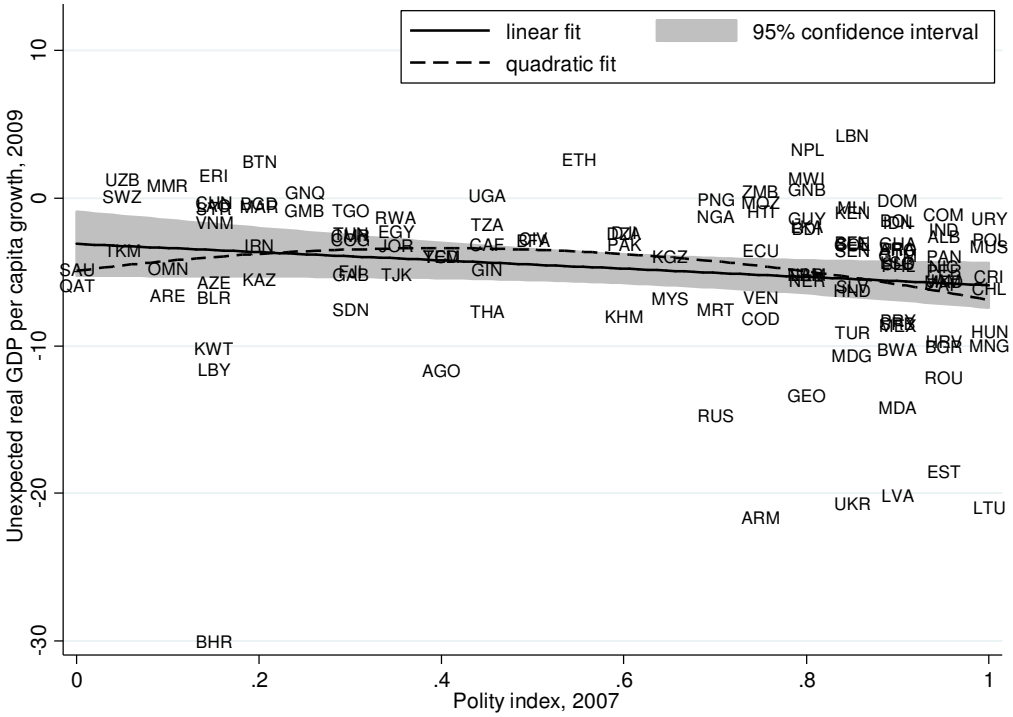
rapid growth in the boom years but made countries more vulnerable during the bust. Domestic credit booms may also be partly fuelled by external finance.

[15] If we exclude oil exporters, the positive pairwise correlation between democracy and institutional quality grows stronger, and also the correlation between democracy and log GDP per capita becomes positive and highly significant.

*Figure 2. Unexpected crisis growth vs. democracy*




Note: Sample countries, ISO codes and variables as defined in the text and Tables A.1-A.2 in Appendix.

## 5. Empirical results

### 5.1. Baseline estimations

Table 1 displays the baseline OLS estimation results for Equation (1). Column (1) of Table 1 broadly confirms what we could expect *a priori* and, to a fair degree, mirrors the findings of earlier cross-country studies, surveyed in Section 2. Countries with higher per capita income, high average pre-crisis growth, rapid domestic credit increases, and those that were overall financially more integrated, suffered larger growth declines in 2009 (again compared to pre-crisis forecasts). For example, a doubling of GDP per capita worsens unexpected crisis growth with about one percentage point.[16] Greater trade openness, favourable changes in external demand growth and a more comfortable current account position are on the contrary positively correlated with growth performance. The influences of trend growth and domestic credit levels are found to be positive but not significantly different from zero. Overall, our model is able to explain just over 56% of the variation in unexpected crisis growth. Controlling for overall institutional quality does not appreciably alter these results (column (2)).

Columns (3) and (4) show that the partial correlation between our Polity-based democracy index and unexpected crisis growth is negative and significant, with or without institutional quality in the specification. The coefficients of the other control variables remain qualitatively similar to those in columns (1) and (2), with the exception of the current account balance. The point estimates imply that, *ceteris paribus*, an increase in the democracy index with 0.3, about one standard deviation in

[16] Since GDP per capita is in log form, this is calculated as $\Delta Y = \beta \Delta X/X$ or $\Delta Y$ = -0.9858*100%.

the 97 country observations baseline sample (or, say, the difference in democracy levels between Angola and Russia) exacerbates unexpected growth during the crisis by between 0.6 and 0.7 percentage points.

*Table 1. Baseline estimation results*

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| *GDP per capita (log), 2007* | -0.9858** | -0.7792+ | -0.8899** | -0.7820+ | -0.8887* | -1.0382** |
| | [0.3916] | [0.4722] | [0.4131] | [0.4728] | [0.4802] | [0.4697] |
| *Av. GDP pc growth, 2004-2007* | -0.2782* | -0.2683+ | -0.2968+ | -0.2956+ | -0.2721+ | -0.2965* |
| | [0.1640] | [0.1624] | [0.1829] | [0.1830] | [0.1759] | [0.1696] |
| *Av. GDP pc trend growth* | 0.2521 | 0.2260 | 0.2709 | 0.2602 | 0.2449 | 0.2960+ |
| | [0.2354] | [0.2319] | [0.2405] | [0.2394] | [0.2393] | [0.2188] |
| *Domestic credit (% of GDP), 2007* | 0.0054 | 0.0118 | 0.0158 | 0.0195 | 0.0216 | 0.0218 |
| | [0.0145] | [0.0188] | [0.0151] | [0.0212] | [0.0207] | [0.0201] |
| *Dom. credit growth, 2000-2007* | -0.0257*** | -0.0267*** | -0.0253*** | -0.0256*** | -0.0255*** | -0.0259*** |
| | [0.0082] | [0.0085] | [0.0083] | [0.0084] | [0.0086] | [0.0085] |
| *Trade openness, 2007* | 0.0515*** | 0.0497** | 0.0422** | 0.0413** | 0.0451** | 0.0487*** |
| | [0.0194] | [0.0192] | [0.0192] | [0.0194] | [0.0195] | [0.0181] |
| *Ch. external demand growth, 2007-2009* | 1.5678*** | 1.5099** | 1.6657** | 1.6249** | 1.7032*** | 1.7692*** |
| | [0.5809] | [0.5757] | [0.6362] | [0.6480] | [0.6372] | [0.5892] |
| *Financial openness, 2007* | -0.0098*** | -0.0098*** | -0.0102*** | -0.0102*** | -0.0103*** | -0.0101*** |
| | [0.0012] | [0.0012] | [0.0011] | [0.0011] | [0.0011] | [0.0010] |
| *CAB (% of GDP), 2007* | 0.0759** | 0.0639* | 0.0420 | 0.0376 | 0.0417 | 0.0379 |
| | [0.0315] | [0.0339] | [0.0396] | [0.0402] | [0.0413] | [0.0407] |
| *Institutional quality, 2007* | | -0.8227 | | -0.4890 | -0.5746 | -1.3654 |
| | | [1.0968] | | [1.2406] | [1.2295] | [1.3686] |
| *Polity index, 2007* | | | -2.2762** | -2.1326* | | -21.3352** |
| | | | [1.1425] | [1.1607] | | [8.1800] |
| *Anocracy dummy, 2007* | | | | | -2.2149** | |
| | | | | | [0.9064] | |
| *Democracy dummy, 2007* | | | | | -1.9763** | |
| | | | | | [0.8683] | |
| *Polity index squared, 2007* | | | | | | 17.7249** |
| | | | | | | [7.4443] |
| Observations | 109 | 109 | 97 | 97 | 97 | 97 |
| $R^2$ | 0.5629 | 0.5663 | 0.6105 | 0.6115 | 0.6219 | 0.6355 |
| Adjusted $R^2$ | 0.5232 | 0.5220 | 0.5653 | 0.5613 | 0.5679 | 0.5834 |

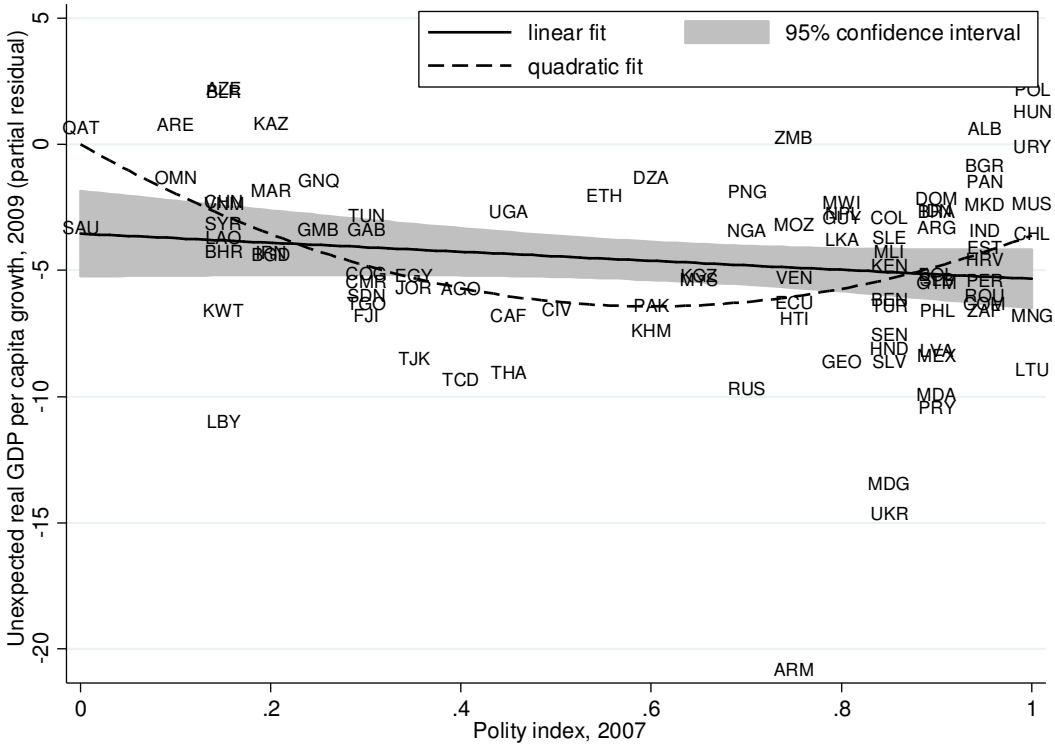
Notes: Dependent variable is unexpected real GDP per capita growth in 2009. Sample countries and independent variables as defined in Tables A.1-A.2 in Appendix. All models are estimated using OLS and include a constant term (coefficient not reported). Heteroskedasticity-robust (Huber-White) standard errors are reported in brackets. ***$p$<0.01; **$p$<0.05; *$p$<0.10; +$p$<0.20.

Of course, the (negative) relation between democracy and unexpected crisis growth does not need to be linear. Strictly speaking and as pointed out before, the democracy index we propose has, at best, only an ordinal meaning. Moreover, the democracy-crisis growth relation could be subject to diminishing or increasing effects. In column (5) of Table 1 we follow Barro (1996) in replacing the Polity-based democracy index by two dummies. The first dummy variable takes the value of one if a country can be classified as an 'anocracy', meaning that it has a Polity index ranging from 0.35 to

0.65, and zero otherwise. The second, 'democracy' dummy equals one if the index exceeds 0.65. We see that both dummies have significantly negative coefficients; the *p*-value for their joint significance is 0.0239. From the point estimates it would seem that the negative effect of democracy on crisis growth is diminishing at the margin. However, a Wald test rejects the null hypothesis of linearity (under which the coefficient of the second dummy should be approximately double that of the first) only at the 15% significance level. When, instead of using dummy variables, a squared democracy index is entered (column (6)), its coefficient is positive (the level index itself remaining negative); the *p*-value for joint significance is then 0.0153. Again it appears that there are diminishing effects at play.[17]

Figure 3 plots the partial residuals of the regression in column (6) against the level democracy index.[18] It shows that the choice between a linear and quadratic functional relationship is not straightforward, with the latter fitting the data only marginally better than the former. A number of countries with relatively high Polity scores, most notably Armenia, but also Ukraine, Madagascar, Moldova and Paraguay, continue to have large negative partial residuals (i.e., unexpected crisis growth that cannot be accounted for by our baseline explanatory variables, excluding democracy).

*Figure 3. Partial unexpected crisis growth residuals and democracy*




Notes: Partial residuals are based on regression in Table 1, column (6). Sample countries, ISO codes and variables as defined in the text and Tables A.1-A.2 in Appendix.

[17] The turning point for this model, after which democracy would start to *improve* unexpected crisis growth, lies at a Polity index of around 0.6 (corresponding to levels of democracy observed in Algeria, Cambodia and Pakistan).

[18] These partial residuals are calculated using the estimated coefficients from a regression that incorporates *all* baseline variables, including the level and squared democracy index (column (6)). Logically, the contributions from the democracy variables themselves are not taken into account in the calculation of the partial residuals (see Barro, 1996, pp. 14-15).

One could also wonder whether the correlation of democracy with unexpected crisis growth is conditioned by the prevailing macroeconomic, financial and institutional environment. Table A.4 in Appendix augments the baseline specification of Table 1, column (4) with multiplicative interaction terms of the Polity score with each of the other regressors (introduced one at a time). To ease interpretation of the coefficients, we have centred variables around their sample mean before interacting them; the democracy coefficient then captures the effect of democracy on unexpected crisis growth when the variable it is interacted with is fixed at its sample mean.[19] From Table A.4 it seems as if the negative correlation between democracy and unexpected crisis growth is further strengthened in an environment of rapid pre-crisis output and domestic credit growth (columns (2), (3) and (5)). Conversely, the negative democracy-unexpected crisis growth link appears to weaken when financial openness is high or the change in external demand growth is more favourable. The mechanisms that lay behind these possible non-linear relations are not directly clear to us and warrant more attention in future work. Yet, Table A.4 also shows that the overall negative correlation of democracy with unexpected crisis growth persists and cannot be fully ascribed to democracy's interaction with one of the control variables of the baseline model (at least not at the sample mean values of these controls). As can been seen from the adjusted $R^2$ measures, the inclusion of interaction terms does not dramatically improve the fit of our model. Moreover, Treier and Jackman (2008, p. 213) argue that the risks of invalid inference associated with the previously highlighted measurement error problems of Polity variables (see Section 4.1) 'bite [especially] when researchers rely on elaborations such as nonlinear functional forms …or highly interactive specifications'.

Our results so far seem to suggest that, on average, democratic country features are negatively correlated with growth performance during the global crisis (whether or not with diminishing effects at the margin or other non-linearities). As evident from Section 3.3, this bucks the trend set by most earlier studies on developing countries' resilience to shocks and crises. However, before drawing too strong conclusions from our rather parsimonious baseline model, it is important to test for its robustness. In the next section we conduct a series of robustness checks that can be classified into three categories: changes in the set of control variables, different country subsamples, and alternative definitions for crisis growth and democracy. For reasons of brevity, we restrict ourselves to testing the specific set-up in Table 1, column (4), the estimated coefficients of which are reproduced for comparison in the first column of each of the robustness results tables (Tables A.5 to A.7 in Appendix). Above all, our focus will be on what happens to the statistical and economic significance of the democracy coefficient when switching between alternative model specifications.

## 5.2. Robustness tests[20]

### *5.2.1. Changes in control variables*

In Table A.5 in Appendix we alter the original set of control variables. First, an alternative indicator for institutional quality is constructed with data from the Political Risk Services (PRS) Group's International Country Risk Guide (ICRG) (cf. Chapter 3). We average three ICRG scores that evaluate countries on their protection of property and contract rights and their efficiency in public good allocation, i.e., the law and order, bureaucracy quality and corruption dimensions of ICRG (see Knack

[19] Interacting uncentred variables produces coefficients that measure the effect of one variable when the other is kept at zero, which is not necessarily useful for interpretation (see Braumoeller, 2004).
[20] Untabulated results mentioned in the text are available from the author upon request.

and Keefer, 1995). This composite index ranges from zero to six, with higher values signalling superior institutional quality. Substitution of the original WGI-based index for institutional quality by the new ICRG-based index narrows our sample to 82 countries (as many of the smallest and poorest economies are not rated by the PRS Group on these dimensions) and increases the economic and statistical significance of the estimated democracy coefficient (column (2)). Employing single WGI and ICRG subcomponents instead also yields very similar results.

Second, we replace our 2007-2009 change in external demand growth measure (as used by Berg *et al.*, 2011) with a proxy of 'unexpected' external demand growth during the crisis, i.e. the percentage point difference between observed real GDP growth of a country's trading partners in 2009 and its pre-crisis (April 2008) forecast for 2009, again weighted by bilateral export shares and scaled by the 2007 exports-to-GDP ratio (cf. Blanchard *et al.*, 2010). This variable is again positively associated with unexpected crisis growth and its inclusion does not alter the democracy coefficient (column (3)); neither does the replacement of the external demand variable by regional dummies.

Third, also alternative indicators of financial exposure do not change the main result. The ratio of international bank claims of BIS-reporting banks to GDP, from the Bank of International Settlements' consolidated banking statistics (a proxy for countries' vulnerability to bank credit shocks, another important transmission channel of the crisis; see Chapter 2) has no clear effect on unexpected crisis growth once financial centres (as identified by Lane and Milesi-Ferretti, 2011) are excluded and hardly influences the negative correlation of democracy with crisis growth (column (4)).[21] Conversely, stock market capitalisation (as a percentage of GDP) enters with the expected negative sign but reduces the economic and statistical significance of democracy (column (5)). The change in the Polity coefficient, however, appears to be largely the result of the change in the country sample. Variations on the baseline model that replace financial openness by countries' *net* foreign asset position, by various subcomponents of financial openness (debt, portfolio equity, FDI), or that take into consideration international reserves stocks, lead to very similar conclusions. Significance of the Polity-based index is again somewhat reduced when substituting *de facto* financial openness by the *de jure* measure of Chinn and Ito (2006) (see Chapter 3 on the KAOPEN index).

Fourth, we add a dummy for countries that had a pegged exchange rate regime in place in 2007, based on Reinhart and Rogoff (2004)'s *de facto* classification. There is some indication that 'floaters' fared better during the crisis than 'peggers' (column (6)). This is less clear when we exclude countries that switched exchange rate regimes over 2007-2009 (cf. Tsangarides, 2012). The correlation of democracy with crisis growth remains unchanged, however.

Fifth, we have included measures of fiscal policy over the crisis years, i.e., changes in the general government's fiscal balance or total expenditures. Since we want to compare constrained and less constrained (and therefore supposedly more flexible and decisive) political regimes, we are especially interested in fiscal policy that is 'discretionary' rather than due to automatic stabilisers or deterministic trends. Therefore, in line with Fatás and Mihov (2003), Afonso *et al.* (2010) and Furceri and Zdzienicka (2012), we regress the nominal changes in the government's fiscal balance or expenditures on current and lagged real oil prices (from the World Bank's Commodity Price 'Pink Sheet' database), the current inflation rate (based on the GDP deflator) and a linear time trend, in a pooled OLS model over 1980-2009 (separately for oil exporters and other developing countries); and collect the residuals for 2009 as our fiscal policy proxies. Unlike the above-mentioned studies, however, we do not include economic growth in the auxiliary regression, as we want to construct

[21] The three financial centre countries that are excluded from column (4), relative to the baseline sample, are Bahrain, Mauritius and Panama.

measures of 'discretionary' fiscal policy that may still be reactive to economic growth. The disadvantage of this approach is of course that our fiscal policy measures are most likely to be endogenous to changes in growth during the crisis. When inserting the just-described fiscal policy proxies into the baseline model, we find counterintuitive signs for the coefficients of the 2008-2009 discretionary changes in the fiscal balance (positive) and government spending (negative); which may well be a consequence of reverse causality.[22] Nevertheless, the inclusion of these variables does not diminish the negative correlation of democracy with unexpected crisis growth (results not shown).

Other unreported regressions indicate that variables such as total inward remittances in 2007 (as a percentage of GDP), Gini coefficients of income inequality (from UNU-WIDER's World Income Inequality Database or WIID), or ethno-linguistic fractionalisation and polarisation indices (see Rodrik, 1999) also do not significantly impact on unexpected crisis growth or affect the democracy coefficient (apart from through changes in the country sample).

### *5.2.2. Country subsamples*

Column (2) of Table A.6 in Appendix applies Stata's 'robust regression' algorithm (the *rreg* command), which provides an iteratively reweighted alternative to simple OLS. After OLS estimation, this algorithm calculates for each observation Cook's D, a measure combining information about its leverage and residual, and drops all observations with D larger than one. Then an iterative process begins in which observation weights are derived from absolute residuals (using Huber and Tukey bisquare weighting functions) until the maximum change in weights of one iteration to the next falls below a certain threshold. While such 'robust regression' yields less efficient results than OLS, it weighs down outliers and other excessively influential observations; possibly an important problem in our rather limited sample (see Figures 2 and 3 and Section 5.2.1). It can be seen from column (2) that, although the democracy coefficient becomes smaller and significant only at the 25% level, it does retain its negative sign. Outliers may indeed have an effect on our findings, but at first sight do not entirely drive the negative democracy-unexpected crisis growth relation.[23]

Next, we verify whether results differ when restricting the analysis to certain developing country subsamples. Excluding oil exporters (based on the IMF's 2007 classification) returns a democracy coefficient that is even more negative than that in the baseline (column (3)); unsurprisingly so, as most oil-exporting countries buck the negative trend in Figure 2. Omission of the three Baltic states (Estonia, Latvia and Lithuania), where democracy and large growth declines during the crisis went together, lowers the point estimate of the democracy coefficient only marginally (column (4)).[24] The correlation between democracy and unexpected crisis growth is similarly robust to the exclusion of Eastern EU member states (Poland, Hungary, Bulgaria and Romania) (column (5)). Additional regressions confirm that neither financial centres (cf. Lane and Milesi-Ferretti, 2011) nor

[22] We acknowledge that further work is needed to construct better measures of discretionary fiscal policy.

[23] The robust regression algorithm results in Bahrain, Armenia and Libya being assigned a final weight of zero. Also the influences of Ukraine and Belarus are heavily discounted, with respective weights of 0.186 and 0.208.

[24] The reasons underlying the large crisis growth collapses in the Baltic states may be very specific and not well captured by our baseline model (as evident from the relatively large residuals for Latvia and Lithuania in Figure 3). In the case of Latvia, for example, Blanchard *et al.* (2010) point to the roles played by foreign ownership of the country's banks (especially by Nordic parent banks), domestic bank runs and a housing boom/bust, as well as a huge pre-crisis run-up in domestic credit and large current account deficits (two factors which we do control for in our models).

small (mostly island) states with a population of less than one million, play a major role in determining our findings.

Likewise, the statistical and economic significance of the democracy index survives the exclusion of both high-income and upper middle-income countries (column (6)). Only if we limit our sample to low-income countries (column (7)), bringing the number of observations down to 29, the coefficient of democracy loses its significance (as do most other explanatory variables).

### *5.2.3. Other crisis growth and democracy measures*

In columns (2)-(4) of Table A.7 in Appendix we substitute our preferred measure of (unexpected) crisis growth in turn by the 2007-2009 percentage point change in real GDP per capita growth[25]; real GDP per capita growth in 2009; and real GDP per capita growth in 2008. In the first two instances, the negative influence of democracy increases in economic and statistical significance relative to the baseline model. Pre-crisis democracy levels are negatively correlated with 2009 growth, whether the latter is expressed in relative terms (compared to pre-crisis forecasts or actual 2007 growth) or in absolute terms. When only 2008 growth is considered, the model loses most of its explanatory power, in line with our expectations (see footnote 9).

Finally, two alternative democracy measures are tried. In column (5) of Table A.7 we employ the well-known *checks and balances* variable from the Database of Political Institutions (DPI) (see Beck *et al.*, 2001). This variable proxies the number of effective, independent veto points in a country's political system, i.e., the number of decision makers whose agreement is needed to change policy, based on legislative and executive electoral rules, the number of governing parties, and their ideological orientations. After exclusion of outliers India and the Solomon Islands (which have 17 and eight veto points, respectively, compared to a maximum of six in all other countries), the results are again qualitatively similar and seemingly in line with the theoretical arguments about veto players we presented in Section 3.3. The checks and balances point estimate, although statistically significant only at the 25% level, indicates that one additional veto point in the political constellation reduces unexpected crisis growth, on average, with about 0.36 percentage points.

Column (6) uses the *democracy dummy* from the Democracy-Dictatorship (DD) dataset, a minimalist dichotomous measure of political regime. The DD data identify democracies as regimes in which both the chief executive office and the legislative body are filled by contested elections. This boils down to four necessary and sufficient conditions: (1) popular election, either direct or indirect, of the chief executive; (2) popular election of the legislature; (3) more than one party competing in the elections; and (4) an alternation of power that has taken place under the same electoral rules than the ones that brought the incumbent to office (which ensures the 'repeatability' of contested elections) (see Cheibub *et al.*, 2010). The DD dummy offers less nuance than more substantive, (polychotomous) measures such as our baseline Polity index or the DPI's checks and balances but, because of its simple and stark coding rules, reduces the room for subjectivity or measurement error. The coefficient of the DD dummy reveals that countries classified as non-democracies would outperform democracies with otherwise similar macroeconomic, financial and institutional features by about 1.4 percentage points of crisis growth; a growth difference which corresponds approximately to a two-standard-deviation change in the Polity index (cf. Section 5.1).

[25] We employed this measure, which is also used by Berg *et al.* (2011), as our baseline dependent variable in previous versions of the paper (see Essers, 2012).

In sum, from the preceding battery of tests it seems that the negative correlation between democracy and crisis growth is (surprisingly) robust. This result seems to go against the majority part of the related empirical literature, but is compatible with theoretical arguments about autocracies' greater decisiveness and insulation from populist demands (see Section 3.3). The next subsection does further probing in examining potential endogeneity issues.

### *5.2.4. Endogeneity*

Certainly, the foregoing does not necessarily imply that democracy has a negative *causal* effect on the differences between observed 2009 growth rates and their pre-crisis forecasts. Indeed, there is a real possibility of spurious correlation, whereby the negative democracy-unexpected crisis growth relation in our model reflects the correlation of both these variables with a third, unobserved factor; in which case the OLS estimator would be biased and inconsistent. Whereas we have tried to control for many different, potentially confounding factors already in the previous sections, it could still be that democracy is just a proxy for certain aspects of developing countries' economies that made them more vulnerable to the external shocks of the global crisis. One way to mitigate omitted variable bias and other potential problems, such as measurement error, in a non-experimental, cross-country setting as ours, is by means of instrumental variable (IV) estimation. Finding valid instruments that satisfy *both* conditions of exogeneity (i.e., instruments are uncorrelated with the error term of the model) *and* relevance (i.e., instruments are strongly correlated with the assumedly endogenous variable) is, as always, difficult.

After experimenting with various candidate instruments for democracy suggested in the literature (see e.g., Barro, 1999; Clague *et al.*, 2001), we have identified two types of instruments as having the greatest validity: first, variables linked to historical Western influence in developing countries, i.e., the fraction of a country's population having one of five primary Western European languages as mother tongue (from Hall and Jones, 1999) and the average temperature in degrees Celsius; and second, the average years of primary schooling for a country's population aged 25 and over (from Barro and Lee, 2013).[26]

The logic underlying the language instrument is that it proxies the extent to which Western Europe, mainly through colonisation, exerted influence on a developing country's 'social infrastructure', including the transmission of ideas and practices of democratic government (Hall and Jones, 1999). In a related manner, Acemoglu *et al.* (2001) have shown how Western European colonisers were more likely to settle and replicate, among other institutions, systems of checks and balances in natural climates similar of their own, i.e., with a similar disease environment and similarly moderate temperatures. This would suggest that, through an historical lock-in of more participatory political institutions, both language and mean temperature are correlated with current democracy levels but, conditional on the controls in our model, not directly with (unexpected) crisis growth.[27]

[26] The other variables we tried include: distance to the equator, colonial settler mortality, nationality of the former coloniser, legal origins, ethno-linguistic fractionalisation/polarisation, religion, male-female gap in years of primary schooling, and lagged Polity scores. All of these candidate instruments were found to be non-exogenous, irrelevant, and/or plagued by limited availability for our broad sample of countries.

[27] It could be argued that if the omitted variables are related to linkages with the advanced economies at the heart of the crisis, the proposed Western European language variable is perhaps not a convincing source of exogenous variation. However our baseline model already attempts to control for such links with the inclusion of the change in external demand growth (which captures the strength of export relations with Western European and other crisis-affected countries).

Glaeser *et al.* (2007) further argue that education induces higher civic engagement and broad-based participation among a country's citizens, necessary ingredients for the inception and survival of democracy. At the same time, one can plausibly make the argument that educational attainment, especially at the primary level, has no direct impact on (changes in) growth during the crisis (again conditional on the inclusion of the other explanatory variables; see further).

*Table 2. IV estimation results*

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
|---|---|---|---|---|---|---|---|
| Excluded instruments | % Eur. language | % Eur. language; mean temp. | % Eur. language; av. years primary schooling | % Eur. language; av. years primary schooling | % Eur. language; av. years primary schooling | % Eur. language; av. years primary schooling | % Eur. language; av. years primary schooling |
| *GDP per capita (log), 2007* | -0.7718* | -1.1815*** | -1.1896*** | -1.4055*** | -2.0219*** | -1.4693*** | -1.2938*** |
| | [0.4415] | [0.4229] | [0.4265] | [0.3577] | [0.6852] | [0.4702] | [0.4232] |
| *Av. GDP pc growth, 2004-2007* | -0.3426* | -0.4507*** | -0.5718** | -0.2907+ | -0.5175+ | -0.9764*** | -0.5796*** |
| | [0.1946] | [0.1638] | [0.2399] | [0.2194] | [0.3413] | [0.2271] | [0.2007] |
| *Av. GDP pc trend growth* | 0.3510* | 0.7710*** | 0.1443 | 0.4092+ | 0.3801 | -0.1601 | 0.1121 |
| | [0.2019] | [0.2590] | [0.3553] | [0.3018] | [0.4587] | [0.3514] | [0.3591] |
| *Domestic credit (% of GDP), 2007* | 0.0203 | 0.0086 | 0.0217 | 0.0000 | 0.0315 | 0.0164 | 0.0287 |
| | [0.0205] | [0.0125] | [0.0253] | [0.0127] | [0.0359] | [0.0251] | [0.0264] |
| *Dom. credit growth, 2000-2007* | -0.0248*** | -0.0118* | -0.0205*** | -0.0225*** | -0.0226* | -0.0257*** | -0.0212*** |
| | [0.0082] | [0.0066] | [0.0078] | [0.0065] | [0.0117] | [0.0096] | [0.0078] |
| *Trade openness, 2007* | 0.0494** | -0.0068 | 0.0574*** | 0.0508*** | 0.0430* | 0.0398* | 0.0546*** |
| | [0.0195] | [0.0189] | [0.0193] | [0.0180] | [0.0226] | [0.0226] | [0.0189] |
| *Ch. external demand growth, 2007-2009* | 1.7215*** | 0.7228+ | 2.1075*** | 2.2876*** | 2.4141*** | 1.3490** | 2.0367*** |
| | [0.6319] | [0.4969] | [0.5575] | [0.4998] | [0.5930] | [0.6702] | [0.5689] |
| *Financial openness, 2007* | -0.0096*** | 0.0070 | -0.0093*** | 0.0062 | 0.0172+ | -0.0099*** | -0.0094*** |
| | [0.0010] | [0.0056] | [0.0009] | [0.0082] | [0.0111] | [0.0008] | [0.0008] |
| *CAB (% of GDP), 2007* | 0.0768+ | -0.0038 | 0.0619+ | 0.0994** | 0.0963+ | 0.0013 | 0.0553+ |
| | [0.0546] | [0.0461] | [0.0412] | [0.0419] | [0.0632] | [0.0577] | [0.0346] |
| *Institutional quality, 2007* | -0.9842 | -0.3574 | 0.6170 | 0.4113 | -0.1355 | 0.3942 | 0.5150 |
| | [1.3186] | [0.8680] | [1.1389] | [0.9396] | [1.8414] | [1.1809] | [1.1030] |
| *Polity index, 2007* | 1.3029 | 0.1295 | 2.3584 | 1.8480 | 5.5272 | -1.8670 | |
| | [3.3665] | [1.8182] | [2.3504] | [2.0418] | [5.1313] | [2.7714] | |
| *Democracy dummy (DD), 2007* | | | | | | | 1.6214 |
| | | | | | | | [1.3304] |
| Observations | 97 | 74 | 83 | 79 | 68 | 83 | 85 |
| Shea partial $R^2$ | 0.1606 | 0.2619 | 0.3354 | 0.2791 | 0.1426 | 0.3354 | 0.3154 |
| Kleibergen-Paap rank Wald F | 25.4589 | 14.5549 | 27.6699 | 19.8522 | 6.7177 | 27.6699 | 22.7425 |
| Hansen J *p*-value | N/A | 0.8990 | 0.7517 | 0.3587 | 0.8414 | 0.9726 | 0.8076 |
| Endogeneity $\chi^2$ *p*-value | 0.3399 | 0.6373 | 0.0168 | 0.0273 | 0.0494 | 0.2212 | 0.0166 |

Notes: Dependent variable is unexpected real GDP per capita growth in 2009, apart from in column (6) where it is the 2007-2009 percentage point change in real GDP per capita growth. Sample countries, independent variables and excluded instruments as defined in the text and Tables A.1-A.2 in Appendix. Column (4) excludes outliers Bahrain, Armenia, Libya and Ukraine; column (5) excludes oil exporters. All models are estimated using the two-stage instrumental variable estimator (IV-2SLS) and include a constant term (coefficient not reported). Heteroskedasticity-robust (Huber-White) standard errors are reported in brackets. 'N/A' means statistic could not be calculated because specification is just identified. ***$p$<0.01; **$p$<0.05; *$p$<0.10; +$p$<0.20.

Table 2 presents the results of a number of (two-stage) IV estimations, with different instrument combinations. In column (1) of Table 2 our baseline Polity index is instrumented by the European language instrument only. The estimated democracy coefficient is now *positive* rather than negative, but has very large standard errors. This makes that a formal endogeneity test cannot reject the null hypothesis of the Polity-based measure being exogenous (in which case more efficient OLS would be preferred over the IV estimator).[28] Of course, such conclusions hinge on the quality and strength of our instruments. Therefore, we add, in turn, the temperature and the primary education variable as extra (excluded) instruments. Column (2) indicates that inclusion of the temperature instrument significantly reduces the sample and lowers the first-stage F statistic. However, it also shows that the Hansen J test of overidentification suggests instrument exogeneity is satisfied. When the language and primary schooling instruments are combined in column (3), this leads to improvements in the Shea partial $R^2$ of excluded instruments, a measure of instrument relevance that takes into account correlations among instruments, and in the first-stage F statistic. Both instrumental variables enter the first-stage regressions with a positive sign, as predicted by theory. Moreover, when compared to the critical values tabulated by Stock and Yogo (2005), the Kleibergen-Paap rank Wald F statistics lead to a rejection of the null of weak identification (which could introduce significant bias in the IV estimator, especially in small samples; see Bound *et al.*, 1995), more convincingly so than for the specifications of columns (1) and (2). Again the null of instrument exogeneity cannot be rejected on the basis of the Hansen J test. The estimated Polity index coefficient is again positive and has relatively large standard errors, although the estimation is somewhat more precise than in column (1). More importantly, we now *reject* the null that the Polity index can be treated as an exogenous variable at the 5% significance level. Endogeneity of democracy thus indeed seems to be an issue in our model. The negative correlation between democracy and unexpected crisis growth we uncovered before does not appear to be causal, but is probably due to omitted variables.

We have applied a number of additional robustness tests to our IV estimates.[29] First, in columns (4) and (5) of Table 2 we have re-estimated the IV model of column (3) (with language and primary schooling as the two instruments), but excluding from our sample Bahrain, Armenia, Libya and Ukraine (which were identified as outliers by the robust regression algorithm of Table A.6 in Appendix, column (2)) and all oil exporters, respectively. In both instances the point estimate for the Polity variable remains positive and imprecise. Exogeneity of the Polity index is also rejected at the 5% level, although the IV regression without oil-exporting countries may suffer from weak instrument problems (given the low Shea partial $R^2$ and Kleibergen-Paap F statistic in column (5)). Second, in column (6) we replace our baseline independent variable with the 2007-2009 percentage point change in real GDP per capita growth (cf. Table A.7 in Appendix, column (2)). This results in a Polity coefficient that is negative (as in our OLS estimations) but insignificant. The null of exogeneity

[28] The reported endogeneity test is in fact a heteroskedasticity-robust difference-in-Hansen test that compares a model where the suspect regressor (democracy) is treated as endogenous with one where the same regressor is treated as exogenous. We have checked that regression-based Wu-Hausman tests, whereby the residuals of the first stage of IV estimation are added to the main equation and tested for significance (a procedure suggested by Wooldridge, 2006, pp. 532-533), lead to very similar conclusions about the exogeneity of democracy as the tests shown in Table 2.

[29] Besides the robustness tests discussed here, we have also attempted IV estimations of the model with a squared Polity index included (cf. Table 1, column (6)). We have thereby followed Wooldridge (2002, pp. 235-237) in employing the square of the predicted value of the Polity index from the first stage of IV estimation as an additional instrument for the Polity index itself and its square in the main equation. The coefficients of such a model are, however, very imprecisely estimated.

cannot be rejected at conventional significance levels in this case.[30] Third, in column (7) of Table 2 we revert back to the model with unexpected crisis growth but replace the Polity-based measure with the DD democracy dummy (cf. Table A.7 in Appendix, column (6)). The results are again in line with those of column (3). Controlling for endogeneity, democracy can be linked positively to unexpected crisis growth. The democracy dummy coefficient is significant at the 25% significance level and the usual tests suggest instrument exogeneity and relevance.[31]

Finally, we have further examined the exclusion restriction of our primary schooling instrument. One could perhaps argue that primary schooling is related with higher educational attainment, which in itself may not be exogenous to crisis growth (because of the importance of human capital for overall economic and financial sector development, for example). This would invalidate the exogeneity of primary educational attainment and call for its inclusion in the main equation. Unreported IV regressions where average years of secondary and tertiary schooling (instead of primary schooling) are used as instruments for democracy indeed indicate, based on Hansen J tests, that such instruments are not exogenous. However, if we add secondary and tertiary schooling to the main equation and instrument democracy with the primary schooling and language variables, we again find a positive effect of democracy on unexpected crisis growth (and a clear rejection of the weak instrument null). In fact, this positive effect is significant at the 15% level when we use the Polity index, and even at the 10% level for the DD democracy dummy.

## 6. Concluding remarks

This paper has examined whether democratic features can explain part of the variation in developing countries' (changes in) economic growth during the global crisis, thereby complementing other recent studies on the Great Recession which have looked almost exclusively at macroeconomic and financial determinants. Evidence from simple OLS models with about 100 country observations hints at a statistically and economically significant negative correlation between democracy and crisis growth. We find this relation to be surprisingly robust to the use of different sets of control variables, changes in the country sample, and alternative definitions for crisis growth or democracy. These first results are compatible with the 'autocratic advantage' interpretation of China's managing of the crisis. They are also in line with theoretical hypotheses of checks and balances reducing flexibility and decisiveness in governments' reaction to crisis and democracies' susceptibility to populist demands.

Once we control for the endogeneity of democracy by means of IV estimation, however, the negative correlation between democracy and crisis growth disappears; in our preferred specifications, the estimated effect even turns positive. This brings our conclusions closer to those of most earlier empirical studies on developing countries' resilience to all sorts of shocks and crises, which typically suggest that democracy helps countries in overcoming shocks and keeping up growth

[30] This is exactly why in a previous version of the current paper, where we used the 2007-2009 change in growth as our main dependent variable, we cautiously concluded that 'even when taking into account endogeneity issues, democracy can still be negatively linked to crisis growth' (Essers, 2012, p. 29).

[31] Wooldridge (2002) shows that normal IV procedures remain valid when the endogenous, instrumented variable is a dummy. Very similar results are obtained if we follow the alternative procedure suggested by Wooldridge (2002, pp. 623-624), whereby the predicted value of the DD democracy dummy from a first-stage probit model is used as an instrument for the original DD democracy dummy in the main equation.

(most notably, Rodrik, 1999). That notwithstanding, there are a number of important caveats that need emphasising.

First, strict causality remains, admittedly, difficult to establish in our small, non-experimental, cross-country set-up and the credibility of our results largely hinges on the validity of the language and primary schooling instruments we propose. Although our best IV estimations do not seem to suffer from weak instrument problems, the positive democracy coefficient is only very imprecisely estimated. We hope that future research can reduce remaining endogeneity concerns about our proposed instruments and/or find new, more convincing and stronger sources of exogenous variation. This would be helpful in judging the approximate size of the average effect of democracy on crisis growth.

Second, our results are limited to only one particular spell of external shocks, the Great Recession of 2008-2009. Given that for many individual developing countries the global crisis was less severe than previous, more idiosyncratic crises (Berg *et al.*, 2011) and of external rather than domestic origin, it may be unwise to extrapolate; even if our findings so far seem to be in line with the majority of the related empirical literature.

Third, we have attempted to identify the *net* effect of democracy on crisis growth, treating the underlying forces largely as a 'black box' yet to be opened. Why exactly may democracy have helped growth during the 2008-2009 crisis, as it did during earlier shock and crisis periods? Was it because of greater credibility of policy commitments, lower 'human fallibility' (Sah, 1991), less distortive rent-seeking by interest groups, or something else? Did the effect run through differences in fiscal, monetary or exchange rate policies between more and less democratic countries? Additional empirical research will be necessary to provide persuasive answers to these questions and disentangle the exact channels through which democracy, in its various aspects, influenced developing countries' growth paths during the global crisis. The current paper is also silent on how any costs related to lower growth during the crisis were distributed within countries and whether there are differences between democracies and autocracies in this area. We believe this to be another promising avenue for follow-up work. We have only just begun to scratch the surface.

# Appendices

*Table A.1. Country sample by income group*

| Low-income | | Lower middle-income | | Upper middle-income | | High-income | |
|---|---|---|---|---|---|---|---|
| Afghanistan* | AFG | Albania | ALB | Argentina | ARG | Antigua and Barbuda* | ATG |
| Bangladesh | BGD | **Algeria** | DZA | Belarus | BLR | Bahamas, The* | BHS |
| Benin | BEN | **Angola** | AGO | *Belize** | BLZ | ***Bahrain*** | BHR |
| Burkina Faso* | BFA | Armenia | ARM | Botswana* | BWA | Barbados* | BRB |
| Burundi* | BDI | **Azerbaijan** | AZE | Brazil | BRA | Brunei Darussalam* | BRN |
| Cambodia | KHM | Bhutan* | BTN | Bulgaria | BGR | **Equatorial Guinea** | GNQ |
| Central African Republic | CAF | Bolivia | BOL | Chile | CHL | Estonia | EST |
| Chad | TCD | Bosnia and Herzegovina* | BIH | Costa Rica* | CRI | Hungary | HUN |
| Comoros | COM | Cameroon | CMR | Croatia | HRV | **Kuwait** | KWT |
| Congo, Dem. Rep. of* | COD | Cape Verde* | CPV | Dominica* | DMA | **Oman** | OMN |
| Côte d'Ivoire | CIV | China | CHN | Fiji | FJI | **Qatar** | QAT |
| Eritrea* | ERI | Colombia | COL | **Gabon** | GAB | **Saudi Arabia** | SAU |
| Ethiopia | ETH | **Congo, Rep. of** | COG | Grenada* | GRD | **United Arab Emirates** | ARE |
| Gambia, The | GMB | Djibouti* | DJI | Jamaica* | JAM | | |
| Ghana* | GHA | Dominican Republic | DOM | Kazakhstan | KAZ | | |
| Guinea* | GIN | **Ecuador** | ECU | Latvia | LVA | | |
| Guinea-Bissau* | GNB | Egypt | EGY | Lebanon | LBN | | |
| Haiti | HTI | El Salvador | SLV | **Libya** | LBY | | |
| Kenya | KEN | Georgia | GEO | Lithuania | LTU | | |
| Kyrgyz Republic | KGZ | Guatemala | GTM | Malaysia | MYS | | |
| Lao PDR | LAO | Guyana | GUY | *Mauritius* | MUS | | |
| *Liberia** | LBR | Honduras | HND | Mexico | MEX | | |
| Madagascar | MDG | India | IND | *Panama* | PAN | | |
| Malawi | MWI | Indonesia | IDN | Poland | POL | | |
| Mali | MLI | **Iran** | IRN | Romania | ROU | | |
| Mauritania* | MRT | Jordan | JOR | **Russia** | RUS | | |
| Mozambique | MOZ | Kiribati* | KIR | Serbia* | SRB | | |
| Myanmar* | MMR | Lesotho* | LSO | *Seychelles** | SYC | | |
| Nepal | NPL | Macedonia, FYR | MKD | South Africa | ZAF | | |
| Niger* | NER | Maldives* | MDV | St. Kitts and Nevis* | KNA | | |
| **Nigeria** | NGA | Moldova | MDA | St. Lucia* | LCA | | |
| Pakistan | PAK | Mongolia | MNG | *St. Vincent and the Grenadines** | VCT | | |
| Papua New Guinea | PNG | Morocco | MAR | Suriname* | SUR | | |
| Rwanda* | RWA | Namibia* | NAM | Turkey | TUR | | |
| São Tomé and Príncipe* | STP | Nicaragua* | NIC | Uruguay | URY | | |
| Senegal | SEN | Paraguay | PRY | **Venezuela** | VEN | | |
| Sierra Leone | SLE | Peru | PER | | | | |
| Solomon Islands | SLB | Philippines | PHL | | | | |
| Tajikistan | TJK | *Samoa** | WSM | | | | |
| Tanzania* | TZA | Sri Lanka | LKA | | | | |
| Togo | TGO | **Sudan** | SDN | | | | |
| Uganda | UGA | Swaziland* | SWZ | | | | |
| Uzbekistan* | UZB | **Syrian Arab Republic** | SYR | | | | |
| Vietnam | VNM | Thailand | THA | | | | |
| **Yemen*** | YEM | Timor-Leste* | TLS | | | | |
| Zambia | ZMB | Tonga* | TON | | | | |
| | | Tunisia | TUN | | | | |
| | | **Turkmenistan*** | TKM | | | | |
| | | Ukraine | UKR | | | | |
| | | *Vanuatu** | VUT | | | | |

Notes: Table contains all 145 emerging and developing countries (IMF WEO classification) for which unexpected growth in 2009 could be calculated. Country codes are official ISO alpha-3 codes. World Bank income group classification, based on 2007 GNI per capita in US$ (Atlas method) is the following: low-income (≤ US$935), lower middle-income (US$936 - US$3,705), upper middle-income (US$3,706 - US$11,455), high-income (> US$11,455). 48 countries with stars are *not* included in baseline regression (Table 1, column (4)) due to missings for one or more independent variables. Countries in bold were classified as fuel exporters in 2007 by the IMF. Countries in italics were classified as financial centres in Lane and Milesi-Ferretti (2011).

*Table A.2. Definitions, sources and descriptive statistics of baseline variables*

| Variable | Definition | Source | Obs. | Mean | Std. dev. | Min. | Max. |
|---|---|---|---|---|---|---|---|
| **Dependent** | | | | | | | |
| Unexpected real GDP per capita growth, 2009 | Difference between real GDP per capita growth in 2009 and the April 2008 forecast of real GDP per capita growth in 2009 (in percentage points) | IMF World Economic Outlook (WEO) | 145 | -4.8555 | 5.4955 | -30.0632 | 12.2674 |
| **Independent** | | | | | | | |
| GDP per capita, 2007 | Natural logarithm of nominal GDP per capita in 2007 (in current US$) | WEO | 145 | 7.7505 | 1.3127 | 4.8292 | 11.0952 |
| Average GDP per capita growth, 2004-2007 | Geometric mean of real GDP per capita growth over 2004-2007 (in %) | WEO | 144 | 4.2825 | 3.4636 | -3.5575 | 24.0325 |
| Average GDP per capita trend growth | Geometric mean of real GDP per capita growth over 1990-2007 (or 1995-2007 for CEE and CIS countries with missing data) (in %) | WEO | 134 | 2.5471 | 2.8123 | -4.2350 | 18.7322 |
| Domestic credit, 2007 | Domestic credit to the private sector (in % of GDP) | World Bank World Development Indicators (WDI) | 137 | 39.2731 | 29.5903 | 2.4846 | 162.4562 |
| Domestic credit growth, 2000-2007 | Cumulative growth of domestic credit to the private sector as a percentage of GDP over 2000-2007 (in %) | WDI | 133 | 35.8380 | 59.0511 | -150.7920 | 184.5996 |
| Trade openness, 2007 | Sum of exports and imports of goods and services (in % of GDP) | WDI | 133 | 93.8864 | 39.4744 | 25.2111 | 224.6584 |
| Change in external demand growth, 2007-2009 | Bilateral export share-weighted difference between real GDP per capita growth in 2009 and real GDP per capita growth in 2007 of trading partner countries, scaled by 2007 exports-to-GDP ratio (in percentage points) | IMF Direction of Trade Statistics (DOTS); WEO; WDI | 126 | -2.8293 | 1.9224 | -13.4988 | -0.5680 |
| Financial openness, 2007 | Sum of total financial assets (portfolio equity, FDI, debt, foreign exchange reserves, derivatives) and total financial liabilities (portfolio equity, FDI, debt, derivatives) (in % of GDP) | External Wealth of Nations (EWN) Mark II database; see Lane and Milesi-Ferretti (2007) | 141 | 180.6943 | 219.2811 | 46.3584 | 2335.8710 |
| Current account balance, 2007 | Current account balance (in % of GDP) | WEO | 145 | -1.6812 | 31.1543 | -43.1600 | 329.0340 |
| Institutional quality, 2007 | Average of five governance indicators that capture perceptions on dimensions of 'political stability and absence of violence/terrorism', 'government effectiveness', 'regulatory quality', 'rule of law' and 'control of corruption' | World Bank Worldwide Governance Indicators (WGI); see Kaufmann *et al.* (2010) | 145 | -0.3444 | 0.6782 | -1.8103 | 1.1790 |
| Polity index, 2007 | 0-to-1 transformation of the (revised) Polity score, which combines institutionalised democracy and autocracy scores, and captures how a country regime performs on dimensions of 'competitiveness/openness of executive recruitment', 'regulation/competitiveness of participation' and 'chief executive constraints' | University of Maryland Polity IV Project database; see Marshall *et al.* (2013) | 124 | 0.6250 | 0.3154 | 0 | 1 |

*Table A.3. Pearson correlation matrix of explanatory variables*

| | *Polity index, 2007* | *GDP per capita (log), 2007* | *Av. GDP pc growth, 2004-2007* | *Av. GDP pc trend growth* | *Domestic credit (% of GDP), 2007* | *Dom. credit growth, 2000-2007* | *Trade openness, 2007* | *Ch. external demand growth, 2007-2009* | *Financial openness, 2007* | *Current account balance(% of GDP), 2007* | *Institutional quality, 2007* |
|---|---|---|---|---|---|---|---|---|---|---|---|
| *Polity index, 2007* | 1.0000 | | | | | | | | | | |
| *GDP per capita (log), 2007* | -0.0243 | 1.0000 | | | | | | | | | |
| *Av. GDP pc growth, 2004-2007* | -0.0368 | 0.1445 | 1.0000 | | | | | | | | |
| *Av. GDP pc trend growth* | -0.1511 | 0.2746* | 0.6644* | 1.0000 | | | | | | | |
| *Domestic credit (% of GDP), 2007* | 0.0300 | 0.5212* | 0.0858 | 0.1981* | 1.0000 | | | | | | |
| *Dom. credit growth, 2000-2007* | 0.0310 | 0.0434 | 0.3696* | 0.2523* | 0.0975 | 1.0000 | | | | | |
| *Trade openness, 2007* | -0.0819 | 0.2650* | 0.0954 | 0.1768* | 0.3558* | 0.1863* | 1.0000 | | | | |
| *Ch. external demand growth, 2007-2009* | 0.1677 | -0.4662* | -0.3254* | -0.4250* | -0.3895* | -0.2749* | -0.6677* | 1.0000 | | | |
| *Financial openness, 2007* | -0.0843 | 0.2630* | -0.0829 | -0.0045 | 0.2835* | -0.0100 | 0.3962* | -0.2143* | 1.0000 | | |
| *Current account balance(% of GDP), 2007* | -0.0850 | -0.0112 | -0.0965 | 0.0098 | -0.1140 | -0.1759* | -0.1961* | -0.1117 | 0.1988* | 1.0000 | |
| *Institutional quality, 2007* | 0.2363* | 0.6744* | 0.0317 | 0.1198 | 0.6434* | 0.0378 | 0.3019* | -0.2716* | 0.2513* | -0.1529 | 1.0000 |

Notes: Sample countries, ISO codes and variables as defined in Tables A.1-A.2 in Appendix. Pearson correlation coefficients are calculated with pairwise deletion of missing data. *$p$<0.05.

*Table A.4. Baseline estimation results with interaction terms*

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
|---|---|---|---|---|---|---|---|---|---|---|
| Variable interacted with Polity index (V) | GDP per capita (log), 2007 | Av. GDP pc growth, 2004-2007 | Av. GDP pc trend growth | Domestic credit (% of GDP), 2007 | Dom. credit growth, 2000-2007 | Trade openness, 2007 | Ch. external demand growth, 2007-2009 | Financial openness, 2007 | CAB (% of GDP), 2007 | Institutional quality, 2007 |
| *V* | -0.7763+ | -0.5918*** | -0.0739 | 0.0195 | -0.0247*** | 0.0406** | 1.4750*** | 0.0030 | 0.0622+ | -0.4746 |
| | [0.4827] | [0.2211] | [0.2823] | [0.0214] | [0.0075] | [0.0202] | [0.5539] | [0.0047] | [0.0425] | [1.2535] |
| *Polity index, 2007* | -2.2002* | -2.6133** | -2.5405** | -2.1427* | -2.2268* | -2.0855* | -1.8955* | -1.7510+ | -2.3962** | -2.1718* |
| | [1.1411] | [1.1239] | [1.1757] | [1.1676] | [1.1246] | [1.1179] | [1.0672] | [1.1493] | [1.1802] | [1.2112] |
| *Polity index × V* | 0.2841 | -1.2615** | -1.6628** | 0.0025 | -0.0496** | -0.0114 | 1.2728** | 0.0281*** | 0.1501 | 0.4160 |
| | [0.9641] | [0.4909] | [0.6434] | [0.0361] | [0.0196] | [0.0340] | [0.6128] | [0.0093] | [0.1241] | [2.1085] |
| Observations | 97 | 97 | 97 | 97 | 97 | 97 | 97 | 97 | 97 | 97 |
| $R^2$ | 0.6118 | 0.6567 | 0.6665 | 0.6116 | 0.6401 | 0.6119 | 0.6238 | 0.6411 | 0.6187 | 0.6117 |
| Adjusted $R^2$ | 0.5564 | 0.6077 | 0.6188 | 0.5561 | 0.5887 | 0.5565 | 0.5700 | 0.5899 | 0.5643 | 0.5562 |

Notes: Dependent variable is unexpected real GDP per capita growth in 2009. Sample countries and independent variables as defined in Tables A.1-A.2 in Appendix. All models are estimated using OLS and include all (ten) baseline regressors of Table 1, column (4) and a constant term. Only coefficients of Polity-based democracy measure, of variable interacted with this measure, and of multiplicative interaction term are reported. Variables are centred around baseline sample mean before interaction. Heteroskedasticity-robust (Huber-White) standard errors are reported in brackets. ***$p$<0.01; **$p$<0.05; *$p$<0.10; +$p$<0.20.

*Table A.5. Robustness - changes in control variables*

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| *GDP per capita (log), 2007* | -0.7820+ | -1.0807** | -0.8914* | -1.1064** | -1.1745 | -0.6797+ |
| | [0.4728] | [0.5395] | [0.4691] | [0.4309] | [0.9339] | [0.4848] |
| *Av. GDP pc growth, 2004-2007* | -0.2956+ | -0.1637 | -0.3127+ | -0.2739+ | -0.4309 | -0.2227+ |
| | [0.1830] | [0.2283] | [0.1896] | [0.1851] | [0.3439] | [0.1649] |
| *Av. GDP pc trend growth* | 0.2602 | -0.0173 | 0.2278 | 0.2687 | -0.3513 | 0.1551 |
| | [0.2394] | [0.5848] | [0.2281] | [0.2424] | [0.4812] | [0.2499] |
| *Domestic credit (% of GDP), 2007* | 0.0195 | 0.0109 | 0.0226 | 0.0144 | 0.0519+ | 0.0154 |
| | [0.0212] | [0.0213] | [0.0212] | [0.0194] | [0.0370] | [0.0211] |
| *Dom. credit growth, 2000-2007* | -0.0256*** | -0.0243** | -0.0267*** | -0.0230** | -0.0339*** | -0.0320*** |
| | [0.0084] | [0.0095] | [0.0086] | [0.0089] | [0.0098] | [0.0080] |
| *Trade openness, 2007* | 0.0413** | 0.0400+ | 0.0249+ | 0.0304+ | 0.0329 | 0.0391** |
| | [0.0194] | [0.0274] | [0.0158] | [0.0235] | [0.0277] | [0.0185] |
| *Ch. external demand growth, 2007-2009* | 1.6249** | 1.6231** | | 1.6174** | 1.5122* | 1.4075** |
| | [0.6480] | [0.8084] | | [0.7797] | [0.8433] | [0.6291] |
| *Financial openness, 2007* | -0.0102*** | -0.0101*** | -0.0097*** | | -0.0094*** | -0.0101*** |
| | [0.0011] | [0.0012] | [0.0012] | | [0.0015] | [0.0013] |
| *CAB (% of GDP), 2007* | 0.0376 | 0.0149 | 0.0196 | 0.0483 | 0.0104 | 0.0552+ |
| | [0.0402] | [0.0456] | [0.0421] | [0.0479] | [0.0547] | [0.0390] |
| *Institutional quality, 2007* | -0.4890 | | -0.4116 | -0.5842 | 0.2451 | -0.6913 |
| | [1.2406] | | [1.2765] | [1.2043] | [1.7192] | [1.2253] |
| *Polity index, 2007* | -2.1326* | -3.1529** | -2.5657** | -2.3835** | -1.9386 | -2.4266* |
| | [1.1607] | [1.3785] | [1.1587] | [1.1341] | [1.8312] | [1.2838] |
| *Institutional quality (ICRG), 2007* | | 0.9686 | | | | |
| | | [0.8168] | | | | |
| *Unexpected external demand growth, 2009* | | | 1.6191** | | | |
| | | | [0.6995] | | | |
| *BIS international bank claims (% of GDP), 2007* | | | | 0.0068 | | |
| | | | | [0.0309] | | |
| *Stock market capitalisation (% of GDP), 2007* | | | | | -0.0163+ | |
| | | | | | [0.0114] | |
| *Pegged exchange rate, 2007* | | | | | | -0.4883 |
| | | | | | | [0.8225] |
| Observations | 97 | 82 | 97 | 94 | 59 | 95 |
| $R^2$ | 0.6115 | 0.6206 | 0.6037 | 0.5398 | 0.7273 | 0.6320 |
| Adjusted $R^2$ | 0.5613 | 0.5610 | 0.5524 | 0.4780 | 0.6562 | 0.5782 |

Notes: Dependent variable is unexpected real GDP per capita growth in 2009. Sample countries and independent variables as defined in the text and Tables A.1-A.2 in Appendix. Column (1) reproduces baseline model (cf. Table 1, column (4)). Financial centres as defined by Lane and Milesi-Ferretti (2011) are excluded from the model in column (4). All models are estimated using OLS and include a constant term (coefficient not reported). Heteroskedasticity-robust (Huber-White) standard errors are reported in brackets. ***$p$<0.01; **$p$<0.05; *$p$<0.10; +$p$<0.20.

*Table A.6. Robustness - country subsamples*

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
|---|---|---|---|---|---|---|---|
| Sample | Baseline | Baseline (weighted) | Excl. oil exporters | Excl. Baltic states | Excl. Eastern EU states | Excl. high- and upper-middle income | Only low-income |
| *GDP per capita (log), 2007* | -0.7820+ | -1.3976*** | -0.8841+ | -0.8442* | -0.8798* | -1.4308* | -1.6250 |
| | [0.4728] | [0.4367] | [0.6349] | [0.4915] | [0.4629] | [0.7206] | [1.4700] |
| *Av. GDP pc growth, 2004-2007* | -0.2956+ | -0.1208 | -0.1389 | -0.3045* | -0.3017* | -0.1542 | 0.0333 |
| | [0.1830] | [0.1246] | [0.2210] | [0.1760] | [0.1741] | [0.1631] | [0.2725] |
| *Av. GDP pc trend growth* | 0.2602 | 0.3935** | -0.1718 | 0.2640 | 0.3260+ | -0.0605 | 0.1348 |
| | [0.2394] | [0.1547] | [0.4071] | [0.2348] | [0.2308] | [0.5412] | [0.4156] |
| *Domestic credit (% of GDP), 2007* | 0.0195 | -0.0022 | 0.0102 | 0.0221 | 0.0247 | 0.0162 | 0.0755+ |
| | [0.0212] | [0.0144] | [0.0229] | [0.0220] | [0.0212] | [0.0364] | [0.0476] |
| *Dom. credit growth, 2000-2007* | -0.0256*** | -0.0283*** | -0.0238** | -0.0244*** | -0.0260*** | -0.0238** | -0.0355*** |
| | [0.0084] | [0.0059] | [0.0110] | [0.0084] | [0.0089] | [0.0108] | [0.0121] |
| *Trade openness, 2007* | 0.0413** | 0.0313* | 0.0159 | 0.0232 | 0.0428** | 0.0437 | -0.0423 |
| | [0.0194] | [0.0180] | [0.0247] | [0.0219] | [0.0196] | [0.0396] | [0.0383] |
| *Ch. external demand growth, 2007-2009* | 1.6249** | 1.9306*** | 1.3276* | 1.0916+ | 1.8044*** | 2.1403* | 0.0601 |
| | [0.6480] | [0.4184] | [0.7520] | [0.7312] | [0.6730] | [1.1060] | [1.0560] |
| *Financial openness, 2007* | -0.0102*** | 0.0105* | 0.0112+ | -0.0100*** | -0.0102*** | 0.0007 | 0.0289 |
| | [0.0011] | [0.0058] | [0.0084] | [0.0011] | [0.0009] | [0.0159] | [0.0286] |
| *CAB (% of GDP), 2007* | 0.0376 | 0.1086*** | 0.1165** | 0.0128 | 0.0534+ | 0.1821*** | 0.2245** |
| | [0.0402] | [0.0354] | [0.0534] | [0.0397] | [0.0411] | [0.0465] | [0.0823] |
| *Institutional quality, 2007* | -0.489 | 0.3613 | -0.2131 | -0.3160 | -0.7851 | 0.8154 | 1.0263 |
| | [1.2406] | [0.8265] | [1.2813] | [1.2392] | [1.2473] | [1.3991] | [2.2846] |
| *Polity index, 2007* | -2.1326* | -1.4857 | -3.5734** | -2.0392* | -2.5265** | -2.8721* | -0.4974 |
| | [1.1607] | [1.1806] | [1.7670] | [1.0977] | [1.1702] | [1.5021] | [2.5927] |
| Observations | 97 | 94 | 77 | 94 | 93 | 64 | 29 |
| $R^2$ | 0.6115 | 0.3929 | 0.5992 | 0.5378 | 0.6328 | 0.5132 | 0.5217 |
| Adjusted $R^2$ | 0.5613 | 0.3114 | 0.5314 | 0.4758 | 0.5830 | 0.4103 | 0.2123 |

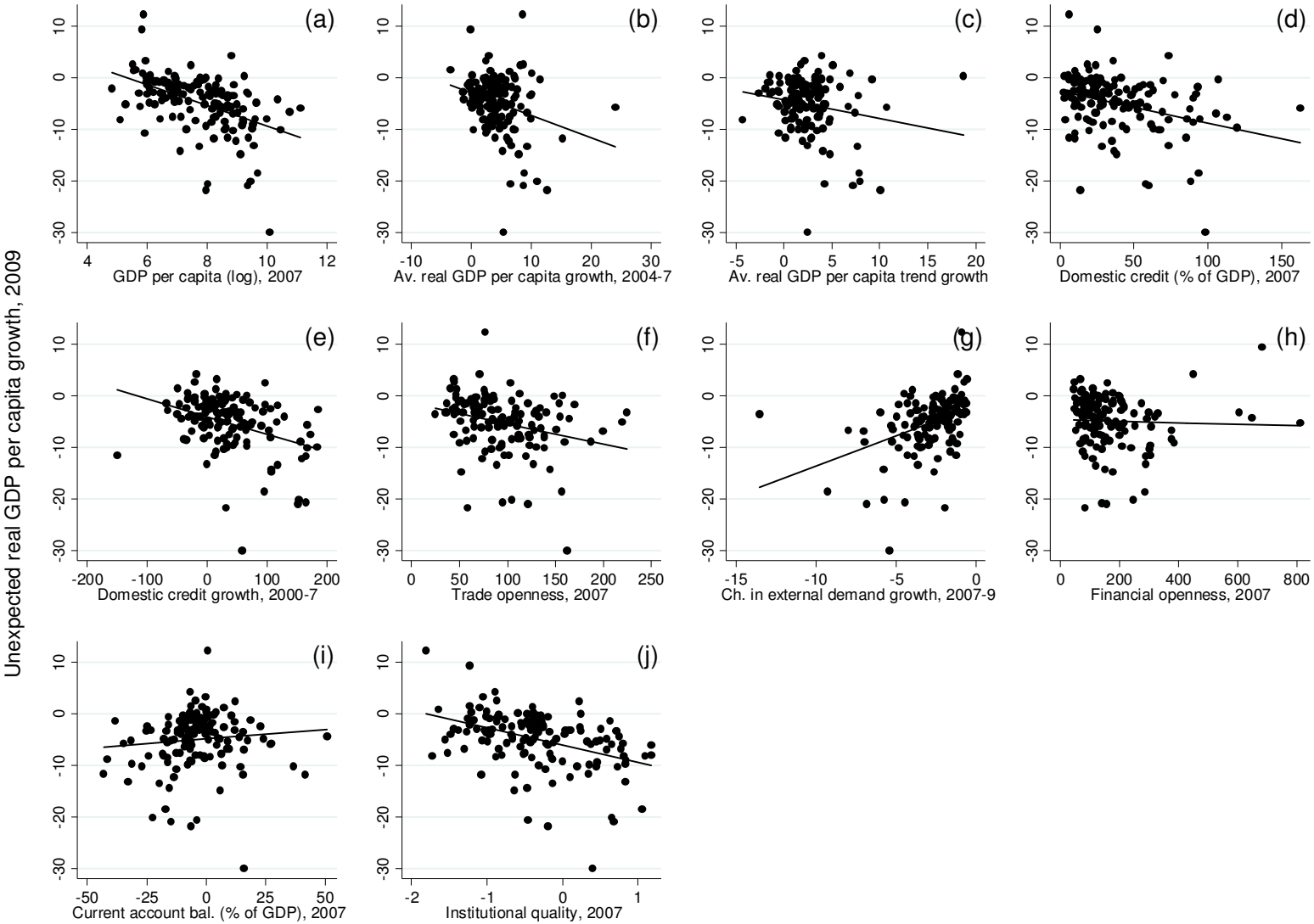
Notes: Dependent variable is unexpected real GDP per capita growth in 2009. Sample countries and independent variables as defined in the text and Tables A.1-A.2 in Appendix. Column (1) reproduces baseline model (cf. Table 1, column (4)). Model in column (2) is estimated using Stata's robust regression algorithm (*rreg* command). All other models are estimated using OLS and include a constant term (coefficient not reported). Heteroskedasticity-robust (Huber-White) standard errors are reported in brackets. ***$p$<0.01; **$p$<0.05; *$p$<0.10; +$p$<0.20.

*Table A.7. Robustness - other crisis growth and democracy measures*

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| Dependent variable | Baseline | 2007-2009 change in real GDP pc growth | GDP pc growth in 2009 | GDP pc growth in 2008 | Baseline | Baseline |
| *GDP per capita (log), 2007* | -0.7820+ | -1.3434*** | -1.2367** | -0.2955 | -0.9371* | -0.7842* |
| | [0.4728] | [0.5010] | [0.5110] | [0.3336] | [0.5157] | [0.4571] |
| *Av. GDP pc growth, 2004-2007* | -0.2956+ | -0.6236*** | 0.1131 | 0.3650*** | -0.3410* | -0.2544+ |
| | [0.1830] | [0.2097] | [0.1874] | [0.1013] | [0.1860] | [0.1594] |
| *Av. GDP pc trend growth* | 0.2602 | -0.2765 | 0.1843 | 0.2098** | 0.2221 | 0.1860 |
| | [0.2394] | [0.2242] | [0.2235] | [0.0989] | [0.2529] | [0.2377] |
| *Domestic credit (% of GDP), 2007* | 0.0195 | 0.0227 | 0.0164 | -0.0200+ | 0.0177 | 0.0066 |
| | [0.0212] | [0.0217] | [0.0228] | [0.0121] | [0.0199] | [0.0187] |
| *Dom. credit growth, 2000-2007* | -0.0256*** | -0.0277*** | -0.0212** | 0.0023 | -0.0247*** | -0.0264*** |
| | [0.0084] | [0.0099] | [0.0087] | [0.0051] | [0.0089] | [0.0084] |
| *Trade openness, 2007* | 0.0413** | 0.0190 | 0.0390* | 0.0300+ | 0.0313+ | 0.0425** |
| | [0.0194] | [0.0221] | [0.0230] | [0.0230] | [0.0192] | [0.0185] |
| *Ch. external demand growth, 2007-2009* | 1.6249** | 0.7565 | 1.3575* | 0.8004 | 1.2069** | 1.4013** |
| | [0.6480] | [0.6815] | [0.7014] | [0.7391] | [0.6018] | [0.5581] |
| *Financial openness, 2007* | -0.0102*** | -0.0107*** | -0.0103*** | 0.0001 | -0.0099*** | -0.0100*** |
| | [0.0011] | [0.0010] | [0.0012] | [0.0006] | [0.0011] | [0.0011] |
| *CAB (% of GDP), 2007* | 0.0376 | 0.0086 | 0.0544 | 0.0539+ | 0.0676* | 0.0479+ |
| | [0.0402] | [0.0502] | [0.0477] | [0.0371] | [0.0357] | [0.0339] |
| *Institutional quality, 2007* | -0.4890 | -0.4111 | -0.2807 | 0.9606 | -0.8845 | -0.3500 |
| | [1.2406] | [1.3022] | [1.3827] | [0.9076] | [1.2225] | [1.0986] |
| *Polity index, 2007* | -2.1326* | -4.8328*** | -3.5618*** | -0.1089 | | |
| | [1.1607] | [1.4230] | [1.3186] | [1.2607] | | |
| *Checks and balances, 2007* | | | | | -0.3644 | |
| | | | | | [0.3056] | |
| *Democracy dummy (DD), 2007* | | | | | | -1.4274* |
| | | | | | | [0.7578] |
| Observations | 97 | 97 | 97 | 97 | 99 | 109 |
| $R^2$ | 0.6115 | 0.6847 | 0.5286 | 0.2896 | 0.5839 | 0.5785 |
| Adjusted $R^2$ | 0.5613 | 0.6439 | 0.4676 | 0.1977 | 0.5312 | 0.5307 |

Notes: Dependent variable in the baseline model is unexpected real GDP per capita growth in 2009; other dependent variables as stated. Sample countries and independent variables as defined in the text and Tables A.1-A.2 in Appendix. Column (1) reproduces baseline model (cf. Table 1, column (4)). Outliers India and Solomon Islands are excluded from the model in column (5). All models are estimated using OLS and include a constant term (coefficient not reported). Heteroskedasticity-robust (Huber-White) standard errors are reported in brackets. ***$p$<0.01; **$p$<0.05; *$p$<0.10; +$p$<0.20.

*Figure A.1. Bivariate scatter plots: unexpected crisis growth vs. explanatory variables*




Notes: Sample countries and variables as defined in Tables A.1-A.2 in Appendix. Lines represent best linear fit. Extreme outliers are omitted for presentation purposes: panel (h) excludes Bahrain; panel (i) excludes Timor-Leste.

## References


Abiad, A., Furceri, D., Kalemli-Ozcan, S., and Pescatori, A. (2013). Dancing together? Spillovers, common shocks, and the role of financial and trade linkages. In: IMF (Ed.), *World Economic Outlook October 2013: Transitions and tensions* (pp. 81-111). Washington, DC: IMF.

Acemoglu, D., Johnson, S., and Robinson, J. A. (2001). The colonial origins of comparative development: An empirical investigation. *American Economic Review*, 91(5), 1369-1401.

Acemoglu, D., Johnson, S., Robinson, J. A., and Thaicharoen, Y. (2003). Institutional causes, macroeconomic symptoms: Volatility, crises and growth. *Journal of Monetary Economics*, 50(1), 49-123.

Acemoglu, D., Johnson, S., Robinson, J. A., and Yared, P. (2008). Income and democracy. *American Economic Review*, 98(3), 808-842.

Acemoglu, D., Johnson, S., Robinson, J. A., and Yared, P. (2009). Reevaluating the modernization hypothesis. *Journal of Monetary Economics*, 56(8), 1043-1058.

Acemoglu, D., and Robinson, J. A. (2012). *Why nations fail: The origins of power, prosperity and poverty*. London: Profile Books.

Afonso, A., Agnello, L., and Furceri, D. (2010). Fiscal policy responsiveness, persistence and discretion. *Public Choice*, 145(3), 503-530.

Aghion, P., Alesina, A., and Trebbi, F. (2004). Endogenous political institutions. *Quarterly Journal of Economics*, 119(2), 565-611.

Alesina, A., Ardagna, S., and Trebbi, F. (2006). Who adjusts and when? The political economy of reforms. *IMF Staff Papers*, 53(Special Issue), 1-29.

Alesina, A., and Drazen, A. (1991). Why are stabilizations delayed? *American Economic Review*, 82(5), 1170-1188.

Almeida, H., and Ferreira, D. (2002). Democracy and the variability of economic performance. *Economics and Politics*, 14(3), 225-257.

Amin, M., and Djankov, S. (2014). Democratic institutions and regulatory reforms. *Journal of Comparative Economics*, 42(4), 839-854.

Barro, R. J. (1996). Democracy and growth. *Journal of Economic Growth*, 1(1), 1-27.

Barro, R. J. (1999). Determinants of democracy. *Journal of Political Economy*, 107(S6), S158-S183.

Barro, R. J., and Lee, J. W. (2013). A new data set of educational attainment in the world, 1950-2010. *Journal of Development Economics*, 104(September 2013), 184-198.

Beck, T., Clarke, G., Groff, A., Keefer, P., and Walsh, P. (2001). New tools in comparative political economy: The database of political institutions. *World Bank Economic Review*, 15(1), 165-176.

Benhabib, J., Corvalán, A., and Spiegel, M. M. (2013). Income and democracy: Evidence from nonlinear estimations. *Economics Letters*, 118(3), 489-492.

Berg, A., Papageorgiou, C., Pattillo, C., Schindler, M., Spatafora, N., and Weisfeld, H. (2011). Global shocks and their impact on low-income countries: Lessons from the global financial crisis. *IMF Working Paper*, No. 11/27.

Berkmen, P., Gelos, G., Rennhack, R., and Walsh, J. P. (2012). The global financial crisis: Explaining cross-country differences in the output impact. *Journal of International Money and Finance*, 31(1), 42-59.

Birdsall, N. (2011). The global financial crisis: The beginning of the end of the 'development' agenda? In: N. Birdsall, and F. Fukuyama (Eds.), *New ideas on development after the financial crisis* (pp. 1-26). Baltimore, MD: John Hopkins University Press.

Blanchard, O. J., Das, M., and Faruqee, H. (2010). The initial impact of the crisis on emerging market countries. *Brookings Papers on Economic Activity*, 41(1), 263-315.

Bluhm, R., de Crombrugghe, D., and Szirmai, A. (2014). Do weak institutions prolong crises? On the identification, characteristics and duration of declines during economic slumps. *CESifo Working Paper*, No. 4594.

Bound, J., Jaeger, D. A., and Baker, R. M. (1995). Problems with instrumental variables estimation when the correlation between the instruments and the endogenous explanatory variable is weak. *Journal of the American Statistical Association*, 90(430), 443-450.

Braumoeller, B. F. (2004). Hypothesis testing and multiplicative interaction terms. *International Organization*, 58(4), 807-820.

Bueno de Mesquita, B., Morrow, J. D., Siverson, R. M., and Smith, A. (2002). Political institutions, policy choice and the survival of leaders. *British Journal of Political Science*, 32(4), 559-590.

Cavallo, A. F., and Cavallo, E. A. (2010). Are crises good for long-term growth? The role of political institutions. *Journal of Macroeconomics*, 32(3), 838-857.

Cecchetti, S., King, M. R., and Yetman, J. (2011). Weathering the financial crisis: Good policy or good luck? *BIS Working Paper*, No. 351.

Chang, H.-J. (2006). Understanding the relationship between institutions and economic development: Some key theoretical issues. *UNU-WIDER Discussion Paper*, No. 2006/05.

Cheibub, J. A., Ghandi, J., and Vreeland, J. R. (2010). Democracy and dictatorship revisited. *Public Choice*, 143(1-2), 67-101.

Chinn, M. D., and Ito, H. (2006). What matters for financial development? Capital controls, institutions, and interactions. *Journal of Development Economics*, 81(1), 163-192.

Claessens, S., Dell'Ariccia, G., Igan, D., and Laeven, L. (2010). Cross-country experiences and policy implications from the global financial crisis. *Economic Policy*, 25(62), 267-293.

Clague, C., Gleason, S., and Knack, S. (2001). Determinants of lasting democracy in poor countries: Culture, development, and institutions. *ANNALS of the American Academy of Political and Social Science*, 573(1), 16-41.

Collier, P., Goderis, B., and Hoeffler, A. (2006). Shocks and growth: Adaptation, precaution and compensation. Oxford University mimeo.

Cox, G. W., and McCubbins, M. D. (2001). The institutional determinants of economic policy outcomes. In: S. Haggard, and M. D. McCubbins (Eds.), *Presidents, parliaments and policies* (pp. 21-63). Cambridge: Cambridge University Press.

Didier, T., Hevia, C., and Schmukler, S. L. (2012). How resilient and countercyclical were emerging economies during the global crisis? *Journal of International Money and Finance*, 31(8), 2052-2077.

Doucouliagos, H., and Ulubasoglu, M. A. (2008). Democracy and economic growth: A meta-analysis. *American Journal of Political Science*, 52(1), 61-83.

Drazen, A. (2000). *Political economy in macroeconomics*. Princeton, NJ: Princeton University Press.

Drummond, P., and Ramirez, G. (2009). Spillovers from the rest of the world into Sub-Saharan African countries. *IMF Working Paper*, No. 09/155.

Easterly, W. (2011). Benevolent autocrats. New York University mimeo.

Easterly, W., and Pennings, S. (2014). How much do leaders explain growth? An exercise in growth accounting. New York University mimeo.

Essers, D. (2012). Democracy and external shock resilience in developing countries: Evidence from the Great Recession. *IOB Working Paper*, No. 2012.02.

Fatás, A., and Mihov, I. (2003). The case for restricting fiscal policy discretion. *Quarterly Journal of Economics*, 118(4), 1419-1447.

Fernández, R., and Rodrik, D. (1991). Resistance to reform: Status quo bias in the presence of individual-specific uncertainty. *American Economic Review*, 81(5), 1146-1155.

Foresti, M., Massa, I., Wild, L., and Harris, D. (2011). Responding to external shocks: Why state capacity and political incentives matter. *ODI Project Briefing*, No. 54.

Frankel, J. A., and Saravelos, G. (2012). Can leading indicators assess country vulnerability? Evidence from the 2008-09 global financial crisis. *Journal of International Economics*, 87(2), 216-231.

Furceri, D., and Zdzienicka, A. (2012). Banking crises and short and medium term output losses in emerging and developing countries: The role of structural and policy variables. *World Development*, 40(12), 2369-2378.

Giannone, D., Lenza, M., and Reichlin, L. (2011). Market freedom and the global recession. *IMF Economic Review*, 59(1), 111-135.

Giuliano, P., Mishra, P., and Spilimbergo, A. (2013). Democracy and reforms: Evidence from a new dataset. *American Economic Journal: Macroeconomics*, 5(4), 179-204.

Glaeser, E. L., La Porta, R., Lopez-de-Silanes, F., and Shleifer, A. (2004). Do institutions cause growth? *Journal of Economic Growth*, 9(3), 271-303.

Glaeser, E. L., Ponzetto, G. A. M., and Shleifer, A. (2007). Why does democracy need education? *Journal of Economic Growth*, 12(2), 77-99.

Gleditsch, K. S., and Ward, M. D. (1997). Double take: A reexamination of democracy and autocracy in modern polities. *Journal of Conflict Resolution*, 41(3), 361-383.

Gourinchas, P.-O., and Obstfeld, M. (2012). Stories of the twentieth century for the twenty-first. *American Economic Journal: Macroeconomics*, 4(1), 226-265.

Ha, E., and Kang, M.-K. (2015). Government policy responses to financial crises: Identifying patterns and policy origins in developing countries. *World Development*, 68(April 2015), 264-281.

Haggard, S., and MacIntyre, A. (1998). The political economy of the Asian economic crisis. *Review of International Political Economy*, 5(3), 381-392.

Haggard, S., and Webb, S. B. (1993). What do we know about the political economy of economic policy reform? *World Bank Research Observer*, 8(2), 143-168.

Hall, R. E., and Jones, C. I. (1999). Why do some countries produce so much more output per worker than others? *Quarterly Journal of Economics*, 114(1), 83-116.

Imbs, J. (2010). The first global recession in decades. *IMF Economic Review*, 58(2), 327-354.

IMF. (2009). *World Economic Outlook April 2009: Crisis and recovery*. Washington, DC: IMF.

Jones, B. A., and Olken, B. F. (2005). Do leaders matter? National leadership and growth since world war II. *Quarterly Journal of Economics*, 120(3), 835-864.

Kaufmann, D., Kraay, A., and Mastruzzi, M. (2010). The Worldwide Governance Indicators: Methodology and analytical issues. *World Bank Policy Research Working Paper*, No. 5430.

Keefer, P. (2002). Politics and the determinants of banking crises: The effects of political checks and balances. In: S. Hernández, and K. Schmidt-Hebbel (Eds.), *Banking, financial integration, and international crises* (pp. 85-112). Santiago: Central Bank of Chile.

Keefer, P. (2007). Elections, special interests, and financial crisis. *International Organization*, 61(3), 607-641.

Khan, M. H. (2010). Political settlements and the governance of growth-enhancing institutions. University of London SOAS mimeo.

Klomp, J., and de Haan, J. (2009). Political institutions and economic volatility. *European Journal of Political Economy*, 25(3), 311-326.

Knack, S., and Keefer, P. (1995). Institutions and economic performance: Cross-country tests using alternative institutional measures. *Economics and Politics*, 7(3), 207-227.

Lane, P. R., and Milesi-Ferretti, G. M. (2007). The external wealth of nations mark II: Revised and extended estimates of foreign assets and liabilities, 1970-2004. *Journal of International Economics*, 73(2), 223-250.

Lane, P. R., and Milesi-Ferretti, G. M. (2011). The cross-country incidence of the global crisis. *IMF Economic Review*, 59(1), 77-110.

Lardy, N. R. (2012). *Sustaining China's economic growth after the global financial crisis*. Washington, DC: Peterson Institute for International Economics.

Lindenberg, M., and Devarajan, S. (1993). Prescribing strong economic medicine: Revisiting the myths about structural adjustment, democracy and economic performance in developing countries. *Comparative Politics*, 25(2), 169-182.

Lipset, S. M. (1959). Some social requisites of democracy: Economic development and political legitimacy. *American Political Science Review*, 53(1), 69-105.

Llaudes, R., Salman, F., and Chivakul, M. (2010). The impact of the great recession on emerging markets. *IMF Working Paper*, No. 10/237.

Marshall, M. G., Gurr, T. R., and Jaggers, K. (2013). *Polity IV project: Political regime characteristics and transitions, 1800-2012. Dataset users' manual*. Vienna, VA: Centre for Systemic Peace.

Mobarak, A. M. (2005). Democracy, volatility, and economic development. *Review of Economics and Statistics*, 87(2), 348-361.

Montinola, G. R. (2003). Who recovers first? Banking crises resolution in developing countries. *Comparative Political Studies*, 36(5), 541-574.

Mulligan, C. B., Gil, R., and Sala-i-Martin, X. (2004). Do democracies have different public policies than nondemocracies? *Journal of Economic Perspectives*, 18(1), 51-74.

North, D. C. (1990). *Institutions, institutional change and economic performance*. New York, NY: Cambridge University Press.

North, D. C., and Weingast, B. R. (1989). Constitutions and commitment: The evolution of institutions governing public choice in seventeenth-century England. *Journal of Economic History*, 49(4), 803-832.

Pei, M. (2011). China's response to the global economic crisis. In: N. Birdsall, and F. Fukuyama (Eds.), *New ideas on development after the financial crisis* (pp. 111-132). Baltimore, MD: John Hopkins University Press.

Persson, T., and Tabellini, G. (2006). Democracy and development: The devil in the details. *American Economic Review*, 96(2), 319-324.

Pitlik, H. (2005). Are less constrained governments really more successful in executing market-oriented policy changes? *Hohenheimer Diskussionbeiträge*, No. 255.

Prati, A., Onorato, M. G., and Papageorgiou, C. (2013). Which reforms work and under what institutional environment? Evidence from a new dataset on structural reforms. *Review of Economics and Statistics*, 95(3), 946-968.

Przeworski, A., and Limongi, F. (1993). Political regimes and economic growth. *Journal of Economic Perspectives*, 7(3), 51-69.

Ramey, G., and Ramey, V. A. (1995). Cross-country evidence on the link between volatility and growth. *American Economic Review*, 85(5), 1138-1151.

Reinhart, C. M., and Rogoff, K. S. (2004). The modern history of exchange rate arrangements: A reinterpretation. *Quarterly Journal of Economics*, 119(1), 1-48.

Reinhart, C. M., and Rogoff, K. S. (2009). *This time is different: Eight centuries of financial folly*. Princeton, NJ: Princeton University Press.

Remmer, K. L. (1990). Democracy and economic crisis: The Latin American experience. *World Politics*, 42(3), 315-335.

Rodrik, D. (1999). Where did all the growth go? External shocks, social conflict, and growth collapses. *Journal of Economic Growth*, 4(4), 385-412.

Rodrik, D. (2000). Participatory politics, social cooperation and economic stability. *American Economic Review*, 90(2), 140-144.

Rodrik, D., Subramanian, A., and Trebbi, F. (2004). Institutions rule: The primacy of institutions over geography and integration in economic development. *Journal of Economic Growth*, 9(2), 131-165.

Rose, A. K., and Spiegel, M. M. (2010). Cross-country causes and consequences of the 2008 crisis: International linkages and American exposure. *Pacific Economic Review*, 15(3), 340-363.

Rose, A. K., and Spiegel, M. M. (2011). Cross-country causes and consequences of the crisis: An update. *European Economic Review*, 55(3), 309-324.

Rose, A. K., and Spiegel, M. M. (2012). Cross-country causes and consequences of the 2008 crisis: Early warning. *Japan and the World Economy*, 24(1), 1-16.

Sah, R. K. (1991). Fallibility in human organizations and political systems. *Journal of Economic Perspectives*, 5(2), 67-88.

Schmidt, D., and Heilmann, S. (2010). Dealing with economic crisis in 2008-2009: The Chinese government's crisis management in comparative perspective. *Trier University China Analysis*, No. 77.

Stein, E., Tommasi, M., Echebarría, K., Lora, E., and Payne, M. (2005). *Economic and Social Progress in Latin America 2006 Report: The politics of policies*. Washington, DC: Inter-American Development Bank.

Stock, J. H., and Yogo, M. (2005). Testing for weak instruments in linear IV regression. In: D. W. K. Andrews, and J. H. Stock (Eds.), *Identification and inference for econometric models: Essays in honor of Thomas Rothenberg* (pp. 80-108). New York, NY: Cambridge University Press.

Tommasi, M. (2004). Crisis, political institutions, and policy reform: The good, the bad, and the ugly. In: B. Tungodden, N. Stern, and I. Kolstad (Eds.), *5th Annual World Bank Conference on Development Economics Europe 2003. Toward pro-poor policies: Aid, institutions and globalization*. New York, NY: World Bank/Oxford University Press.

Treier, S., and Jackman, S. (2008). Democracy as a latent variable. *American Journal of Political Science*, 52(1), 201-217.

Tsangarides, C. G. (2012). Crisis and recovery: Role of the exchange rate regime in emerging market economies. *Journal of Macroeconomics*, 34(2), 470-488.

Tsebelis, G. (1995). Decision making in political systems: Veto players in presidentialism, parliamentarism, multicameralism and multipartyism. *British Journal of Political Science*, 25(3), 289-325.

Vincelette, G. A., Manoel, A., Hansson, A., and Kuijs, L. (2011). China: Global crisis avoided, robust economic growth sustained. In: M. K. Nabli (Ed.), *The Great Recession and the developing countries: Economic impact and growth prospects* (pp. 161-196). Washington, DC: World Bank.

Wooldridge, J. M. (2002). *Econometric analysis of cross section and panel data*. Cambridge, MA: MIT Press.

Wooldridge, J. M. (2006). *Introductory econometrics: A modern approach (3rd Edition)*. Mason, OH: South-Western.

Yang, B. (2008). Does democracy lower growth volatility? A dynamic panel analysis. *Journal of Macroeconomics*, 30(1), 562-574.

# Chapter 6

# South African labour market transitions since the global financial and economic crisis: Evidence from two longitudinal datasets


## Abstract

This paper examines individual-level labour market transitions in South Africa since the start of the global financial and economic crisis using two nationally representative longitudinal datasets: three waves of panel data from the National Income Dynamics Study (2008-2010-2012) and quarter-to-quarter matched cross-sections of the Quarterly Labour Force Survey (2008Q1-2013Q4). We find considerable mobility in South African labour markets over the study period, in and out of employment and between different forms of employment and non-employment; both in the short run, and, even more so, in the medium run. Our econometric analysis of the individual, household-level and job-specific factors associated with labour market transitions suggests that, next to deliberate individual or household choices, also external circumstances played a role. Several skill-related variables are found to positively affect job security and job finding chances. Above and beyond the influence of occupational and industry categories, contract and firm types, and union membership, higher educational attainment, i.e., a matric or post-matric level qualification, shielded workers from job loss; it also helped individuals find regular wage employment and formal sector jobs, independently of their initial labour market status and recent work experience.



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## 1. Introduction

Described as its 'Achilles' heel' (Kingdon and Knight, 2009), South Africa's extraordinarily and persistently high unemployment rate has attracted great attention from policymakers and academics. Several lines of argument have been advanced to account for this unemployment and broader labour market dysfunction in post-apartheid South Africa, including the role of a rapidly growing labour force combined with limited output and labour demand growth; skills mismatches; labour market rigidities, due to strong unionisation and other factors; and entry barriers in the informal sector (see Fourie, 2012 for a recent meta-analysis and key references).

Whereas high unemployment in South Africa is mostly a structural phenomenon, rather than the result of temporary shocks (Banerjee *et al.*, 2008), this does not deduct from the fact that South African labour markets were significantly affected by the global financial and economic crisis that gained steam from end 2008 onwards. It is this latter, economically adverse period that is our focus.

The principal aims of the current paper are to chart the evolution in South African labour market mobility and to tease out the individual, household-level and job-specific characteristics associated with remaining in or finding employment in South Africa during the height and aftermath of the global crisis. As is well-documented for both developed and developing countries, recessions tend to have heterogeneous impacts across workers with different characteristics and employed in different industries and occupations (see, among others, Clark and Summers, 1981; Fallon and Lucas, 2002; Verick, 2011; Cho and Newhouse, 2012; Hoynes *et al.*, 2012; Bergin *et al.*, 2014).

Our dynamic analysis is based on two longitudinal datasets that have so far received relatively limited attention in the academic literature. The first is the National Income Dynamics Study (NIDS), South Africa's first nationally representative individual-level panel data survey, of which we use the three waves that were available at the time of writing: 2008, 2010 and 2012. Second, we employ a variant of the algorithm developed by Ranchhod and Dinkelman (2008) to create quarter-to-quarter matched, individual-level panels from the 2008Q1-2013Q4 rounds of the QLFS.

The paper's contribution is threefold. First, by considering the NIDS and QLFS in parallel, we are able to compare labour market mobility in the medium and short run. Unlike other papers using either one of these datasets, we do so explicitly by constructing mobility measures that can be decomposed into upward, downward and within mobility components. Second, relative to previous research in this area, we study in detail a greater variety of labour market transitions, both in and out of employment, and larger sets of potential correlates of such transitions. For example, this paper is one of few to evaluate the effects of completed secondary and tertiary education, rather than simply the years of education, and to our knowledge, the first to assess the relative security of government jobs in South Africa. Using two different datasets, we can also check the robustness of our findings on transition determinants. Third, we adopt a much longer post-crisis timeframe than earlier studies, by incorporating the third wave of the NIDS and extending our own carefully matched QLFS dataset beyond 2010, up to end 2013. This enables us to examine potential variations in labour market transitions and their determinants during and after the zenith of the crisis.

Largely because of data limitations, we restrict ourselves in this paper to changes in employment and do not consider changes in wage earnings or the numbers of hours worked by the employed, two other potential channels of labour market adjustment during the crisis (see Khanna *et al.*, 2014). However, the data that *is* available for South Africa seems to indicate that working hours

were remarkably stable and that wage earnings increased during most of the post-crisis period.[1] Because of South African labour market segmentation into 'insiders' (those initially employed) and 'outsiders' (the unemployed) and differences in bargaining strength between these two groups, the largest burden of adjustment during the crisis was likely to fall on employment *levels* rather than on wages or hours of work (von Fintel and Burger, 2009; see further). One should moreover note that we do not attempt to assess the *impact* of the crisis on South African labour markets and its participants. Indeed, strictly speaking, our methodological approach does not allow us to attribute the observed labour market transitions (and changes in their determinants) directly to the crisis. An impact study *stricto sensu* would need a more elaborate identification strategy, linking macroeconomic and/or firm-level trends more directly to labour market outcomes.[2]

To preview our main results, we find considerable mobility in South African labour markets over the study period, both in the short run, and, even more so, in the medium run. An econometric analysis of the determinants of labour market transitions suggests that, next to deliberate individual or household choices, also external circumstances mattered. Several skill-related variables are found to positively affect job security and job finding probabilities. Most notably, above and beyond the influence of job-specific variables, higher educational attainment, i.e., a matric or post-matric level qualification, protected workers from job loss. In addition, higher education levels helped individuals find regular wage and formal sector jobs, independently of their initial labour market status and recent work experience.

The remainder of the paper is structured as follows. Section 2 provides some more background to South Africa's overall labour market situation and its evolution since 2008. Section 3 summarises the findings of other research using NIDS or QLFS data (that is closely related to the current paper) and highlights the remaining knowledge gaps. Section 4 first describes the NIDS dataset and employs it to construct transition matrices and decomposable measures of labour market mobility. Second, we explicate our empirical model for the analysis of the determinants of individual-level labour market transitions. A third subsection discusses the NIDS model estimates. Section 5 introduces the matched QLFS dataset and puts the results from the NIDS into a higher-frequency perspective. Section 6 concludes.

## 2. South African labour markets

### 2.1. General structure

As evident from the extensive literature that exists on the topic, multiple factors may be responsible for the high and persistent unemployment in South Africa. Kingdon and Knight (2007) and Banerjee *et al.* (2008), for example, contend that the rise in South African unemployment since the country's democratic transition can be explained by the combination of a rapidly growing labour force of

[1] The public QLFS datasets do not contain information on earnings (although it is reportedly collected since 2009Q3) and in the NIDS earnings data is mostly based on bracket responses or imputation. There are also some concerns about the hours worked variable in the NIDS (Cichello *et al.*, 2014). Based on confidential data, Statistics South Africa (2014b) shows that, for most population subgroups, median monthly earnings rose over 2010-2012 and slightly declined in 2013. The same report also indicates that, overall, the weekly average number of hours worked declined only marginally, from 45 in 2008 over 44 in 2009-2012 to 43 in 2013.

[2] See, for example, Mabugu *et al.* (2010), who combine theoretical models with pre-crisis baselines and simulated/projected data to evaluate the impact of the global crisis on child poverty in South Africa.

relatively low-educated individuals, Black African women in particular, with limited output growth and a tendency of increasing capital intensity (and, hence, a stagnation in labour demand). On the supply side, the lifting in the mid 1990s of apartheid restrictions on movement to urban centres of activity, new employment equity legislation and rising education levels are said to have increased expectations about the possibilities of and returns to employment among the non-White population of South Africa. Growing unemployment among men, the HIV epidemic and other trends changing household structure arguably led to a decline in the income accessible by women, who in response increasingly joined the labour force (Kingdon and Knight, 2007). On the demand side, post-apartheid output growth has fallen significantly short of the estimated 5% (or higher) needed to make a serious dent in the unemployment rate; with the exception of pre-crisis years 2005-2007, when accelerated growth (and job creation) was driven by a boom in domestic demand and financed by a widening current account deficit (Hausmann, 2008; Mlatsheni and Leibbrandt, 2014). Fedderke (2014) argues that one of the principal constraints on South African growth has been the lack of competition in many economic sectors, apparent from the high mark-ups of prices over marginal production costs (relative to a broad set of comparator countries). This pricing power is found to reduce productivity and output growth; simulations suggest that with a ten percentage point reduction in mark-ups (over 1970-2012) South Africa's total GDP would have been about 21% higher than it is now.

The discrepancy between labour supply and demand has been further compounded by a structural shift in demand away from low-skilled to higher-skilled workers, both across and within economic sectors, leading to a skills mismatch between labour market entrants and job opportunities (Bhorat and Hodge, 1999; Rodrik, 2008; Bhorat, Goga*, et al.*, 2014). Key trends have been the gradual decline in absolute employment levels in primary sectors agriculture and mining, where allegedly more than 500,000 and 200,000 jobs were lost between 2001 and 2012, and the very limited increase in manufacturing employment, of about 100,000 jobs over the same period. Conversely, the tertiary sector has been the real driver of (overall limited) employment growth, both in relative and absolute terms. Tertiary sector employment buoyancy has in part been due to rapid growth in public sector jobs since 2000 (Bhorat, Hirsch*, et al.*, 2014).

In a competitive labour market one would expect wages to adjust downwards in the face of excess labour supply. Fedderke (2012) and others have shown, however, that in South Africa's formal sector real labour costs have not sufficiently come down to clear the market and reduce unemployment. Several labour market rigidities have been blamed for the stickiness of formal sector wages. One strand of the literature emphasises the contribution of factors such as strong unionisation, collective bargaining and other industrial relations regulations (including the extension of bargaining council arrangements to non-parties) to labour market inflexibility. Most studies find clear positive wage premia associated with the union membership and bargaining council coverage of workers, although estimates of the size of such premia vary widely (Hofmeyr and Lucas, 2001; Bhorat *et al.*, 2012). Others have asserted that also excessive reservation wages may partly explain limited wage adjustment (Rankin and Roberts, 2011).

In addition, Kingdon and Knight (2004) document how in South Africa, unlike in many other developing countries, the informal sector has failed to absorb those that are excluded from the formal sector, leading to high levels of open unemployment. They find that unemployment is largely involuntary and due to various barriers to entry into informal employment, including legacies of the apartheid regime, which repressed and disempowered the informal activities of the Black majority of South Africans, and inadequate government support for small entrepreneurs. Other studies stress the importance of limited access to credit, high crime levels, spatial mismatch between centres of

economic activity and population concentration, a dearth of affordable public transport, and remaining racial prejudices as employment entry barriers (Banerjee *et al.*, 2008; Heintz and Posel, 2008; Hinks, 2008; Naudé, 2008; Mahajan, 2014). These and other observations have led researchers to conclude that many of the non-searching unemployed, which are excluded from South Africa's official unemployment definition (in line with ILO guidelines), can be best classified as 'discouraged' individuals that are deterred from active search by low job prospects and high search or start-up costs, rather than as having a 'taste for unemployment' or lacking in labour force commitment (Dinkelman and Pirouz, 2002; Kingdon and Knight, 2006).

In view of the above, observers have labelled South Africa's unemployment problem as structural and grounded in the country's idiosyncratic economic and political history (Banerjee *et al.*, 2008) and have characterised South African labour markets as segmented into 'insiders', i.e., most formal sector employees whose positions and wages may be protected by unions and industrial relation regulations, and 'outsiders', i.e., the unemployed and most informal sector workers (which typically do not enjoy the benefits associated with formal sector jobs) (Hofmeyr, 2000; Kingdon and Knight, 2007). Mlatsheni and Leibbrandt (2014) note that the voices of these outsiders are not finding their way into discussions about the difficult trade-offs involved in increasing wage and overall labour market flexibility.

In the next subsection we offer a first, bird's eye view on how the dire situation of South African labour markets at the eve of the global financial and economic crisis has evolved since 2008.

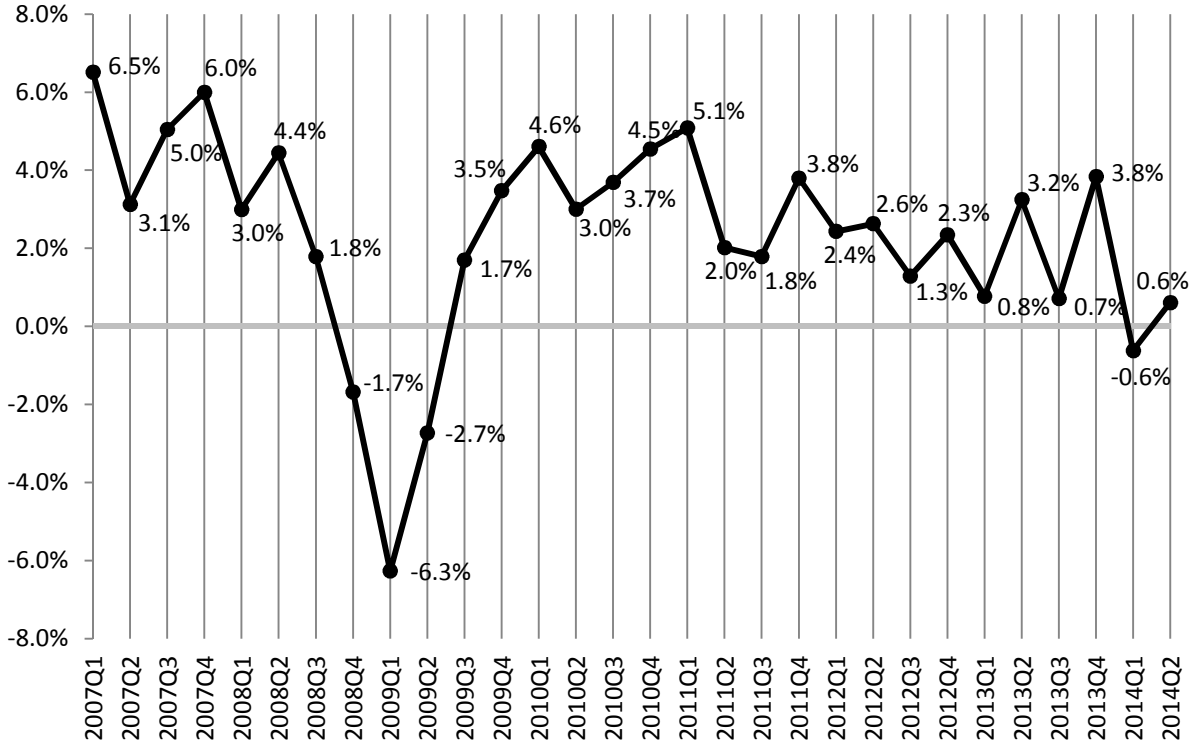
### 2.2. Trends since 2008

Because of its strong trade and financial links with Europe and, to a lesser extent, the US (the two crisis epicentres; cf. Chapter 2), South Africa was hit rapidly by the global crisis and in 2008Q4 entered its first post-apartheid recession (see Figure 1). The slump in economic activity was driven largely by a fall in manufacturing output; next to contractions in the mining sector, wholesale and retail trade, financial services, and declining net taxes.[3] After three quarters of negative growth, in 2009Q3 the South African economy picked up again. However, despite an ambitious government action plan including monetary policy easing and new public investment, economic revival has been anaemic. South African post-crisis growth seems to have suffered from lingering problems in its European trading partners, a slowdown in Chinese commodity imports and a volatile and overvalued exchange rate, as well as from domestic political uncertainty, electricity and transport bottlenecks, and outbursts of social instability, most visibly a number of large, protracted mining strikes (OECD, 2013; IMF, 2014).[4]

[3] Manufacturing alone contributed approximately -2.9, -3.8 and -1.5 percentage points to the annualised -1.7%, -6.3% and -2.7% quarter-on-quarter growth of real GDP in 2008Q4, 2009Q1 and 2009Q2, respectively, according to industry-level output data from Statistics South Africa (2014a).

[4] Again, contractions in manufacturing and mining contributed most to low GDP growth in the post-crisis years (Statistics South Africa, 2014a).

*Figure 1. Annualised growth of (seasonally adjusted) quarterly GDP at constant prices, 2007Q1-2014Q2*




Source: Statistics South Africa (2014a).

The reaction of South African labour markets to the crisis has been very pronounced relative to that of output, and labour market recovery has seriously lagged the (timid) upturn in GDP, arguably because of some of the structural rigidities outlined above (von Fintel and Burger, 2009; Fedderke, 2012). According to the Quarterly Labour Force Survey (QLFS) and as shown in Figure 2, total employment decreased from a peak of about 14.8 million in 2008Q4 to a trough of 13.6 million in 2010Q3, partly reversing the modest gains made during the preceding economic boom (see Hodge, 2009). Only in 2013Q3 did total employment surpass its pre-crisis peak; as of 2014Q3, it stood at just over 15 million, only 2% above the 2008Q4 level.

Figure A.1 in Appendix breaks down the employment trends since 2008 by gender and by industry. Panels (a) and (b) of Figure A.1 first of all demonstrate that most South African employment is male (hovering around 56-57% of total employment) and that sectoral employment patterns differ significantly between men and women. Seen over the whole 2008Q1-2014Q3 period, male employment was greatest in trade (about 20.2% of all male jobs on average), manufacturing (15.7%), community and social services (15.6%), financial services (13.3%), and construction (12.6%). Women were mostly employed in community and social services (28.6% on average), followed by trade (24.1%), work in private household and other unclassified businesses (15.7%), financial services (12.6%), and manufacturing (9.6%). Figure A.1 also reveals striking cross-industry differences in the evolution of employment numbers (plotted for the five most important industries of employment for men and women, respectively). Male manufacturing employment numbers decreased by 18% from their peak in 2008Q4 to 2014Q3; in construction net male job losses amounted to 19% of the 2008Q4 level in 2012Q1, but by 2014Q3 construction employment numbers had almost fully recovered. Male

employment in community services and finance, on the other hand, increased by 15% and 20%, respectively, over 2008Q4-2014Q3. Female employment numbers in trade, private households, and manufacturing in 2014Q3 were between 11% and 14% lower than in 2008Q4, whereas community services jobs increased by 31% in absolute terms.

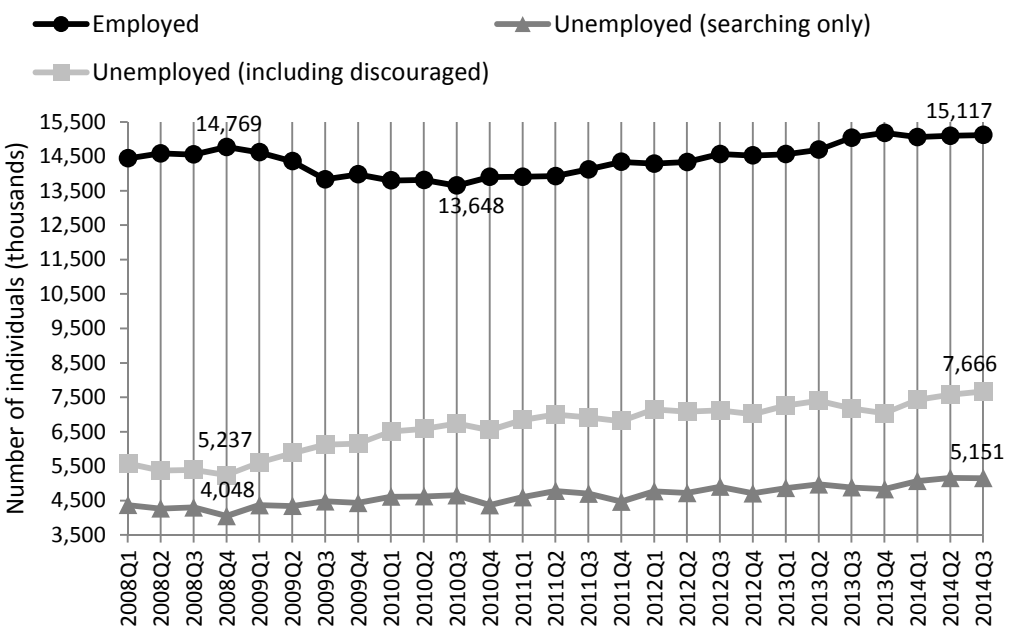
Taken together, men accounted for 619,000 (or 55%) of the 1.1 million decline in jobs between 2008Q4 and 2010Q3 shown in Figure 2. At the industry level, net employment losses over that period were concentrated in manufacturing (283,000 jobs, of which 265,000 male), trade (245,000 jobs, of which 203,000 female) and construction (158,000 jobs, nearly all male).[5] The 2010Q3-2014Q3 net increase in employment with about 1.5 million jobs was almost evenly split between men (51%) and women (49%) and was driven to a large extent by growing community and social services employment (708,000 jobs, of which 511,000 female) and financial services employment (336,000 jobs, of which 173,000 female). The longer-term, structural shift of South African employment towards the tertiary sector (cf. Section 2.1) seems to have continued apace post 2008.

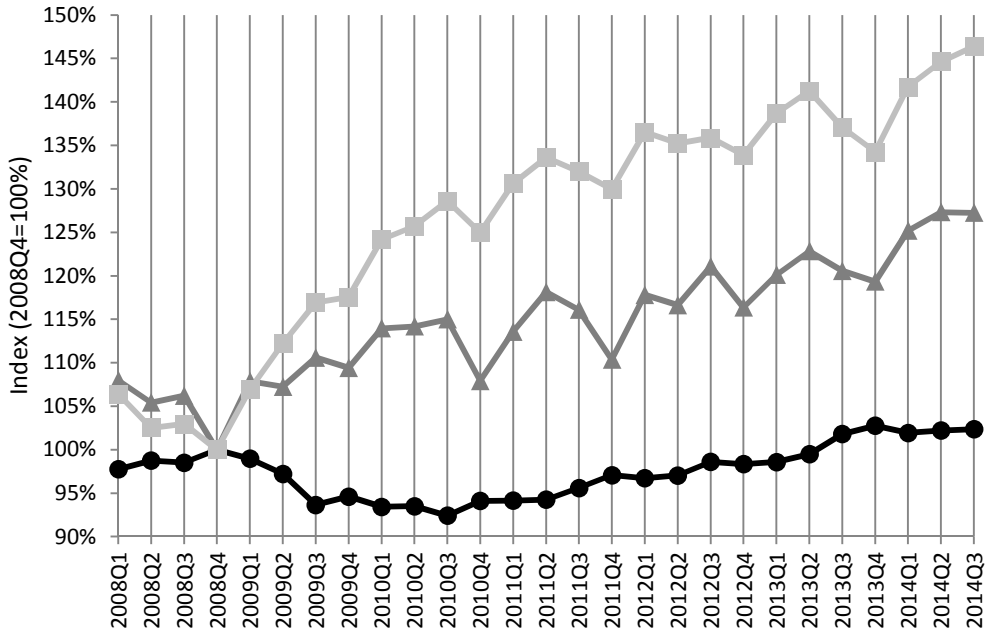
In Figure A.2 in Appendix a similar deconstruction of employment numbers and trends as in Figure A.1 is presented, now by gender and firm type. It is evident that private enterprises accounted for the bulk of total employment (73% on average) between 2008Q1 and 2013Q4, although its average share was larger for male (81%) than female employment (63%). National, provincial and local government jobs constituted about 14% of all employment, on average, over 2008-2013; 18% for women and 12% for men. Private household jobs were also an important job category for female workers (17%, versus only 5% for men). Employment in government-controlled businesses (companies like Eskom and Transnet) and in non-profit organisations (NGOs and community-based groups) was relatively minor. Comparisons over time in Figure A.2 show the sharp contrast between (male and female) private enterprise employment, which fell back sharply in the early crisis period (with a net decline of about 833,000 jobs from 2008Q4 to 2010Q3) and recovered only slowly thereafter, and government employment, which remained much more stable early on in the crisis and boomed from late 2010 onwards. Especially with respect to female employment, the increase in government jobs, dominant in the community and social services cluster, was spectacular; between 2008Q1 and 2013Q4, the share of government jobs in overall female employment numbers shot up from 15% to 20%.

Employment trends are of course only one side of South Africa's post-2008 labour market story. Figure 2 also presents the evolution in the number of unemployed individuals. It can be seen that the ranks of the searching unemployed swelled from 4 million in 2008Q4 to 5.2 million people in 2014Q3, an increase of 27%. Over the same period, the number of broadly defined unemployed, including discouraged individuals that would prefer to work but had given up (active) job search, grew no less than 46%, from 5.2 million to 7.7 million.

[5] A simulation exercise by Kucera *et al.* (2012), estimating the impact of the contraction in South African exports to Europe and the US on employment, finds overall employment declines of the same order of magnitude as those actually observed in the QLFS data. Viewed at the industry level, these *ceteris paribus* simulations are broadly consistent with the observed employment trends in manufacturing and trade, but not in construction (where the model predicts an increase in employment).

*Figure 2. Evolution of employment and unemployment numbers, 2008Q4-2014Q3*




Source: Calculated from 2008Q1-2014Q3 QLFS data (Statistics South Africa, various years).

By definition, shrinking numbers of employed and growing numbers of unemployed labour market participants imply worsening unemployment rates. Table 1 presents 2008-2013 yearly averaged South African unemployment rates, disaggregated by gender, race, age group, and geography type. It demonstrates that the official, narrowly defined unemployment rate increased only moderately over this time span, from 22.5% in 2008 to 24.7% in 2013, whereas the rise in the broad unemployment rate, including the discouraged unemployed, was more substantial (from 27% to 32.7%).[6] Table 1 moreover shows that the evolution in unemployment rates varies significantly across population segments and geographically. Increases in broad unemployment rates were greatest for men, Black Africans and Coloureds, youth and in rural areas.

*Table 1. Evolution of unemployment rates, 2008-2013: annual averages*

| | Narrow unemployment rate (%) | | | | | | Broad unemployment rate (%) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 |
| Overall | 22.5 | 23.7 | 24.9 | 24.8 | 24.9 | 24.7 | 27.0 | 29.5 | 32.3 | 32.9 | 33.0 | 32.7 |
| | | | | | | | | | | | | |
| Male | 19.8 | 22.0 | 23.0 | 22.7 | 23.0 | 23.1 | 23.2 | 26.7 | 29.2 | 29.6 | 29.8 | 30.0 |
| Female | 25.9 | 25.7 | 27.2 | 27.3 | 27.2 | 26.7 | 31.4 | 32.8 | 36.0 | 36.7 | 36.7 | 35.8 |
| | | | | | | | | | | | | |
| Black/African | 26.5 | 27.7 | 29.0 | 28.6 | 28.3 | 27.9 | 31.7 | 34.6 | 37.7 | 38.0 | 37.8 | 37.1 |
| Coloured | 18.8 | 20.2 | 22.2 | 22.9 | 24.1 | 24.1 | 20.7 | 22.2 | 25.1 | 26.2 | 26.9 | 27.0 |
| Asian/Indian | 11.6 | 11.6 | 8.7 | 10.5 | 10.6 | 12.3 | 12.4 | 13.8 | 10.9 | 12.6 | 12.9 | 15.5 |
| White | 4.2 | 4.7 | 5.9 | 5.8 | 5.8 | 6.8 | 4.7 | 5.4 | 7.1 | 7.0 | 6.9 | 7.8 |
| | | | | | | | | | | | | |
| Age 15-25 | 43.4 | 45.8 | 48.8 | 48.1 | 49.2 | 48.9 | 49.0 | 53.4 | 58.1 | 58.7 | 59.5 | 59.2 |
| Age 26-35 | 24.1 | 26.6 | 27.7 | 28.0 | 27.8 | 27.4 | 28.4 | 32.1 | 34.8 | 35.6 | 35.5 | 35.1 |
| Age 36-45 | 15.4 | 15.9 | 16.9 | 17.5 | 17.6 | 18.0 | 18.7 | 20.5 | 22.7 | 23.9 | 23.9 | 23.9 |
| Age 46-55 | 9.7 | 10.7 | 11.8 | 12.1 | 12.5 | 12.3 | 13.1 | 14.8 | 17.4 | 17.7 | 18.3 | 18.3 |
| Age 56-64 | 6.8 | 5.7 | 7.2 | 5.8 | 6.6 | 7.2 | 9.6 | 8.7 | 11.5 | 9.9 | 11.4 | 11.8 |
| | | | | | | | | | | | | |
| Urban | 21.1 | 22.7 | 24.1 | 24.2 | 24.2 | 24.5 | 23.8 | 26.1 | 28.5 | 28.6 | 28.5 | 28.8 |
| Rural | 27.3 | 26.9 | 27.5 | 27.0 | 27.3 | 25.6 | 36.3 | 39.3 | 43.4 | 45.2 | 45.2 | 43.3 |

Source: Calculated from 2008Q1-2013Q4 QLFS data (Statistics South Africa, various years).
Notes: Sample includes only people of working age (15-64). All figures are averaged over four quarters and population-weighted. Narrow unemployment rates are calculated as (searching unemployed)/(searching unemployed + employed); broad unemployment rates as (searching and discouraged unemployed)/(searching and discouraged unemployed + employed).

[6] The broad unemployment rates in Table 1 include only the truly 'discouraged' (cf. Verick, 2012), i.e., the unemployed that wanted and were available to work, but did not undertake active job search during the last four weeks prior to interview because they believed that there were no jobs available in the area; they would be unable to find work requiring their skills; or because they lost hope of finding any kind of work. Note that these broad unemployment rates are somewhat lower than the 'expanded' unemployment rates reported by Statistics South Africa (2014b), which also incorporates individuals that were willing and available to work but stopped looking for work for other reasons than utter discouragement, such as bad health, study or training, or a lack of money.

Most of the post-2008 trends we have discussed in this section have also been documented in official publications by Statistics South Africa and in earlier academic work on South African labour markets during the global crisis (see Verick, 2012 in particular). However, aggregate overviews such as the above, based on repeated cross-sectional data, do not allow one to evaluate *gross* changes in labour market participation, with individuals entering and exiting particular labour market statuses like employment or unemployment (Kingdon and Knight, 2007). Researchers have therefore started to analyse individual-level panel datasets, constructed from either the old Labour Force Survey (LFS) (Banerjee *et al.*, 2008; Ranchhod and Dinkelman, 2008), the KwaZulu-Natal Income Dynamics Survey (KIDS) (Keswell, 2000; Dinkelman, 2004; Cichello *et al.*, 2005), or the Cape Area Panel Study (CAPS) (Lam *et al.*, 2009). Most of these dynamic studies discern a considerable degree of 'churning' underlying the netted-out trends in the cross-sectional data, i.e., large flows of people moving from one labour market status to another between two points in time. Such gross transitions across different labour market statuses are exactly what we will study in the remainder of this paper, focusing thereby on transitions since the start of the global crisis in 2008. Before describing our empirical approach and datasets in detail, we summarise the findings of a number of related studies.

## 3. Related research

A first batch of studies related to the current paper uses the QLFS. An early overview by von Fintel and Burger (2009) contrasts transition probabilities in and out of employment between 2008Q1 and 2008Q2 with such probabilities over 2008Q4-2009Q1 by means of matched QLFS cross-sections and finds, above all, a decline in unskilled and semi-skilled job creation at the start of South Africa's recession. Leung *et al.* (2009) evaluate the effects of different individual characteristics on the likelihood of employment based on six QLFS cross-sections pooled over 2008-2009. They conclude that human capital, both years of schooling and work experience, significantly reduced (and in some cases even entirely offset) the negative impact of the crisis on employment probability. Female workers were found to be less affected than men. Race, while in itself highly significant in determining labour market outcomes, did not further compound crisis effects. In an update of their work, Leung *et al.* (2014) use the same QLFS dataset to construct a matched, unbalanced panel of individuals. Even after controlling for unobserved individual heterogeneity, their results corroborate the buffering effect of human capital. Comparing differences in out-of-employment and into-employment transition rates between 2008 and 2009, Leung *et al.* (2014) moreover find that the crisis did not affect the former but reduced the latter, with no clear differences between industries. Verick (2012) uses QLFS data pooled over four pre-crisis (2008) and eight crisis (2009-2010) quarters in a multinomial logit set-up with five distinct labour market outcomes: formal sector employment, informal sector employment, unemployment, discouragement, and outside the labour force. For African men and males with below-tertiary education, his estimates indicate a significant increase in the probability of discouragement. Again based on a matched individual-level QLFS panel, Verick (2012) shows that, on average, mobility between different labour market statuses was higher in 2008 than in 2009, with markedly lower inflows into employment in 2009. None of the above papers, however, controls for potential attrition problems in the matched QLFS data (see further), or uses

the panels to investigate, in a multivariate set-up, the determinants of particular labour market *transitions* rather than outcomes.[7]

A second group of studies relies on the NIDS. Cichello *et al.* (2014) examine 2008-2010 labour market transitions in a balanced panel of individuals using the two first NIDS waves and find extensive mobility. A probit analysis of transitions out of regular wage employment of Black Africans learns that the probability of making such a transition is lower for middle-aged married men employed in lower-skilled occupations with a permanent contract and no young children in the household. For women, the probability of moving out of wage employment declines with more years of education, longer job tenure and fewer young children. Transitions into regular wage employment are also found to differ significantly by gender. Posel *et al.* (2014) study in more detail the entry into employment of 2008-2010 NIDS panel members that started out as being unemployed. They identify tertiary education and work experience as the key determinants of finding employment. Women, the longer-term unemployed, and people living with young children faced lower transition probabilities. Both Cichello *et al.* (2014) and Posel *et al.* (2014) leave room for additional variables to be included in the set of potential transition determinants. A recent paper by Ranchhod (2013) incorporates the 2012 NIDS wave and considers transitions into and out of employment in a three-wave balanced NIDS panel. He finds that the probability of remaining non-employed in the next two waves was high for youth not employed in the first wave, decreased for non-employed prime aged adults, and then increased again for the elderly. Conversely, the likelihood of continued employment was higher for initially employed prime aged adults than for employed youth or the elderly. Compared to men, women are found less likely to escape non-employment (and find stable employment) and more likely to lose employment (and remain unemployed thereafter). Higher education levels and urban residence were correlated with greater probabilities of finding and remaining in employment. Ranchhod (2013), however, does not attempt a multivariate analysis of individual labour market trajectories.

In the following two sections we try to mitigate some of the limitations of the just-described papers. Section 4 deals with the three-wave NIDS panel. In Section 5 we return to the approach of using matching techniques to construct an individual-level panel dataset from different rounds of the QLFS.

## 4. National Income Dynamics Study (NIDS) panel

### 4.1. Dataset and descriptives

The NIDS, South Africa's first nationally representative panel data survey that tracks individuals, collects detailed information on, among other topics, household composition, demographics, education, health, well-being, and labour market participation.[8] It is implemented by the Southern Africa Labour and Development Research Unit (SALDRU) at the University of Cape Town and

[7] Leung *et al.* (2014, p. 103) make reference to a weighted least square estimation as robustness check but do not present the results thereof or provide any further detail on the type of weighting used to account for attrition.

[8] For a more extensive overview of the NIDS we refer to de Villiers *et al.* (2013) and the NIDS website: http://www.nids.uct.ac.za. The NIDS is a panel of individuals and not of households; household identifiers are only meaningful within (and not between) waves.

currently consists of three waves (with a fourth wave in the field at the moment of writing). Wave 1 data was collected between January and December 2008, with a baseline of 26,776 successful individual-level interviews. Wave 2 was organised from May 2010 to September 2011 and Wave 3 between April and December 2012.[9] The resulting balanced panel of individuals who were successfully interviewed in all three waves consists of 18,864 observations. Because of its timing the NIDS qualifies as a useful instrument to gauge medium- to longer-term labour market transitions since the beginning of the global crisis. Indeed, wave 1 captures information from before the South African economic recession[10]; wave 2 was undertaken when economic recovery had already set in, but the labour market situation was still deteriorating; and wave 3 covers a period when overall unemployment rates had more or less stabilised (cf. Figures 1-2 and Table 1).

Of course, the balanced NIDS panel is not a random subsample of the original wave 1 sample. Brown *et al.* (2012) and de Villiers *et al.* (2013) show that between-wave attrition rates in the NIDS differ significantly across population segments and are particularly high for Whites in their twenties and for the top income decile, mostly due to interview refusal. Baigrie and Eyal (2013) further demonstrate that individuals that attrit between wave 1 and wave 2 are more likely to be employed and have higher labour market earnings than non-attritors, which may lead to biases in models based on the balanced sample.

The NIDS dataset comes with different sets of panel weights that account for initial non-response, calibrate the sample to mid-year population estimates and attempt to correct for attrition, either between wave 1 and 2, wave 1 and 3, or wave 2 and 3. Since the official release of the NIDS does not supply panel weights that factor in attrition between all three waves, we construct such weights ourselves, along the lines of Ranchhod (2013) and Finn and Leibbrandt (2013). First, we estimate the probability of successfully re-interviewing a wave 1 respondent in wave 2 using a probit model with as regressors dummies for age intervals, race, gender, marital status, educational attainment, provinces and geography types of household location (urban, traditional communal land or farms).[11] Second, we perform similar probit estimations, again using wave 1 baseline characteristics as regressors, for the probability of re-interview in wave 3 conditional on successful interviews in both waves 1 and 2. Finally, the three-wave balanced panel weights are obtained by multiplying the original wave 1 post-stratification weights (adjusted for initial non-response and population-calibrated) consecutively with the inverse of the predicted probabilities of re-interview in wave 2, and with the inverse of the wave 3 re-interview probabilities. To avoid extreme panel weights, which result from the fact that some individuals with large wave 1 weights were also more likely to attrit from the panel, we trimmed at the 1$^{st}$ and 99$^{th}$ percentiles after both stages of multiplication.

Differences between the NIDS balanced panel and its cross-sections are not only caused by attrition (which can be largely solved using panel weights) but also by between-wave patterns of selective migration into the households of original NIDS sample members and new household formation by NIDS members (Ranchhod, 2013). This implies that even if the balanced panel gives a good overview of how a group of individuals representative of the population at wave 1 fares over

[9] To simplify notation we will refer to wave 2 of the NIDS as year 2010 in the rest of the paper. Almost 80% of wave 2 interviews took place in 2010.

[10] Over 90% of all wave 1 interviews were conducted between February and June 2008.

[11] We have experimented with different specifications and additional regressors, such as race-gender-specific age interval dummies or the inclusion of wave 1 labour market status dummies. These alternative panel weights are, in practice, very similar and have little impact on the results presented in this paper.

time, generalisations to South African society in waves 2 and 3 are much more tentative. Furthermore, because of small sample sizes and relatively high attrition of White and Asian/Indian respondents in the panel, racial comparisons based on the NIDS panel should be viewed with great caution.

Following Cichello *et al.* (2014) we restrict our analysis to adults aged 20 to 55 in wave 1 (2008). The official working age in South Africa is 15 to 64, but because of our focus on the crisis we do not want our results to be unduly influenced by school leavers or pensioners.[12] Dropping individuals outside these age limits, with missing labour market status information, or for which no panel weight could be calculated (due to missing values in one or more of the probit regressors), leaves us with a sample of 6,458 balanced panel members.[13] These individuals can be categorised into mutually exclusive groups according to their labour market status. Within the NIDS, the employed include those that are paid a wage or salary to work on a regular basis for an employer, whether full- or part-time ('regular wage employment'); work for themselves, including in partnership with others ('self-employment'); work on an irregular and short-term basis ('casual employment'); work on the household's own plot or food garden ('subsistence agriculture'); or assist other people with their business activities ('assistance with others' business'). The 'searching unemployed' are not employed but had actively searched for work in the four weeks prior to interview. They can be distinguished from the 'discouraged unemployed', who would have liked to work but did not actively look for a job. Lastly, the 'not economically active' (NEA) were outside the labour force at the time of interview (for example, full-time students, the sick and disabled, and those that fulfil unpaid domestic duties).

One problem, however, is that cross-sectional analysis of the NIDS data reveals a large reduction in the number of unemployed and a large increase in the number of the NEA between waves 1 and 2, which does not fully correspond with the trends observed in the QLFS (Cichello *et al.*, 2014). Elsewhere it is suggested that this may be the result of a misclassification in wave 2 of unemployed individuals as NEA by NIDS fieldworkers (see Finn and Ranchhod, 2013). We will keep this in mind when specifying our empirical models in Section 4.2.

Panes (a) and (b) of Table 2 present the 2008-2010 and 2010-2012 transition matrices for our three-wave balanced NIDS panel, based on the just-described labour market statuses and applying our self-constructed panel weights. By construction, each row sums up to 100%. We pool together the categories of casual employment, subsistence agriculture and assistance with others' business.[14]

[12] The upper age limit of 55 in 2008 ensures that by wave 3 (2012) the individuals in our sample still fall below the official 60 year cut-off to be eligible for the government-provided Old Age Pension.

[13] In our transition matrices, where more detailed information on labour market statuses (with more missings) is used, sample size is further reduced to a panel of 6,084 individuals (see further).

[14] Cichello *et al.* (2014) report on problems with capturing subsistence agriculture in wave 2 of the NIDS. However, because of subsistence agriculture's limited share in overall employment, excluding individuals in this category altogether makes little difference to the transition matrices.

*Table 2. Transition matrices for labour market statuses (NIDS), 2008-2010 and 2010-2012: row proportions (%)*

Pane (a)

| Labour market status in 2008 | | Labour market status in 2010: Regular wage employ. (38.8) | Self-employ. (5.7) | Casual and other employ. (4.8) | Searching unemploy. (12.5) | Discour. unemploy. (5.0) | NEA (33.3) |
|---|---|---|---|---|---|---|---|
| 35.6 | Regular wage employment | **77.2** | 2.8 | 3.6 | 5.1 | 2.7 | 8.6 |
| 7.4 | Self-employment | 15.5 | **34.2** | 4.8 | 7.8 | 3.2 | 34.5 |
| 8.3 | Casual and other employment | 24.1 | 5.3 | **6.0** | 13.8 | 6.0 | 44.8 |
| 19.0 | Searching unemployed | 21.1 | 3.7 | 6.8 | **22.6** | 6.0 | 39.8 |
| 6.6 | Discouraged unemployed | 16.5 | 3.3 | 6.8 | 19.4 | **11.9** | 42.0 |
| 23.2 | NEA | 13.3 | 3.6 | 3.9 | 14.6 | 5.9 | **58.8** |

Pane (b)

| Labour market status in 2010 | | Labour market status in 2012: Regular wage employ. (41.0) | Self-employ. (6.1) | Casual and other employ. (5.3) | Searching unemploy. (17.6) | Discour. unemploy. (3.4) | NEA (26.7) |
|---|---|---|---|---|---|---|---|
| 38.8 | Regular wage employment | **76.5** | 2.4 | 2.8 | 8.8 | 0.7 | 8.8 |
| 5.7 | Self-employment | 17.0 | **42.8** | 3.9 | 9.4 | 2.7 | 24.2 |
| 4.8 | Casual and other employment | 31.1 | 6.6 | **10.5** | 17.6 | 5.5 | 28.7 |
| 12.5 | Searching Unemployed | 25.8 | 5.2 | 8.3 | **29.3** | 5.8 | 25.7 |
| 5.0 | Discouraged unemployed | 19.3 | 2.9 | 8.1 | 21.9 | **9.1** | 38.7 |
| 33.3 | NEA | 14.2 | 4.8 | 6.1 | 24.1 | 4.7 | **46.2** |

Source: Calculated from 2008-2010-2012 NIDS data (SALDRU, various years).

Notes: Sample includes only three-wave balanced panel members aged 20-55 in 2008. All figures have been weighted using panel weights that are population-calibrated and account for initial non-response and between-wave attrition. Outer left column of pane (a) (pane (b)) gives the overall proportion of each labour market status in 2008 (2010). Top row of pane (a) (pane (b)) gives the overall proportion of each status in 2010 (2012).

From Table 2 it is clearly visible that, in spite of a large literature emphasising labour market rigidities and inflexibility (but conform to other longitudinal studies), there is considerable individual movement across labour market statuses in South Africa. Almost 23% of those in regular wage employment in 2008 were no longer in this category by 2010. Surprisingly perhaps, this percentage was similar over the economically more favourable, 'post-crisis' 2010-2012 period. The relative importance of flows out of wage employment and into searching unemployment increased from the crisis to the post-crisis period, whereas that of flows into discouragement declined. We also observe that wage employment is a relatively stable state compared to self- or casual and other employment. The limited inflow into and considerable flow out of self-employment and, especially, casual work may partly reflect the limited size of South Africa's informal sector (cf. Section 1), although the formal-informal distinction does not neatly map onto the categories of wage, self- and casual employment.[15]

Over 40% of the NEA in 2008 were in the labour force by 2010; this further increased in the post-crisis period. Among the searching and discouraged unemployed mobility was even greater. However, here we need to keep in mind possible misclassification between the unemployed and NEA in wave 2 (see before). Both between 2008 and 2010 and between 2010 and 2012, the searching unemployed had a greater probability of finding regular wage employment than those initially discouraged. For both categories of the unemployed, wage job-finding probabilities increased in the post-crisis period, relative to the crisis period. Constructing similar transition matrices for male and female adults separately (not shown), we find that regular wage employment, casual and other work, and unemployment were more stable states for men than for women. The opposite is true for self-employment and NEA. Men enjoyed higher probabilities of making the transition into wage employment than women, especially from unemployment or self-employment (as women more often moved out of the labour force).

An interesting exercise, which helps to summarise the information contained in the transition matrices, is to decompose overall labour market mobility, i.e., the percentage of individuals changing labour market status between two NIDS waves, into 'upward', 'downward' and 'within' mobility components. Note that, using the above taxonomy of six labour market statuses, total mobility can be written as:

$$m_{total} = \sum_{i=1}^{6}\sum_{j=1}^{6} s_i t_{ij\,|\,i\neq j} \tag{1}$$

where $s_i$ is the $i^{th}$ element of the 6×1 vector $S$ comprising the proportions of each labour market category in the initial wave, and $t_{ij}$ is the element on the $i^{th}$ row and in the $j^{th}$ column of the 6×6 transition matrix $T$ between waves, as depicted in pane (a) (or pane (b)) of Table 2. Formula (1) is decomposable into:

$$\begin{aligned} m_{total} &= \sum_{i=4}^{6}\sum_{j=1}^{3} s_i t_{ij} + \sum_{i=1}^{3}\sum_{j=4}^{6} s_i t_{ij} + \sum_{i=1}^{3}\sum_{j=1}^{3} s_i t_{ij\,|\,i\neq j} + \sum_{i=4}^{6}\sum_{j=4}^{6} s_i t_{ij\,|\,i\neq j} \\ &= m_{upward} + m_{downward} + m_{within\ employment} + m_{within\ non-employment} \end{aligned} \tag{2}$$

[15] Note that the NIDS does not allow for an unambiguous division between formal and informal sector employment, unlike the QLFS (see Section 5.1).

with upward mobility the mobility from different non-employment states into employment; downward mobility the transitions from employment into non-employment; and within (non-) employment mobility the movement between distinct forms of (non-)employment.

Table A.1 in Appendix lists the labour market mobility measures and their decompositions, calculated using Formula (2), for the whole NIDS balanced panel sample and for men and women separately. Overall, almost 51% of the studied individuals switched labour market status over 2008-2010; 48% did so over 2010-2012. The NIDS mobility measures (and underlying transition matrices) cannot be directly compared with those of previous studies on South African or other countries' labour market dynamics because of differences in the length of transition periods considered and labour market status definitions/breakdowns.[16] It is therefore difficult to say how much mobility one should expect. However, within the context of the NIDS, these simple summary measures do help us to spot changes in labour market mobility over time and gender differences. For example, from Table A.1 we observe that between 2008 and 2010 downward mobility was somewhat larger than upward mobility, with little difference between men and women in this regard. Between 2010 and 2012, on the contrary, upward mobility trumped downward mobility. Within employment, mobility was greater for men than for women. Nevertheless, women were overall more 'mobile' than men, due to greater movement within non-employment.

### 4.2. Model set-up

To evaluate the effect of particular individual, household and job characteristics on the probability of making certain labour market transitions we opt for simple binary probit models of the following form[17]:

$$P(y = 1 \mid X, Z) = \Phi(X'\beta + Z'\delta) \tag{3}$$

where $y$ is a binary transition outcome variable; $\Phi$ is the standard normal cumulative density function; $X$ is a vector of individual, household-level and geographical variables; and $Z$ is a vector of job-related variables.

We estimate two sets of probit models, both for 2008-2010 and 2010-2012. In models of the first kind, transition outcome $y$ takes the value one for individuals that are in regular wage employment in one wave (2008 or 2010) and again in the next wave (2010 or 2012), and the value zero for those no longer in regular wage employment in the next wave. Individuals without a regular wage job in the first wave are excluded. Alternatively, in the second set of models, we limit our analysis to individuals that are initially not in regular wage employment and assign to outcome variable $y$ a value of one for individuals that find regular wage employment in the next wave, and a

[16] For example, based on the KIDS panel, Cichello *et al.* (2005) report a transition matrix for KwaZulu-Natal's Black South Africans over a single five-year period (1993-1998) with just three labour market statuses: formal sector employment, informal sector employment and not employed. Banerjee *et al.* (2008) and Ranchhod and Dinkelman (2008) consider half-year transitions using various rounds of the LFS over 2001-2004 and also differentiate between formal and informal sector employment. For NIDS transition matrices similar to ours, but limited to the first two waves, see Cichello *et al.* (2014). None of the mentioned studies construct (decomposable) labour market mobility measures, however.

[17] Because of the likely misclassifications in wave 2 of the NIDS of some of the non-employed (see Section 4.1), we choose not to use multinomial models that differentiate between different types of non-employment.

value of zero for those that do not. We thus consider, in turn, particular forms of downward and upward mobility.[18]

The focus on regular wage jobs follows Cichello *et al.* (2014) and is motivated by the observation that such jobs generally provide more stability (as well as other pecuniary and non-pecuniary benefits) and are therefore, arguably, preferred over other employment.[19] We further expect that exit from regular wage work is less often voluntary than transitions out of self-, casual or other employment, which would help us to concentrate the analysis more on the role of the crisis in explaining downward mobility. That said, we do not pretend to be able to fully separate and identify the effects of individual or household choice, on the one hand, and those related to the external environment, on the other hand.

In our baseline specifications, vector *X* includes age interval and educational attainment dummies as our main variables of interest; these are considered general proxies for experience and skills, dimensions that have proven important in previous studies (see Section 3). It also contains race, marital status, household size, rural geography and province dummies as control variables. Other specifications incorporate additional (household-level) controls, such as the presence of other household members in wage employment, young children or pensioners. We will also look at variations in *Z*, a vector of job (or job history) variables. In the first set of models (of downward mobility) vector *Z* includes occupation and industry dummies, trade union membership, contract type/duration, job tenure and initial wage earnings. For the second set of models (of upward mobility) we select variables such as the initial labour market status and work experience. For all variables in *X* and *Z* we use values from the initial wave of the transition under study (either 2008 or 2010), which should attenuate endogeneity concerns. In other words, we investigate how the starting position of an individual in one wave influences his/her labour market transition outcome in the next wave. Because of gender differences in labour market dynamics (see Section 4.1), separate models are estimated for male and female three-wave balanced panel members (aged 20 to 55 in 2008).

Simple comparisons of the baseline explanatory variables over the different transition outcomes indicate that male workers that transitioned out of regular wage employment between 2008 and 2010 tended to be younger, less educated, part of larger households, and were more likely to be unmarried and living in rural areas in 2008 than the ones remaining wage employed. Roughly similar conclusions can be drawn for the 2010-2012 transition period, and for women over the two periods. Conversely, men and women that found wage employment were generally more educated and part of smaller, urban households than those that did not. Interestingly, individuals aged 20 to 35 in 2008 constituted a greater proportion of wage job finders than of the group that stayed outside regular wage employment. It therefore seems that there is relatively more labour market mobility, both upward and downward, among the younger South Africans in our balanced panel.

The next subsection presents and discusses our findings for the different multivariate model specifications described above.

[18] We acknowledge that by focusing only on the initially wage employed in the first set of probit models and on those outside wage employment in the second set of models, we introduce important selection effects, which we need to keep in mind when interpreting the results (see further). The joint estimation of wage employment entry and exit (in a system of equations) is an interesting avenue for further research.

[19] The relative stability of regular wage employment is evident from Table 2. Moreover, Cichello *et al.* (2014) provide evidence suggesting that about two thirds of workers moving from wage jobs to self- or casual employment between 2008 and 2010 experienced losses in earnings, and that over 80% of those who made the opposite transition gained financially.

## 4.3. Model estimates and discussion[20]

### *4.3.1. Continued regular wage employment or not*

Table 3 displays the baseline estimation results for our first set of probit models, which investigate the correlates of continued wage employment for men and women and for both transition periods. We report the estimated average marginal effects; for categorical variables, each parameter should be read as the weighted average percentage point difference in the predicted probability of being wage employed in the next wave between the category of individuals in question and the reference group, conditional on regular wage employment in the starting wave and holding all other regressors at their sample values. Significance of the reported marginal effects is based on standard errors adjusted for the stratified, two-stage cluster sample design of the NIDS.[21] All estimations in Table 3 control for race, marital status, household size, rural geography and the province of household location. To increase the readability of the table and maintain a focus on key variables age and education we do not show the marginal effects of these control variables.

*Table 3. Probit estimates for continued regular wage employment (NIDS), 2008-2010 and 2010-2012 (baseline): average marginal effects*

| | **(M1a)** | **(M1b)** | **(F1a)** | **(F1b)** |
|---|---|---|---|---|
| | Male | Male | Female | Female |
| | 2008-2010 | 2010-2012 | 2008-2010 | 2010-2012 |
| *Age 26-35* (ref.: age 20-25) | 0.1045 | 0.0457 | 0.0298 | 0.0737 |
| *Age 36-45* | 0.1773** | 0.0984 | 0.0764 | 0.1350** |
| *Age 46-55* | 0.1928** | 0.0546 | 0.0620 | 0.1239* |
| *Primary education* (ref.: none) | -0.1163** | 0.1346** | 0.0502 | 0.0844 |
| *Secondary education* | 0.0234 | 0.1984*** | 0.2161*** | 0.1932*** |
| *Tertiary education* | 0.1123** | 0.0786 | 0.3088*** | 0.2658*** |
| Observations | 877 | 938 | 1,025 | 1,136 |

Source: Calculated from 2008-2010-2012 NIDS data (SALDRU, various years).
Notes: Average marginal effects based on binary probit regressions where dependent variable takes value 1 if individual was in regular wage employment in initial wave and next wave, and 0 if only in initial wave. Sample includes only three-wave balanced panel members aged 20-55 in 2008 who were in regular wage employment in initial wave. All regressions have been weighted using panel weights that are population-calibrated and account for initial non-response and between-wave attrition. All models include as extra controls race dummies, a dummy for being married, household size, a rural geography dummy and province dummies (marginal effects not shown). Significance based on survey design-adjusted standard errors. ***$p$<0.01; **$p$<0.05; *$p$<0.10.

Column (M1a) of Table 3 indicates that men aged 36 to 45 in 2008 had an almost 18 percentage point higher chance of continued regular wage employment in 2010 than 20-25 year-olds. The estimated difference between the latter and the 46-55 age group was more than 19 percentage points. Age group differences in the 2010-2012 transition period were apparently not significant for men (column (M1b)). Younger female workers also faced less job security, but only significantly so in the post-crisis period (columns (F1a)-(F1b)). Greater educational attainment seems to have protected

[20] For reasons of brevity we do not report all estimation results discussed. However, as all other unreported results mentioned in the paper, they are available upon request.
[21] Like Verick (2012), we use the *margins, dydx()* Stata command in combination with the *svy* prefix. We employ panel weights as discussed in Section 4.1.

both men and women from transitioning out of employment, a result that mirrors Leung *et al.* (2014). For male workers, only tertiary (post-matric) education led to a significantly higher probability of remaining in wage employment over the crisis period; while between 2010 and 2012 primary and, especially, completed secondary education (a matric or equivalent certificate) offered the best buffer. For female workers, secondary and tertiary education were strongly correlated with remaining wage employed throughout. Survey-adjusted Wald F tests confirm that in the crisis period all marginal effects of education were significantly larger for women than for men.

As highlighted before, small initial sample sizes and high attrition rates for Whites and Asians in our balanced panel make it difficult to evaluate the independent effect of race on employment probabilities; estimates for such small subcategories cannot be taken as representative (another reason why they are not reported in Table 3).[22] Unreported marginal effects further show that married men and, to a lesser extent, married women had a greater chance of staying wage employed, a result which may not be readily interpretable. Household size seems to have had a small negative effect, possibly reflecting the importance of intra-household transfers (Verick, 2012). Lastly, rural women's likelihood of continued wage employment was significantly lower than that of urban-based women, but only during the crisis period.

Including additional household characteristics, such as whether the individual lives together with one or more other regular wage workers (cf. Dinkelman, 2004), the presence of a pensioner receiving an Old Age Pension (OAP), or the number of young children (younger than six) in the household (cf Cichello *et al.*, 2014), leaves the marginal effects of age and educational attainment practically unchanged; as does the inclusion of interview quarter dummies (to account for the long period covered by wave 2).

More importantly, because we restrict our analysis to individuals that were initially in regular wage employment, we can also include extra job-specific variables (vector *Z*) in our estimations. Most of these variables are not available for other forms of employment in the NIDS. In Table 4 we add to our baseline specification in turn, dummies for the occupation type, industry of employment, union membership and contract duration. The effect of such variables could not be tested in the cross-sectional setup of studies such as Leung *et al.* (2009) and Verick (2012) (cf. Section 3).

Column (F1a) of Table 4 shows that female wage workers were about 12-13 percentage points less likely to transition out of regular wage jobs over the crisis period if they practised semi-skilled or managerial/professional rather than elementary (unskilled) occupations in 2008; between 2010 and 2012 only managerial/professional occupations were associated with lower job exit probabilities (column (F1b)). For men there were seemingly no significant differences between these broad occupation types (columns (M1a)-(M1b)). These findings appear to be at odds with Cichello *et al.* (2014), who use the same classification of occupations but consider only the African subsample of NIDS.

The inclusion of industry dummies in column (M2a), whereby we exclude private household workers and take agriculture as the reference industry, suggests that especially men active in the construction sector in 2008 were less likely to still be in wage employment by 2010.[23] This makes sense, given the large net job losses in this sector observed in the official data (cf. Section 2 and Figure A.1 in Appendix). What is puzzling, however, is the insignificance of the dummy for manufacturing, whose contribution to South African GDP suffered most during the crisis and which

[22] For example, in the 2010-2012 period there was not even a single Asian/Indian female wage worker in our sample.

[23] The significant effect for male workers in the utility industry is based on very few observations.

accounted for the largest net (male) job losses between 2008Q4 and 2010Q3 (the peak and through in total employment). Perhaps workers in manufacturing had overall more transferable skills than, say, construction workers, which would give them an advantage in reallocating to other wage jobs (possibly in another sector or subsector) when made redundant.[24] Another possibility is that the balanced NIDS sample is simply too small and that the NIDS waves are too long and too far away from one another to pick up particular industry effects. That said, we find that employment in trade, transport, financial services and, again, construction was negatively associated with staying wage employed for men in the post-crisis period (column (M2b). Also, between 2010 and 2012 we observe higher probabilities of continued regular wage employment for women active in community services, compared to agricultural workers (column (F2b)).[25] The relative (in)security of construction and community services jobs differs significantly between male and female workers, according to Wald tests. Interestingly, when adding occupation or industry variables the estimated marginal effects of education remain significant. It therefore seems that education, a general proxy for skills, had a positive influence on the probability of remaining in wage employment above and beyond broad typologies of jobs, both during and after the crisis.

Columns (M3a)-(M3b) and (F3a)-(F3b) of Table 4 further indicate that, in terms of job security, union members were in an advantaged position, particularly post crisis. The estimated marginal effects of union membership are somewhat larger for women than for men, but not significantly so. Similar positive effects are found for permanent contract jobs (columns (M4a)-(M4b) and (F4a)-(F4b)) and for work under a written contract. Again the independent buffering effect of education remains present. Lastly, in unreported estimations we have examined the role of job tenure, i.e., the log of the number of months an individual was employed in his/her wage job prior to interview, and initial wage earnings, i.e., the log of real monthly take-home pay (deflated to December 2012 price levels). Both variables turn out to be highly significant in explaining male and female job security. The inclusion of monthly pay, however, reduces the economic and statistical significance of our education dummies markedly, as education and wage earnings are obviously collinear.

[24] The public NIDS data does not allow for an investigation of within-manufacturing heterogeneity in job security or within-sector reallocation. We come back to this issue when discussing possible avenues for further research in Section 6.

[25] Other significant industry effects for women, such as mining or construction, again hinge on just a few observations.

*Table 4. Probit estimates for continued regular wage employment (NIDS), 2008-2010 and 2010-2012 (extra job variables): average marginal effects*

| | **(M1a)** | **(M1b)** | **(M2a)** | **(M2b)** | **(M3a)** | **(M3b)** | **(M4a)** | **(M4b)** |
|---|---|---|---|---|---|---|---|---|
| | Male | Male | Male | Male | Male | Male | Male | Male |
| | 2008-2010 | 2010-2012 | 2008-2010 | 2010-2012 | 2008-2010 | 2010-2012 | 2008-2010 | 2010-2012 |
| *Age 26-35* (ref.: age 20-25) | 0.1075 | 0.0471 | 0.1547* | 0.0173 | 0.1016 | 0.0392 | 0.0826 | 0.0559 |
| *Age 36-45* | 0.1798** | 0.0887 | 0.2134** | 0.0700 | 0.1715** | 0.0911 | 0.1525* | 0.0853 |
| *Age 46-55* | 0.2028** | 0.0670 | 0.2115** | 0.0126 | 0.1721** | 0.0212 | 0.1713** | 0.0101 |
| *Primary education* (ref.: none) | -0.1073** | 0.1386** | -0.1026** | 0.1328** | -0.1101** | 0.1196** | -0.1201*** | 0.0929 |
| *Secondary education* | 0.0369 | 0.2091*** | 0.0301 | 0.1673** | 0.0372 | 0.1874*** | 0.0164 | 0.1586** |
| *Tertiary education* | 0.1318** | 0.0727 | 0.0968* | 0.0349 | 0.1050* | 0.0712 | 0.0979* | 0.0069 |
| *Semi-skilled* (ref.: elementary) | -0.0390 | -0.0002 | | | | | | |
| *Managerial/professional* | -0.0761 | 0.0352 | | | | | | |
| *Mining* (ref.: agriculture) | | | -0.1253 | -0.0663 | | | | |
| *Manufacturing* | | | 0.0070 | -0.0912 | | | | |
| *Utilities* | | | 0.1460*** | -0.2313 | | | | |
| *Construction* | | | -0.2912*** | -0.2837*** | | | | |
| *Trade* | | | -0.1094 | -0.1704*** | | | | |
| *Transport* | | | 0.0246 | -0.1674* | | | | |
| *Financial services* | | | -0.0318 | -0.1867* | | | | |
| *Community services* | | | -0.0310 | 0.0033 | | | | |
| *Union member* | | | | | 0.0261 | 0.1566*** | | |
| *Permanent contract* | | | | | | | 0.0708* | 0.1632*** |
| Observations | 857 | 878 | 780 | 885 | 850 | 928 | 873 | 916 |

*Table 4* (Continued)

| | (F1a) | (F1b) | (F2a) | (F2b) | (F3a) | (F3b) | (F4a) | (F4b) |
|---|---|---|---|---|---|---|---|---|
| | Female | Female | Female | Female | Female | Female | Female | Female |
| | 2008-2010 | 2010-2012 | 2008-2010 | 2010-2012 | 2008-2010 | 2010-2012 | 2008-2010 | 2010-2012 |
| *Age 26-35* (ref.: age 20-25) | 0.0273 | 0.0616 | 0.0544 | 0.0783 | 0.0214 | 0.0771 | 0.0042 | 0.0721 |
| *Age 36-45* | 0.0885 | 0.1106* | 0.1043 | 0.1273** | 0.0667 | 0.1091* | 0.0603 | 0.1059* |
| *Age 46-55* | 0.0724 | 0.1034 | 0.1224* | 0.0910 | 0.0424 | 0.0729 | 0.0322 | 0.0984 |
| *Primary education* (ref.: none) | 0.0291 | 0.0608 | 0.0686 | 0.0047 | 0.0230 | 0.0396 | 0.0447 | 0.0596 |
| *Secondary education* | 0.1441** | 0.1255* | 0.1920** | 0.1084 | 0.1660*** | 0.1106* | 0.1800*** | 0.1143 |
| *Tertiary education* | 0.2289*** | 0.1773** | 0.2543*** | 0.1387* | 0.2489*** | 0.1662*** | 0.2879*** | 0.1882*** |
| *Semi-skilled* (ref.: elementary) | 0.1261*** | 0.0378 | | | | | | |
| *Managerial/professional* | 0.1200** | 0.1564*** | | | | | | |
| *Mining* (ref.: agriculture) | | | 0.1886*** | | | | | |
| *Manufacturing* | | | -0.0629 | -0.0748 | | | | |
| *Utilities* | | | | | | | | |
| *Construction* | | | 0.0070 | -0.3185** | | | | |
| *Trade* | | | -0.0049 | -0.0779 | | | | |
| *Transport* | | | -0.0089 | -0.3478** | | | | |
| *Financial services* | | | 0.0236 | -0.0351 | | | | |
| *Community services* | | | 0.0313 | 0.1222* | | | | |
| *Union member* | | | | | 0.0825** | 0.2080*** | | |
| *Permanent contract* | | | | | | | 0.0910** | 0.1999*** |
| Observations | 1,018 | 1,099 | 762 | 904 | 1,007 | 1,128 | 1,017 | 1,100 |

Source: Calculated from 2008-2010-2012 NIDS data (SALDRU, various years).

Notes: Average marginal effects based on binary probit regressions where dependent variable takes value 1 if individual was in regular wage employment in initial wave and next wave, and 0 if only in initial wave. Sample includes only three-wave balanced panel members aged 20-55 in 2008 who were in regular wage employment in initial wave. All regressions have been weighted using panel weights that are population-calibrated and account for initial non-response and between-wave attrition. All models include as extra controls race dummies, a dummy for being married, household size, a rural geography dummy and province dummies (marginal effects not shown). Significance based on survey design-adjusted standard errors. ***$p$<0.01; **$p$<0.05; *$p$<0.10.

### *4.3.2. Entry into regular wage employment or not*

Table 5 shows the baseline estimation results of our second set of probit models, on the determinants of transitions *into* regular wage employment. It reveals that older men were significantly less likely to become wage employed than younger males over the crisis and non-crisis periods (columns (M1a)-(M1b)), while women aged 26-35 in 2008 were relatively more successful in finding wage jobs between 2008 and 2010 (column (F1a)). Education again played an important role; men with some form of tertiary education had a 36 percentage point higher probability of moving into wage employment during the crisis than those without completed primary education. In the post-crisis period the estimated effect of tertiary education halves in size, but secondary education too became a significant predictor. For women, both secondary and tertiary education were helpful in getting into wage employment. Gender differences with respect to these education effects are however not significant at conventional levels.

According to the other (unreported) marginal effects, rural-based women were less likely to find wage jobs, but only between 2008 and 2010.[26] We do not uncover any significant effects linked to household composition, such as the presence of other wage workers, young children or OAP-receiving pensioners. Other specifications indicate that the age and education effects in Table 5 are robust to controlling for the timing of the wave 2 interview or local unemployment rates at the district council level.[27]

*Table 5. Probit estimates for finding regular wage employment (NIDS), 2008-2010 and 2010-2012 (baseline): average marginal effects*

| | **(M1a)** | **(M1b)** | **(F1a)** | **(F1b)** |
|---|---|---|---|---|
| | Male | Male | Female | Female |
| | 2008-2010 | 2010-2012 | 2008-2010 | 2010-2012 |
| *Age 26-35* (ref.: age 20-25) | -0.0129 | 0.0257 | 0.0540** | 0.0232 |
| *Age 36-45* | 0.0236 | -0.0539 | -0.0042 | 0.0288 |
| *Age 46-55* | -0.1023** | -0.1108** | -0.0319 | -0.0342 |
| *Primary education* (ref.: none) | -0.0172 | 0.0425 | 0.0296 | 0.0551*** |
| *Secondary education* | 0.0628 | 0.1058* | 0.0773** | 0.0949*** |
| *Tertiary education* | 0.3632*** | 0.1758** | 0.2022*** | 0.1917*** |
| Observations | 1,354 | 1,277 | 3,202 | 3,043 |

Source: Calculated from 2008-2010-2012 NIDS data (SALDRU, various years).

Notes: Average marginal effects based on binary probit regressions where dependent variable takes value 1 if individual was not in regular wage employment in initial wave but wage employed in next wave, and 0 if not in regular wage employment in either of the waves. Sample includes only three-wave balanced panel members aged 20-55 in 2008 who were not in regular wage employment in initial wave. All regressions have been weighted using panel weights that are population-calibrated and account for initial non-response and between-wave attrition. All models include as extra controls race dummies, a dummy for being married, household size, a rural geography dummy and province dummies (marginal effects not shown). Significance based on survey design-adjusted standard errors. ***$p$<0.01; **$p$<0.05; *$p$<0.10.

[26] Racial differences are again hard to evaluate. The subsamples of Whites and Asians/Indians outside regular wage employment at the beginning of either of the two transition periods are very small.

[27] Men whose wave 2 interview took place in later quarters, especially in 2011, had a significantly greater chance of having found wage employment by then.

Table 6 adds a number of extra job history variables to the baseline model of Table 5. For men the original labour market status, i.e., either NEA, discouraged, searching unemployed or employed in a 'non-wage' job (self-employment, casual employment, subsistence agriculture or assistance with others' business), had no statistically significant impact on wage job finding chances during the crisis (column (M1a); cf. Posel *et al.*, 2014). Men who were actively searching for a job or in non-wage jobs in 2010 were, however, significantly more likely than the NEA to become wage employed by 2012 (column (M1b)). Job finding probabilities were also greater for women engaged in active search (in both periods) and the non-wage employed (first period) (columns (F1a)-(F1b)). Differences between the discouraged unemployed and the NEA were apparently not significantly different. Overall, the estimated labour market status effects are similar for men and women. Work experience, defined here as having a non-wage job in the initial wave or having worked at least some time prior to that, is positively associated with finding regular wage employment (columns (M2a)-(M2b) and (F2a)-(F2b)).[28]

Individuals that reported having moved dwelling between two waves were more likely to have a regular wage job in the second wave (columns (M3a)-(M3b) and (F3a)-(F3b)). Wald F tests indicate that the marginal effects of moving are significantly larger for men than for women. This result may reflect not only the importance of internal migration to increase job finding prospects in South Africa (see Cornwell and Inder, 2004; Mbatha and Roodt, 2014), but also possible endogeneity of the decision to move to labour market statuses. Indeed, Klasen and Woolard (2009) and Ebrahim *et al.* (2013) find that the unemployed typically delay setting up their own households, whereas gaining employment enables individuals to move out of the family home. Furthermore, those that move may possess certain characteristics, uncontrolled for in our specifications, that make them more likely to get into wage jobs in the first place. The marginal effects of higher educational attainment seem little influenced by the inclusion of the extra variables of Table 6.

Our results so far suggest that both deliberate individual or household choices and external factors, such as the broader economic environment or firms' hiring and firing strategies, played a role in determining transitions in an out of regular wage employment during the crisis and its aftermath. The importance of labour supply decisions follows from the significance of variables such as household size and marital status (and some of the household composition variables) in our probits. The significance of higher educational attainment and other skill-related variables, including occupation and contract types, length of job tenure and work experience, instead points to labour demand effects on the probability of remaining in or finding wage employment.

[28] We classify an individual as having work experience in wave 1 if he or she is employed in some form in wave 1 or answers affirmatively to the question 'Have you EVER worked for pay or profit or helped unpaid in a household business?'. In wave 2 we copy the work experience information from wave 1 and adjust it based on the wave 2 labour market status and wave 2 self-reported work experience (to account for between-wave employment). Many individuals that in wave 2 report never having worked, are however classified as employed in wave 1, which calls into doubt the validity of the recall question (and may be due to differences between official/survey definitions and people's conceptions of what constitutes work/employment). In case of inconsistencies we give priority to the employment status observed in wave 1 over individuals' self-reporting about the past.

*Table 6. Probit estimates for finding regular wage employment (NIDS), 2008-2010 and 2010-2012 (extra job history variables): average marginal effects*

| | **(M1a)** | **(M1b)** | **(M2a)** | **(M2b)** | **(M3a)** | **(M3b)** | **(F1a)** | **(F1b)** | **(F2a)** | **(F2b)** | **(F3a)** | **(F3b)** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Male | Male | Male | Male | Male | Male | Female | Female | Female | Female | Female | Female |
| | 2008-2010 | 2010-2012 | 2008-2010 | 2010-2012 | 2008-2010 | 2010-2012 | 2008-2010 | 2010-2012 | 2008-2010 | 2010-2012 | 2008-2010 | 2010-2012 |
| *Age 26-35* (ref.: age 20-25) | -0.0136 | 0.0079 | -0.0238 | -0.0101 | -0.0112 | 0.0325 | 0.0393 | 0.0146 | 0.0374 | -0.0009 | 0.0551** | 0.0249 |
| *Age 36-45* | 0.0136 | -0.0428 | -0.0033 | -0.0743 | 0.0298 | -0.0329 | -0.0174 | 0.0199 | -0.0233 | -0.0047 | 0.0012 | 0.0386 |
| *Age 46-55* | -0.0943** | -0.1074* | -0.1087** | -0.1294** | -0.0950** | -0.0852 | -0.0376 | -0.0380 | -0.0481* | -0.0669** | -0.0233 | -0.0225 |
| *Primary education* (ref.: none) | -0.0053 | 0.0351 | -0.0068 | 0.0494 | -0.0252 | 0.0359 | 0.0243 | 0.0466** | 0.0248 | 0.0509** | 0.0296 | 0.0542*** |
| *Secondary education* | 0.0761 | 0.0930 | 0.0795 | 0.1035* | 0.0520 | 0.0977* | 0.0699** | 0.0817*** | 0.0729** | 0.0818*** | 0.0738** | 0.0919*** |
| *Tertiary education* | 0.3690*** | 0.1518* | 0.3778*** | 0.1832** | 0.3508*** | 0.1858** | 0.1764*** | 0.1631*** | 0.1711*** | 0.1706*** | 0.2029*** | 0.1882*** |
| *Discouraged* (ref.: NEA) | 0.0462 | 0.0743 | | | | | 0.0209 | 0.0156 | | | | |
| *Searching unemployed* | 0.0608 | 0.0982** | | | | | 0.0406* | 0.0641*** | | | | |
| *Employed in non-wage job* | 0.0526 | 0.0927* | | | | | 0.0517* | 0.0412 | | | | |
| *Work experience* | | | 0.0547 | 0.1209*** | | | | | 0.0441** | 0.0819*** | | |
| *Moved dwelling* | | | | | 0.2203*** | 0.2564*** | | | | | 0.0622* | 0.0928** |
| Observations | 1,250 | 1,213 | 1,186 | 1,180 | 1,354 | 1,277 | 3,084 | 2,961 | 3,033 | 2,959 | 3,202 | 3,043 |

Source: Calculated from 2008-2010-2012 NIDS data (SALDRU, various years).

Notes: Average marginal effects based on binary probit regressions where dependent variable takes value 1 if individual was not in regular wage employment in initial wave but wage employed in next wave, and 0 if not in regular wage employment in either of the waves. Sample includes only three-wave balanced panel members aged 20-55 in 2008 who were not in regular wage employment in initial wave. All regressions have been weighted using panel weights that are population-calibrated and account for initial non-response and between-wave attrition. All models include as extra controls race dummies, a dummy for being married, household size, a rural geography dummy and province dummies (marginal effects not shown). Significance based on survey design-adjusted standard errors. ***$p$<0.01; **$p$<0.05; *$p$<0.10.

Further examination of those individuals that transition out of wage employment or do not transition into wage employment between waves provides additional (albeit anecdotal) support to the hypothesis that these forms of downward mobility and lack of upward mobility are, in part, 'involuntary'. Even though information on the self-reported reasons someone stopped working in his/her last job is largely missing from the NIDS, 'lost job/job ended/laid off' tops the list of the responses given. Among the unemployed that did not find employment by the next wave, almost no one reported having turned down any job offers. The non-searching unemployed that reported in 2010 and 2012 on why they had stopped looking for work cited 'discouragement' and the unaffordability of job search costs as the main drivers, although the number of non-missing responses is again too small for meaningful inference.[29]

An important limitation of our analysis based on the NIDS panel is that its survey design forces us to adopt a medium-term view on South African labour market transitions. The two-year(-plus) time span between the three NIDS waves possibly hides considerable shorter-term churning across labour market statuses and may be too coarse to pick up some of the shorter-lived effects of the crisis. Also, the small size of certain subsamples in the balanced panel, whether racial groups or workers in particular industries, limits the generalisability of the results found for these particular groups. Therefore, in the next section we will complement our NIDS findings with results from another, larger and higher-frequency longitudinal dataset, i.e., a panel constructed from QLFS cross-sections.

## 5. Matched Quarterly Labour Force Survey (QLFS) cross-sections

### 5.1. Dataset and descriptives

The QLFS, the source of South Africa's official unemployment rate, collects information on the labour market activity of individual respondents aged 15 and older.[30] It was launched in 2008, replacing the semi-annual Labour Force Survey (LFS), and is designed as a rotating panel of around 30,000 dwellings, divided into four rotation groups. Each quarter, 25% of the dwellings rotate out of the sample and are replaced by new dwellings on a master list. In principle, each dwelling thus remains in the sample for four consecutive quarters. Whereas the dwelling is the sampling unit, the unit of observation is the household. If one household moves out of a particular dwelling and another moves in, say, after two quarters, the new household will be enumerated for the remaining two quarters.

Using the QFLS as a longitudinal dataset of individuals is not straightforward, since household identifiers are generally maintained across quarters but individual identifiers not necessarily so. To get around this problem we use matching on observable characteristics, following an algorithm similar to the one originally developed by Ranchhod and Dinkelman (2008) for the former LFS and applied to the QLFS by von Fintel and Burger (2009), Verick (2012) and Leung *et al.* (2014) (see Section 3). Individuals are matched from one quarter to the next on the basis of their household

[29] We also inspected new wage job entrants in 2010 and 2012, and were able to replicate the result of Posel *et al.* (2014) that successful job finding occurs mostly through being told about the job by a friend or relative outside the own household. In both transition periods, more than half of all (responding) individuals in our balanced panel that found a wage job did so by referral from friends or relatives.

[30] See http://www.statssa.gov.za/qlfs/index.asp for more details about the QLFS.

identifier, gender, race and age, with additional consistency checks on educational attainment and marital status to minimise false matches. Table A.2 in Appendix describes our matching algorithm in more detail. Applied to a total of 1,303,404 observations for working-age individuals in 24 quarters of QLFS data over 2008Q1-2013Q4, the algorithm results in a pooled dataset of 952,158 observations that can be matched between at least two waves and that satisfy the various consistency constraints we impose. We calculate that our average matching rate is 72.1%[31], which compares well to the 48.7% reported by Verick (2012).

A number of issues arise when matching (see Ranchhod and Dinkelman, 2008). Like in a 'genuine' panel such as the NIDS, matched individuals may not be a random subsample of the pooled QLFS cross-sections and hence not adequately represent South Africa's working age population. If attrition between quarters is correlated with observable characteristics, however, we can use similar inverse probability weighting as in the NIDS to reduce the bias caused by non-random matching. Probit estimations indicate that in the QLFS individuals that are older, female, non-African, married, better-educated and live in formal urban areas are generally more likely to be matched between quarters. Clearly, these attrition patterns are very different from those in the NIDS, where selective attrition is highest among richer (better-educated) Whites, largely due to greater interview refusal rates (Brown *et al.*, 2012; de Villiers *et al.*, 2013).

Unlike in the NIDS, where individuals are tracked even if they change residence (within South Africa), the matched QLFS dataset does not contain any movers (because of the QLFS' design as a rotating panel of dwellings, not of individuals). This is arguably the main drawback of the matched QLFS. Individuals that move will often be migrants, whose labour market participation is deemed to be very different from non-migrants. As we have explained before and as our NIDS estimations suggests (see Section 4.3.2), in South Africa (internal) migration is often either a cause or consequence of changes in the labour market status. Unemployed migrants may have better job finding prospects than non-migrants, as they move to centres of economic activity (Mbatha and Roodt, 2014), while individuals that gain employment may be more able and willing to move out of the family home and set up their own household (Klasen and Woolard, 2009; Ebrahim *et al.*, 2013). The exclusion of migrants from matched QLFS cross-sections will therefore lead us to underestimate upward labour market mobility. Moreover, individuals that become unemployed may be tempted to move (back) in with relatives or friends in search of support (Klasen and Woolard, 2009), which would lead to an underestimation of downward mobility too in the matched QLFS.[32] Inverse probability weighting may of course help to attenuate these biases somewhat, but cannot be expected to solve this problem, since the migration decision is likely also correlated with unobservable characteristics not well proxied by observables such as race, age and educational attainment.[33]

Another, lesser issue with the QLFS is that, even after consistency checks, false matches of individuals between quarters cannot be ruled out completely. Such mismatches could in principle lead to an *over*estimation of labour market mobility. On the whole, however, we expect labour

[31] This average matching rate is calculated as the number of successful individual matches (after consistency checks) divided by the number of individuals resident in households that are common to two consecutive quarters (the latter being the theoretical maximum number of matches), averaged over all pairs of quarters (cf. Ranchhod and Dinkelman, 2008, p. 6).

[32] In the words of Ranchhod and Dinkelman (2008, p. 7), 'the stability of individuals who are matched may lead us to overestimate [labour market] persistence'.

[33] Indeed, in our NIDS model we found the marginal effect of moving dwelling on the probability of finding wage employment to be highly significant, having controlled for a range of other observables (see Table 6).

market mobility measures calculated from the matched QLFS data to be underestimating actual mobility.

In our analysis of the QLFS we only look at labour market transitions from one quarter to the next, rather than trying to follow individuals over more than two quarters. Doing so would require more complex (and, arguably, more unreliable) weights to counter the attrition bias unfolding over multiple quarters. Simple quarter-to-quarter panel weights were constructed as the cross-sectional weights found in the publicly released QLFS data (which adjust for initial selection, non-response and benchmarking to population estimates) multiplied by the inverse of the next-quarter match probability predicted by the earlier-mentioned probits and trimmed at the 1st and 99th percentiles.[34]

Following Verick (2012), we focus on the QLFS's five major labour market statuses: 'formal sector employment' (based on company size and registration for VAT and income tax), 'informal sector employment' (including private household workers), 'searching unemployed', 'discouraged unemployed' and 'NEA'. This classification is broadly equivalent to that of the NIDS, although there is no one-to-one correspondence between formal sector and regular wage employment, on the one hand, and between informal sector employment and self-, casual or other employment, on the other hand. For the reasons outlined before and to facilitate comparison with the NIDS, we restrict our analysis of transitions between quarter *t* and quarter *t*+1 of the QLFS to panel members aged 20-55 in quarter *t*. Final sample sizes of matched individuals that meet the age requirement are between 18,000 and 22,000 per quarter.

Bearing the limitations of the matched QLFS in mind, we again inspect transition matrices. Table 7 compiles quarter-to-quarter transition rates across the five labour market statuses specified above. Transitions from Q1 to Q2, Q2 to Q3 and Q3 to Q4 are pooled and compared over the years 2008 to 2013.[35] In line with our expectations, we find that quarter-to-quarter mobility is much more limited than the two-year mobility in the NIDS (cf. Table 2). Still, labour market statuses seemed far from stable. In 2008, on average 9% of workers initially in formal sector employment were no longer so in the next quarter. Especially job search decisions changed considerably between quarters, with discouragement being the least stable state. Labour market statuses became progressively more persistent or 'absorbing' during the recession (2009) and in its aftermath (2010-2012), with only a slight reversal of this trend in 2013. The decrease in mobility was bi-directional according to the QLFS; both transitions from unemployment into employment and, to a lesser extent, from formal and informal sector employment to narrow unemployment became less prevalent. Indeed, it seems that the net increases in unemployment rates following the recession (cf. Table 1) are driven more by reduced inflows of labour market participants into employment than by larger outflows from employment. This assertion has been made by von Fintel and Burger (2009), Verick (2012) and Leung *et al.* (2014) in comparing 2008 with 2009 labour market transitions, and our update in Table 7

[34] Again, panel weights based on alternative probit estimations (with race-gender-specific age intervals or including the initial labour market status) were attempted but had little impact on our results.

[35] Unlike in the NIDS panel, where labour market transitions of the exact same individuals (the three-wave balanced panel) are compared over two periods, we here compare over time transitions by different individuals with the same characteristics (i.e., belonging to the same 20-55 age group and having the same labour market status) in starting quarter *t*. Therefore, our transition matrices based on the NIDS and the matched QLFS will not be strictly comparable but rather complementary (also because of the differences between regular wage employment in the NIDS and formal sector employment in the QLFS). Reassuringly, quarter-to-quarter transition matrices reported by Statistics South Africa (2014b), based on a non-released (confidential) QLFS panel matched using names and surnames, are very similar to those based on our self-matched QLFS data; differences in transition rates are virtually always smaller than one percentage point.

demonstrates that it continued to hold for quite some time thereafter. von Fintel and Burger (2009) suggest that the dominance of declining job creation in explaining rising unemployment rates in South Africa since 2008 is, at least partly, due to the relatively strong bargaining power of those who already had a job. It is argued that wage bargains of those 'insiders' probably reduced employers' willingness to create new job vacancies (for 'outsiders', i.e., the unemployed) and made that the global crisis and the ensuing recession in South Africa had a long-term impact on unemployment.[36]

In line with the NIDS, transition matrices by gender show that, overall, formal sector employment and unemployment were more stable for men than for women, whereas informal sector employment and NEA were steadier labour market statuses for women.

Mobility measures in Table A.3 in Appendix (calculated using Formula (2) of Section 4.1) indicate that about 18% of all 20-55 year-old individuals switched labour market status between quarters in 2012, down from 21% in 2008. In 2013 average labour market mobility crept up again to 19%. The crisis and early post-crisis decline is present in all components of mobility apart from mobility within non-employment, and is largest for upward mobility. Female mobility trumps that of men in all years, again mostly due to greater within non-employment movement. Because of a faster decline in female mobility, however, the gender gap has narrowed since 2008.

[36] This is not to say that job destruction was not a problem in South Africa during the global crisis. In fact, Bhorat (2009) (cited in von Fintel and Burger, 2009) documents a fast acceleration in retrenchments in the period leading up to and at the very start of the South African recession (January 2008 - January 2009), especially by small firms. Overall job destruction rates seem to have tailed off thereafter.

*Table 7. Transition matrices for labour market statuses (QLFS), 2008Q1-2013Q4: row proportions (%)*

| Labour market status in quarter *t* | | Labour market status in quarter *t*+1: Formal sector employment | | | | | | Informal sector employment | | | | | | Searching unemployed | | | | | | Discouraged unemployed | | | | | | NEA | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 41.7 | 40.3 | 37.7 | 37.6 | 38.7 | 39.2 | 14.2 | 13.0 | 13.0 | 12.7 | 12.4 | 12.4 | 15.4 | 16.0 | 16.5 | 16.8 | 16.9 | 17.2 | 4.2 | 5.7 | 7.5 | 8.1 | 8.3 | 8.1 | 24.5 | 25.2 | 25.2 | 24.7 | 23.7 | 23.1 |
| | | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 |
| 41.1 2008 | Formal sector employ. | **91.0** | **92.0** | **92.5** | **92.6** | **92.6** | **92.1** | 3.9 | 3.2 | 3.2 | 3.2 | 3.1 | 3.0 | 2.9 | 2.9 | 2.4 | 2.4 | 2.4 | 2.7 | 0.5 | 0.5 | 0.6 | 0.7 | 0.7 | 1.0 | 1.7 | 1.3 | 1.4 | 1.2 | 1.2 | 1.3 |
| 40.4 2009 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 37.6 2010 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 37.5 2011 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 38.5 2012 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 38.9 2013 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 14.0 2008 | Informal sector employ. | 12.1 | 10.3 | 9.9 | 9.4 | 9.7 | 10.5 | **74.1** | **76.9** | **79.4** | **79.8** | **78.8** | **77.2** | 6.5 | 5.6 | 4.5 | 5.0 | 5.0 | 5.7 | 1.7 | 2.3 | 2.4 | 2.1 | 2.6 | 3.0 | 5.7 | 4.9 | 3.9 | 3.7 | 3.9 | 3.6 |
| 12.8 2009 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 12.6 2010 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 12.5 2011 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 12.2 2012 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 12.2 2013 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 16.0 2008 | Search. unempl. | 9.9 | 7.0 | 5.5 | 5.6 | 6.4 | 7.1 | 6.9 | 5.3 | 5.2 | 4.2 | 4.4 | 4.7 | **62.0** | **65.5** | **68.4** | **69.4** | **70.0** | **70.3** | 5.5 | 7.0 | 8.0 | 7.7 | 7.1 | 6.8 | 15.6 | 15.2 | 12.9 | 13.1 | 12.1 | 11.1 |
| 16.3 2009 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 17.0 2010 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 17.0 2011 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 17.3 2012 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 17.2 2013 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4.3 2008 | Discour. unempl. | 6.1 | 4.0 | 3.4 | 3.7 | 3.4 | 4.6 | 6.9 | 5.3 | 5.2 | 4.1 | 4.2 | 4.7 | 18.6 | 18.1 | 15.8 | 15.9 | 15.1 | 14.7 | **44.2** | **51.1** | **56.1** | **58.0** | **60.2** | **58.2** | 24.1 | 21.6 | 19.5 | 18.3 | 17.2 | 17.8 |
| 5.2 2009 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7.1 2010 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 8.0 2011 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 8.3 2012 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 8.1 2013 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 24.6 2008 | NEA | 2.8 | 1.8 | 1.9 | 1.9 | 1.9 | 2.3 | 3.5 | 2.7 | 2.1 | 1.9 | 2.0 | 2.3 | 10.6 | 9.7 | 9.1 | 9.0 | 8.8 | 9.3 | 4.2 | 5.3 | 6.4 | 6.7 | 6.2 | 6.4 | **78.9** | **80.6** | **80.6** | **80.6** | **81.1** | **79.7** |
| 25.3 2009 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 25.6 2010 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 25.0 2011 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 23.8 2012 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 23.6 2013 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

Source: Calculated from matched 2008Q1-2013Q4 QLFS data (Statistics South Africa, various years).

Notes: Sample includes only matched individuals aged 20-55 in quarter t. All figures have been weighted using panel weights that are population-calibrated and account for initial non-response and attrition between quarters *t* and *t*+1. Inner matrix cells give quarter-to-quarter transition rates (Q1 to Q2, Q2 to Q3, and Q3 to Q4) pooled per year for 2008-2013. Outer left column gives the overall proportion of each labour market status in quarter *t*, pooled per year. Top row gives the overall proportion of each status in quarter *t*+1, pooled per year. Inner and outer cells of the same shade of grey together form the pooled transition matrix for one particular year (2008-2013).

### 5.2. Model estimates and discussion

For the matched QLFS we limit ourselves again to two sets of binary probit models to study the determinants of downward and upward labour market mobility for 20-55 year-olds during the years 2008-2013. In the first set, transition outcome *y* of Equation (3) is assigned a value of one for individuals that remain in formal sector employment from one quarter to the next, and zero for those moving out of formal sector jobs between quarters. The dependent variable of the second set of probits equals one for individuals that are initially outside of formal sector employment but find such employment in the next wave, and equals zero for those that do not. We include in our models the same vectors *X* and *Z* of regressors as before, as well as a number of job-specific variables unavailable in the NIDS, such as firm type and firm size. Because of the matching issues highlighted earlier, the exclusion of movers in particular, all results based on the matched QLFS should be interpreted with care.

#### *5.2.1. Continued formal sector employment or not*

Table 8 presents the average marginal effects for the baseline probit models of the first kind, again with transitions from Q1 to Q2, Q2 to Q3, and Q3 to Q4 pooled per year. One noticeable result, which shows clear communalities with NIDS-based Table 3, is the importance of secondary and tertiary education for sustained formal sector employment for both sexes. In 2008-2010 and 2013 the marginal effects of higher education were significantly larger for women than for men according to Wald F tests. Furthermore, the strength of the education buffer seemingly decreased over the years; in the case of women higher education's protection against job exit was significantly lower in 2010-2012 compared to 2008. Formal sector job persistence increased with age, right up to the 46-55 age group.

Unlike in the NIDS, where subsamples were too small to trust the estimated marginal effects, we do find some significant racial differences in staying employed in the QLFS, most clearly between White and Black male workers.[37] Marginal effects of the other control variables indicate positive associations of continued employment with being married (for men) and negative associations with household size and rural residence (for women), which corresponds reasonably well with our earlier findings.

Unreported specifications show that living together with other formal sector workers had a small, one to two percentage point, positive effect on an individual's own chances of remaining employed in the formal sector; that the presence of an OAP-receiving pensioner in the household had an equally small, negative influence on male workers; and no clear effect of the number of young children.

[37] The limited economic and statistical significance of some of the racial marginal effects in Table 8 does not mean that race does not matter for South African employment. On the contrary, whereas race may not be a strong determinant of *continued* formal sector employment, it is strongly correlated with being employed in the formal sector in the first place.

*Table 8. Probit estimates for continued formal sector employment (QLFS), 2008Q1-2013Q4 (baseline): average marginal effects*

| | **(M1a)** | **(M1b)** | **(M1c)** | **(M1d)** | **(M1e)** | **(M1f)** | **(F1a)** | **(F1b)** | **(F1c)** | **(F1d)** | **(F1e)** | **(F1f)** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Male | Male | Male | Male | Male | Male | Female | Female | Female | Female | Female | Female |
| | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 |
| *Age 26-35* (ref.: age 20-25) | 0.0184** | 0.0145 | 0.0299*** | 0.0283*** | 0.0386*** | 0.0495*** | 0.0459*** | 0.0498*** | 0.0202* | 0.0490*** | 0.0307** | 0.0451*** |
| *Age 36-45* | 0.0402*** | 0.0267*** | 0.0570*** | 0.0406*** | 0.0508*** | 0.0572*** | 0.0703*** | 0.0641*** | 0.0470*** | 0.0512*** | 0.0498*** | 0.0707*** |
| *Age 46-55* | 0.0426*** | 0.0390*** | 0.0520*** | 0.0489*** | 0.0527*** | 0.0501*** | 0.0750*** | 0.0954*** | 0.0693*** | 0.0549*** | 0.0571*** | 0.0831*** |
| *Primary education* (ref.: none) | 0.0259** | 0.0011 | 0.0215* | 0.0065 | 0.0091 | 0.0040 | 0.0431* | 0.0476** | 0.0261 | -0.0030 | -0.0175 | 0.0340* |
| *Secondary education* | 0.0764*** | 0.0461*** | 0.0631*** | 0.0416*** | 0.0504*** | 0.0483*** | 0.1183*** | 0.1028*** | 0.0734*** | 0.0441** | 0.0398** | 0.0886*** |
| *Tertiary education* | 0.1055*** | 0.0818*** | 0.0881*** | 0.0819*** | 0.0825*** | 0.0821*** | 0.1676*** | 0.1512*** | 0.1203*** | 0.0917*** | 0.0716*** | 0.1366*** |
| *Coloured* (ref.: Black/African) | 0.0198* | 0.0191** | 0.0388*** | 0.0071 | 0.0226** | 0.0265*** | 0.0431*** | 0.0257** | 0.0236** | 0.0195* | -0.0045 | 0.0014 |
| *Asian/Indian* | 0.0055 | 0.0333** | -0.0003 | 0.0090 | 0.0276* | 0.0236 | 0.0256 | 0.0309* | 0.0219 | 0.0141 | 0.0099 | -0.0133 |
| *White* | 0.0150 | 0.0354*** | 0.0487*** | 0.0267*** | 0.0469*** | 0.0353*** | 0.0042 | 0.0124 | 0.0246** | 0.0103 | -0.0092 | 0.0045 |
| Observations | 12,380 | 12,594 | 12,561 | 11,671 | 12,713 | 12,948 | 9,272 | 9,896 | 9,868 | 9,413 | 10,133 | 10,705 |

Source: Calculated from matched 2008Q1-2013Q4 QLFS data (Statistics South Africa, various years).

Notes: Average marginal effects based on binary probit regressions where dependent variable takes value 1 if individual was in formal sector employment in quarter *t* and quarter *t*+1, and 0 if only in quarter *t*. Sample includes only panel members aged 20-55 who were in formal sector employment in quarter *t*. Results for transitions from Q1 to Q2, Q2 to Q3, and Q3 to Q4 are pooled per year for 2008-2013. All regressions have been weighted using panel weights that are population-calibrated and account for initial non-response and attrition between quarters *t* and *t*+1. All models include as extra controls a dummy for being married, household size, a rural geography dummy and province dummies (marginal effects not shown). Significance based on survey design-adjusted standard errors. ***$p$<0.01; **$p$<0.05; *$p$<0.10.

Table 9 augments the baseline specifications of Table 8 with a full set of job-specific variables: occupation and industry types, union membership, contract type and duration, firm types (either private business, government/government-controlled, or non-profit) and firm size categories (proxied by the number of employees). These last two variables were not available in the public NIDS datasets. Information on union membership is only available in the QLFS data from 2010Q3 onwards.

Columns (M1a)-(M1f) of Table 9 show that male semi-skilled and professional workers were, in general, more likely to stay employed in the formal sector than elementary workers; for women only the differences between professional and elementary workers are clearly visible (columns (F1a)-(F1f). As before, male and female workers with a written and/or permanent contract and union members had relatively higher chances of continued formal sector employment, with no clear time trends in the strength of these determinants. Almost all sectors underperformed in terms of male job security relative to agriculture over 2008-2013, especially so once we control for contract-related variables (since insecure verbal and non-permanent contracts were comparatively common in the agricultural sector). Construction stands out as the industry with the lowest male job security (as in the medium-term NIDS panel). For female workers the likelihood of keeping a formal sector job did not vary significantly between agriculture and other industries in the presence of the other job controls. Gender differences in industry effects are highly significant in 2009-2013 but not in 2008.

Having a government rather than a private enterprise job also shielded individuals from transitioning out of formal sector work, consistent with international evidence. Kopelman and Rosen (2014), for example, find that in the US job loss rates are generally lower for public sector employees than for private sector workers and that this public sector advantage further increases during recessions, including that of 2007-2009. We are not aware of similar studies on South Africa or comparable economies. Table 9 further reveals that men and women working in larger firms were in all years more likely to remain formally employed between quarters than small company workers. This could reflect that small firms typically exhibit higher job destruction rates, an empirical regularity across developed and emerging market economies in the West, Latin America and Eastern Europe (Haltiwanger *et al.*, 2008) that arguably also holds for African countries (see Sandefur, 2010; Shiferaw and Bedi, 2013 on Ghanaian and Ethiopian manufacturing firms, respectively). Using a nationally representative panel of registered enterprises from Statistics South Africa's Quarterly Employment Surveys (QES), Kerr *et al.* (2014) show that job destruction rates are indeed significantly greater in small than in larger firms in South Africa, partly due to much more enterprise deaths in the former group than in the latter.[38]

Despite a decline in the economic and statistical significance of marginal effects, higher education's protection against transitions out of formal sector employment remains clearly visible even with all the foregoing job-specific variables included simultaneously. This reinforces our findings from the NIDS and supports the claim by Leung *et al.* (2014) that educational attainment captures skills (or other aspects of human capital) that provide a buffer against job loss independent from the industry or broader occupation group in which one is active, unionisation, and contract and firm types.

[38] See also Bhorat (2009) on the retrenchment by small firms early on in the crisis. In contrast to the international evidence, Kerr *et al.* (2014) do not find higher job creation rates for small than for larger firms in South Africa; although they note that, because of its sampling procedure, the QES panel undercounts the birth of new firms (and therefore job creation by small start-ups).

*Table 9. Probit estimates for continued formal sector employment (QLFS), 2008Q1-2013Q4 (extra job variables): average marginal effects*

| | (M1a) | (M1b) | (M1c) | (M1d) | (M1e) | (M1f) | (F1a) | (F1b) | (F1c) | (F1d) | (F1e) | (F1f) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Male | Male | Male | Male | Male | Male | Female | Female | Female | Female | Female | Female |
| | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 |
| *Age 26-35* (ref.: age 20-25) | 0.0050 | 0.0078 | 0.0211** | 0.0151 | 0.0274*** | 0.0351*** | 0.0257** | 0.0234** | 0.0059 | 0.0330*** | 0.0173* | 0.0208* |
| *Age 36-45* | 0.0221** | 0.0132 | 0.0409*** | 0.0204** | 0.0325*** | 0.0349*** | 0.0398*** | 0.0333*** | 0.0242** | 0.0296** | 0.0271** | 0.0426*** |
| *Age 46-55* | 0.0192* | 0.0207** | 0.0312*** | 0.0240** | 0.0305*** | 0.0234** | 0.0356*** | 0.0592*** | 0.0406*** | 0.0266** | 0.0313*** | 0.0493*** |
| *Primary education* (ref.: none) | 0.0132 | -0.0074 | 0.0068 | -0.0030 | 0.0081 | -0.0025 | 0.0118 | 0.0096 | 0.0048 | -0.0151 | -0.0264** | 0.0039 |
| *Secondary education* | 0.0405*** | 0.0182* | 0.0305*** | 0.0053 | 0.0300** | 0.0163 | 0.0500** | 0.0260 | 0.0238 | 0.0018 | 0.0015 | 0.0232 |
| *Tertiary education* | 0.0641*** | 0.0511*** | 0.0497*** | 0.0410*** | 0.0550*** | 0.0375*** | 0.0844*** | 0.0628*** | 0.0642*** | 0.0390*** | 0.0191 | 0.0607*** |
| *Coloured* (ref.: Black/African) | 0.0051 | 0.0137 | 0.0269*** | -0.0076 | 0.0200** | 0.0118 | 0.0260** | 0.0076 | 0.0071 | 0.0088 | -0.0151 | -0.0102 |
| *Asian/Indian* | 0.0114 | 0.0353*** | 0.0074 | 0.0103 | 0.0279* | 0.0128 | 0.0163 | 0.0203 | 0.0183 | 0.0126 | -0.0046 | -0.0050 |
| *White* | 0.0250** | 0.0439*** | 0.0508*** | 0.0297*** | 0.0503*** | 0.0370*** | 0.0173 | 0.0081 | 0.0340*** | 0.0278** | 0.0058 | 0.0253** |
| *Semi-skilled* (ref.: elementary) | -0.0013 | 0.0284*** | 0.0184** | 0.0312*** | 0.0149** | 0.0268*** | 0.0169 | 0.0126 | 0.0058 | 0.0166* | 0.0008 | 0.0208** |
| *Managerial/professional* | 0.0232** | 0.0309*** | 0.0357*** | 0.0607*** | 0.0247** | 0.0501*** | 0.0406*** | 0.0432*** | 0.0108 | 0.0293*** | 0.0119 | 0.0232** |
| *Mining* (ref: agriculture) | 0.0181 | -0.0196 | 0.0177 | -0.0357** | -0.0300** | -0.0225 | 0.0529* | 0.0809*** | 0.0437* | 0.0367 | 0.0416 | 0.0563** |
| *Manufacturing* | -0.0056 | -0.0344*** | -0.0223** | -0.0360*** | -0.0325*** | -0.0430*** | 0.0182 | 0.0294* | 0.0294** | -0.0101 | 0.0166 | 0.0267 |
| *Utilities* | -0.0276 | -0.0310 | -0.0558* | -0.0346 | -0.0403 | -0.0172 | -0.1786** | 0.0173 | 0.0228 | -0.0728 | 0.0698*** | 0.0105 |
| *Construction* | -0.0435*** | -0.0522*** | -0.0514*** | -0.0628*** | -0.0627*** | -0.0648*** | -0.0365 | -0.0237 | -0.0360 | 0.0042 | 0.0145 | -0.0135 |
| *Trade* | -0.0151 | -0.0239** | -0.0173* | -0.0328*** | -0.0355*** | -0.0400*** | 0.0032 | 0.0300** | 0.0163 | 0.0052 | 0.0257 | 0.0120 |
| *Transport* | -0.0242* | -0.0354*** | -0.0373*** | -0.0539*** | -0.0418*** | -0.0421*** | -0.0044 | 0.0340 | 0.0027 | 0.0035 | 0.0267 | -0.0124 |
| *Financial services* | -0.0305** | -0.0340*** | -0.0252** | -0.0309*** | -0.0287*** | -0.0476*** | 0.0038 | 0.0393** | 0.0066 | 0.0000 | 0.0228 | 0.0234 |
| *Community services* | -0.0088 | -0.0409*** | -0.0347*** | -0.0461*** | -0.0284** | -0.0265** | 0.0025 | -0.0019 | -0.0081 | -0.0080 | 0.0217 | 0.0067 |
| *Union member* | | | | 0.0321*** | 0.0186*** | 0.0288*** | | | | 0.0210** | 0.0272*** | 0.0396*** |
| *Written contract* | 0.0295*** | 0.0215** | 0.0334*** | 0.0195** | 0.0337*** | 0.0369*** | 0.0162 | 0.0328*** | 0.0305*** | 0.0426*** | 0.0034 | 0.0297*** |
| *Permanent contract* | 0.0554*** | 0.0563*** | 0.0525*** | 0.0460*** | 0.0459*** | 0.0553*** | 0.0748*** | 0.0881*** | 0.0834*** | 0.0645*** | 0.0738*** | 0.0536*** |
| *Government/government-controlled* (ref.: private enterprise) | 0.0273*** | 0.0341*** | 0.0296*** | 0.0257*** | 0.0133 | 0.0002 | 0.0511*** | 0.0295*** | 0.0389*** | 0.0203** | 0.0227*** | 0.0266*** |
| *Non-profit* | -0.0247 | -0.0112 | -0.0509* | -0.0063 | -0.0039 | -0.0061 | 0.0298 | 0.0115 | -0.0261 | -0.0053 | 0.0105 | 0.0101 |
| *Between 10 and 50 employees* (ref.: less than 10 employees) | 0.0557*** | 0.0487*** | 0.0469*** | 0.0484*** | 0.0394*** | 0.0374*** | 0.0436*** | 0.0500*** | 0.0460*** | 0.0541*** | 0.0553*** | 0.0524*** |
| *50 or more employees* | 0.0677*** | 0.0700*** | 0.0566*** | 0.0624*** | 0.0421*** | 0.0492*** | 0.0612*** | 0.0506*** | 0.0504*** | 0.0619*** | 0.0646*** | 0.0554*** |
| Observations | 12,102 | 12,360 | 12,231 | 11,140 | 12,116 | 12,283 | 9,102 | 9,715 | 9,644 | 9,073 | 9,698 | 10,221 |

Source: Calculated from matched 2008Q1-2013Q4 QLFS data (Statistics South Africa, various years).

Notes: Average marginal effects based on binary probit regressions where dependent variable takes value 1 if individual was in formal sector employment in quarter *t* and quarter *t*+1, and 0 if only in quarter *t*. Sample includes only panel members aged 20-55 who were in formal sector employment in quarter *t*. Results for transitions from Q1 to Q2, Q2 to Q3, and Q3 to Q4 are pooled per year for 2008-2013. All regressions have been weighted using panel weights that are population-calibrated and account for initial non-response and attrition between quarters *t* and *t*+1. All models include as extra controls a dummy for being married, household size, a rural geography dummy and province dummies (marginal effects not shown). Significance based on survey design-adjusted standard errors. ***$p$<0.01; **$p$<0.05; *$p$<0.10.

### *5.2.2. Entry into formal sector employment or not*

Table 10 reports on the baseline specifications of our second class of QLFS probits. Overall, entry into formal sector employment was more likely for men and women aged 26-45 than for younger and older individuals. These results differ somewhat from those on medium-term job entry based on the NIDS. But again similar to the NIDS, job finding probabilities increased progressively with educational attainment, with few significant gender differences. Similarly as for remaining in employment, the estimated positive effects of secondary and tertiary education on finding formal sector employment were slightly larger before the crisis, in 2008, than in crisis year 2009 and during early recovery (cf. Tables 8 and 9), again most clearly and significantly so for women.[39] The influence of race on job finding does not show a clear pattern. According to other marginal effects, married men were in all years more likely to get into formal jobs than unmarried men; for women, marriage had a negative but much smaller influence. Rural residence appears to have hindered men (and to a lesser degree women) in finding a formal sector job.

Unreported regressions suggest that the probability of finding a formal sector job was not significantly influenced by co-habitation with other formal sector workers. For men, the number of young children was in 2008 and 2012-2013 positively associated with the likelihood of transitioning into formal sector employment, whereas the presence of OAP-receiving pensioners had a negative marginal effect throughout. For women we find a very small, non-significant negative effect of the number of young children but no consistent influence of pensioners.

To be sure, some of the marginal effects reported in Table 10, such as those associated with age and education, may be driven by differences in the initial labour market status, rather than point to discrimination or selectivity by firms. To reduce the risk of omitted variable bias, in Table 11 we add dummies for the labour market status in quarter *t* to our baseline specifications. Initial labour market participation clearly matters. Male informal sector workers had a 10-12 percentage points higher chance of transitioning to formal sector employment between quarters than the NEA. Also unemployed men, especially if engaged in active job search, were more likely to find formal sector jobs compared to the NEA (columns (M1a)-(M1f)). We obtain similar results for women, although the estimated effects are significantly smaller (columns (F1a)-(F1f)). These findings partially correspond with the medium-term results of the NIDS (cf. Table 6). In the QLFS, the estimated marginal effects of the different labour market statuses are greatest in 2008, before the crisis. Wald F tests show that the post-2008 declines in marginal job finding probabilities of the (male and female) searching unemployed and (female) discouraged unemployed are highly significant.

Some of the age effects present in the specifications of Table 10 indeed disappear once the original labour market status is controlled for. The size of the marginal effects of educational attainment on male and female job finding probabilities is, however, only slightly reduced. This suggests that other channels, such as perhaps firms' selection of workers based on their skills (signalled by education), play a more important role for job finding prospects than simply education's influence on self-selection into particular labour market statuses.

[39] One potential explanation for the insignificant marginal effect of tertiary education in 2009 for men would be that during the peak of the crisis higher-educated individuals decided to remain in (or return to) school rather than to participate in the labour market. Closer inspection shows indeed that the percentage of not formally employed men with tertiary education in one quarter that are students in the next quarter is higher in 2009 than in 2008. This percentage is however equally high in 2010 (where we do find a significant positive effect of tertiary education on job finding chances).

*Table 10. Probit estimates for finding formal sector employment (QLFS), 2008Q1-2013Q4 (baseline): average marginal effects*

| | **(M1a)** | **(M1b)** | **(M1c)** | **(M1d)** | **(M1e)** | **(M1f)** | **(F1a)** | **(F1b)** | **(F1c)** | **(F1d)** | **(F1e)** | **(F1f)** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Male | Male | Male | Male | Male | Male | Female | Female | Female | Female | Female | Female |
| | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 |
| *Age 26-35* (ref.: age 20-25) | 0.0618*** | 0.0385*** | 0.0388*** | 0.0308*** | 0.0287*** | 0.0321*** | 0.0056 | 0.0114*** | 0.0102*** | 0.0155*** | 0.0181*** | 0.0074* |
| *Age 36-45* | 0.0265*** | 0.0272*** | 0.0215*** | 0.0155** | 0.0160** | 0.0261*** | 0.0046 | 0.0171*** | 0.0142*** | 0.0094** | 0.0158*** | 0.0060 |
| *Age 46-55* | -0.0080 | 0.0003 | 0.0109 | -0.0014 | -0.0050 | -0.0010 | -0.0067 | -0.0005 | 0.0051 | 0.0068 | 0.0121*** | -0.0055 |
| *Primary education* (ref.: none) | 0.0156* | 0.0087 | 0.0234*** | 0.0187*** | 0.0156** | 0.0133* | 0.0131*** | 0.0116*** | 0.0135*** | 0.0086*** | 0.0122*** | 0.0136*** |
| *Secondary education* | 0.0390*** | 0.0243*** | 0.0308*** | 0.0288*** | 0.0295*** | 0.0284*** | 0.0485*** | 0.0343*** | 0.0322*** | 0.0327*** | 0.0323*** | 0.0275*** |
| *Tertiary education* | 0.0943*** | 0.0255 | 0.0650*** | 0.0646*** | 0.0459*** | 0.0445*** | 0.1080*** | 0.0681*** | 0.0485*** | 0.0581*** | 0.0788*** | 0.0666*** |
| *Coloured* (ref.: Black/African) | 0.0006 | 0.0209 | 0.0039 | 0.0005 | 0.0029 | 0.0265** | 0.0162* | 0.0124 | 0.0199*** | 0.0132* | 0.0082 | 0.0167* |
| *Asian/Indian* | 0.0321 | 0.0393* | 0.0356 | -0.0042 | -0.0065 | -0.0106 | 0.0082 | -0.0160* | 0.0265* | 0.0090 | 0.0102 | -0.0077 |
| *White* | 0.0106 | 0.0222 | 0.0180 | 0.0288 | -0.0005 | 0.0376** | 0.0191* | 0.0121 | 0.0107 | 0.0020 | -0.0017 | 0.0149 |
| Observations | 12,248 | 13,203 | 15,768 | 14,420 | 15,757 | 15,876 | 22,774 | 23,900 | 25,903 | 23,872 | 24,742 | 24,538 |

Source: Calculated from matched 2008Q1-2013Q4 QLFS data (Statistics South Africa, various years).

Notes: Average marginal effects based on binary probit regressions where dependent variable takes value 1 if individual was not in formal sector employment in quarter *t* but formal sector employed in quarter *t*+1, and 0 if not in formal sector employment in either of the quarters. Sample includes only panel members aged 20-55 who were not in formal sector employment in quarter *t*. Results for transitions from Q1 to Q2, Q2 to Q3, and Q3 to Q4 are pooled per year for 2008-2013. All regressions have been weighted using panel weights that are population-calibrated and account for initial non-response and attrition between quarters *t* and *t*+1. All models include as extra controls a dummy for being married, household size, a rural geography dummy and province dummies (marginal effects not shown). Significance based on survey design-adjusted standard errors.***$p<0.01$; **$p<0.05$; *$p<0.10$.

Columns (M2a)-(M2f) and (F2a)-(F2f) of Table 11 further show that work experience, i.e., being employed in the informal sector in the current quarter or having worked in any kind of job in the past, increases men's and women's chances of moving into formal sector employment by the next quarter. Inclusion of this variable makes the effect of the 46-55 age group dummy become significantly negative, reflecting that older individuals were more likely to have work experience than younger ones but otherwise less likely to get into formal sector jobs. Finally, in unreported estimations we find that work experience that dates from three years or longer ago had no significant effect on finding formal sector work compared to having no work experience at all.[40] This result held for both men and women and throughout 2008-2013. The insignificance for job finding of work experience in the more distant past appears to be in line with arguments of 'human capital depreciation' (see von Fintel and Burger, 2009). People that have been out of work for a longer time may see their knowledge and skills lose relevance, because of technological progress and new production techniques. Hence, longer spells of non-employment (or a total lack of work experience) could be perceived by employers as signalling low productivity.

Similar to the NIDS, the QLFS permits digging a little deeper into the self-reported motivations behind the occurrence (or not) of particular labour market transitions. Individuals that transitioned from formal sector employment in one quarter to non-employment in the next quarter mostly cited 'lost job/job ended/laid off' as the underlying reason, in line with the NIDS (but based on much larger samples). Overall, over the whole 2008-2013 period, no less than 81% of men and 71% of all women who moved out of formal sector employment and gave a valid response, referred to job loss. Interestingly, these percentages were somewhat lower in pre-crisis year 2008 than in the other years (78% and 66% for men and women, respectively). Individuals who switched from being searching unemployed to either non-searching unemployed or NEA between quarters indicated 'no jobs available in the area' as their main motive for stopping job search (65% and 58% of male and female respondents).[41] Unfortunately, The QLFS does not collect information on whether the unemployed received (and turned down) job offers or on how formal sector jobs were found.

[40] Because of the problems we uncovered in the NIDS with self-reporting on past work experience, the QLFS results with respect to (again self-reported) work experience and time since last employment should also be interpreted with caution.

[41] The second most frequent answer was 'lack of money for transport' for men (14%) and being a housewife or other 'family considerations' for women (11%).

*Table 11. Probit estimates for finding formal sector employment (QLFS), 2008Q1-2013Q4 (extra job history variables): average marginal effects*

| | **(M1a)** | **(M1b)** | **(M1c)** | **(M1d)** | **(M1e)** | **(M1f)** | **(M2a)** | **(M2b)** | **(M2c)** | **(M2d)** | **(M2e)** | **(M2f)** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Male | Male | Male | Male | Male | Male | Male | Male | Male | Male | Male | Male |
| | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 |
| *Age 26-35* (ref.: age 20-25) | 0.0343*** | 0.0177** | 0.0198*** | 0.0121* | 0.0094 | 0.0121* | 0.0299*** | 0.0045 | 0.0153** | 0.0057 | -0.0025 | 0.0041 |
| *Age 36-45* | 0.0045 | 0.0062 | 0.0036 | -0.0018 | -0.0025 | 0.0060 | -0.0115 | -0.0153* | -0.0091 | -0.0168** | -0.0242*** | -0.0109 |
| *Age 46-55* | -0.0164* | -0.0099 | 0.0027 | -0.0074 | -0.0124 | -0.0106 | -0.0424*** | -0.0383*** | -0.0197** | -0.0319*** | -0.0421*** | -0.0343*** |
| *Primary education* (ref.: none) | 0.0092 | 0.0036 | 0.0216*** | 0.0166*** | 0.0136** | 0.0096 | 0.0141* | 0.0069 | 0.0211*** | 0.0172*** | 0.0126** | 0.0108 |
| *Secondary education* | 0.0306*** | 0.0199** | 0.0312*** | 0.0279*** | 0.0285*** | 0.0280*** | 0.0425*** | 0.0275*** | 0.0331*** | 0.0314*** | 0.0316*** | 0.0315*** |
| *Tertiary education* | 0.0822*** | 0.0204 | 0.0604*** | 0.0591*** | 0.0513*** | 0.0455*** | 0.0959*** | 0.0276 | 0.0664*** | 0.0621*** | 0.0471*** | 0.0464*** |
| *Coloured* (ref.: Black/African) | 0.0015 | 0.0240* | 0.0072 | 0.0055 | 0.0048 | 0.0327** | -0.0044 | 0.0125 | 0.0025 | -0.0033 | -0.0019 | 0.0201 |
| *Asian/Indian* | 0.0420 | 0.0432* | 0.0323 | 0.0030 | 0.0012 | -0.0094 | 0.0319 | 0.0416* | 0.0396 | -0.0016 | -0.0027 | -0.0097 |
| *White* | 0.0388* | 0.0425** | 0.0310* | 0.0480* | 0.0133 | 0.0544*** | 0.0150 | 0.0279 | 0.0252 | 0.0331 | 0.0019 | 0.0422** |
| *Discouraged* (ref.: NEA) | 0.0441*** | 0.0433*** | 0.0227*** | 0.0337*** | 0.0227*** | 0.0287*** | | | | | | |
| *Searching unemployed* | 0.0822*** | 0.0559*** | 0.0396*** | 0.0460*** | 0.0451*** | 0.0514*** | | | | | | |
| *Employed in informal sector* | 0.1228*** | 0.1139*** | 0.1070*** | 0.1039*** | 0.1034*** | 0.1083*** | | | | | | |
| *Work experience* | | | | | | | 0.0823*** | 0.0792*** | 0.0615*** | 0.0640*** | 0.0712*** | 0.0657*** |
| Observations | 12,248 | 13,203 | 15,768 | 14,420 | 15,757 | 15,876 | 12,248 | 13,203 | 15,768 | 14,420 | 15,757 | 15,876 |

*Table 11* (Continued)

| | (F1a) | (F1b) | (F1c) | (F1d) | (F1e) | (F1f) | (F2a) | (F2b) | (F2c) | (F2d) | (F2e) | (F2f) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Female 2008 | Female 2009 | Female 2010 | Female 2011 | Female 2012 | Female 2013 | Female 2008 | Female 2009 | Female 2010 | Female 2011 | Female 2012 | Female 2013 |
| *Age 26-35* (ref.: age 20-25) | -0.0039 | 0.0036 | 0.0042 | 0.0104*** | 0.0118*** | -0.0007 | -0.0121** | -0.0037 | -0.0025 | 0.0045 | 0.0070* | -0.0076 |
| *Age 36-45* | -0.0070 | 0.0030 | 0.0040 | 0.0010 | 0.0053 | -0.0070 | -0.0192*** | -0.0058 | -0.0051 | -0.0073 | -0.0017 | -0.0149** |
| *Age 46-55* | -0.0142** | -0.0104** | -0.0033 | -0.0009 | 0.0044 | -0.0149*** | -0.0305*** | -0.0212*** | -0.0137*** | -0.0106** | -0.0066 | -0.0265*** |
| *Primary education* (ref.: none) | 0.0113*** | 0.0092*** | 0.0123*** | 0.0079** | 0.0107*** | 0.0117*** | 0.0123*** | 0.0107*** | 0.0126*** | 0.0083*** | 0.0111*** | 0.0117*** |
| *Secondary education* | 0.0418*** | 0.0301*** | 0.0295*** | 0.0314*** | 0.0293*** | 0.0256*** | 0.0493*** | 0.0347*** | 0.0330*** | 0.0346*** | 0.0327*** | 0.0265*** |
| *Tertiary education* | 0.0920*** | 0.0578*** | 0.0494*** | 0.0540*** | 0.0718*** | 0.0657*** | 0.0982*** | 0.0667*** | 0.0465*** | 0.0551*** | 0.0743*** | 0.0619*** |
| *Coloured* (ref.: Black/African) | 0.0240** | 0.0200** | 0.0247*** | 0.0179** | 0.0162** | 0.0222** | 0.0089 | 0.0068 | 0.0169** | 0.0078 | 0.0036 | 0.0101 |
| *Asian/Indian* | 0.0382** | -0.0004 | 0.0461** | 0.0207 | 0.0297 | 0.0049 | 0.0178 | -0.0135 | 0.0390** | 0.0167 | 0.0157 | -0.0063 |
| *White* | 0.0477*** | 0.0299*** | 0.0227** | 0.0107 | 0.0136 | 0.0274** | 0.0184* | 0.0117 | 0.0098 | 0.0008 | -0.0016 | 0.0135 |
| *Discouraged* (ref.: NEA) | 0.0409*** | 0.0143*** | 0.0133*** | 0.0132*** | 0.0165*** | 0.0265*** | | | | | | |
| *Searching unemployed* | 0.0428*** | 0.0318*** | 0.0166*** | 0.0150*** | 0.0312*** | 0.0284*** | | | | | | |
| *Employed in informal sector* | 0.0673*** | 0.0655*** | 0.0536*** | 0.0500*** | 0.0556*** | 0.0655*** | | | | | | |
| *Work experience* | | | | | | | 0.0466*** | 0.0439*** | 0.0353*** | 0.0348*** | 0.0364*** | 0.0376*** |
| Observations | 22,774 | 23,900 | 25,903 | 23,872 | 24,742 | 24,538 | 22,774 | 23,900 | 25,903 | 23,872 | 24,742 | 24,538 |

Source: Calculated from matched 2008Q1-2013Q4 QLFS data (Statistics South Africa, various years).

Notes: Average marginal effects based on binary probit regressions where dependent variable takes value 1 if individual was not in formal sector employment in quarter *t* but formal sector employed in quarter *t*+1, and 0 if not in formal sector employment in either of the quarters. Sample includes only panel members aged 20-55 who were not in formal sector employment in quarter *t*. Results for transitions from Q1 to Q2, Q2 to Q3, and Q3 to Q4 are pooled per year for 2008-2013. All regressions have been weighted using panel weights that are population-calibrated and account for initial non-response and attrition between quarters *t* and *t*+1. All models include as extra controls a dummy for being married, household size, a rural geography dummy and province dummies (marginal effects not shown). Significance based on survey design-adjusted standard errors. ***$p$<0.01; **$p$<0.05; *$p$<0.10.

## 6. Concluding remarks

This paper has studied South African labour market transitions and their determinants since the start of the global financial and economic crisis, making use of and comparing two longitudinal, individual-level datasets: first, a balanced panel based on the NIDS with waves in 2008, 2010 and 2012; and second, quarter-to-quarter matched cross-sections of the QLFS over 2008Q1-2013Q4. These datasets have allowed us to examine the evolution of labour market mobility and to uncover the individual, household-level and job-specific characteristics associated with remaining in or finding employment in South Africa during and after the zenith of the crisis. We have thereby focused on representative groups of individuals aged 20 to 55 and, above all, on transitions in and out of the most stable and valued forms of employment, i.e., regular wage employment (NIDS) and formal sector jobs (QLFS).

Keeping in mind the limitations of the data at hand, several results stand out from our analysis. First of all, underlying (sometimes relatively small) net changes in South African labour market statistics, we find considerable mobility, with large gross transitions in and out of employment and between different employment and non-employment statuses; both in the short run (between quarters), and, even more so, in the medium run (over two-year periods). This finding is in line with previous longitudinal studies and stresses the need to qualify the hardwired image of South African labour markets as being very rigid and inflexible in every respect.

Second, labour market mobility also varied between men and women and over time. Women are on the whole more 'mobile' than men, largely due to their greater movement between different states of non-employment. Extending the work of von Fintel and Burger (2009), Verick (2012) and Leung *et al.* (2014) on the QLFS, we have presented evidence indicating that overall labour market mobility decreased from 2008 up to 2012 (with only a small reversal in 2013), and that the net rise in unemployment rates since the crisis should be ascribed more to reduced inflows into employment than to increased outflows. It could well be that the observed dominance of declining job creation over job destruction in explaining rising unemployment in South Africa is, in part at least, a consequence of the uphill battle of labour market 'outsiders' (outside employment) against 'insiders' (with a job) that have relatively more bargaining power and high wage demands (von Fintel and Burger, 2009).

Third, our results on the determinants of transitions in and out of regular wage and formal sector jobs suggest that both deliberate individual or household choices and external circumstances, related to the broader economic environment or firm-level decisions, played their part; although, admittedly, fully disentangling labour supply and demand effects remains difficult. The importance of labour demand factors is evidenced by the significant effects of a list of skill-related variables on the likelihood that an individual remains in employment and on job finding probabilities. A closer examination of the self-reported reasons why particular individuals leave or fail to get into employment lends further support to the hypothesis that the observed 'downward' mobility and lack of 'upward' mobility of these individuals was, at least partly, involuntary rather than out of free choice.

Fourth, and arguably the strongest result of this paper, conform Leung *et al.* (2014), is that higher educational attainment, i.e., completed secondary (matric) education or some form of tertiary (post-matric) education, provided a strong buffer against job exit for those individuals already employed and appreciably helped both men and women to transition into employment. Interestingly, the buffering effect of education seems to hold above and beyond the influence of job-specific variables such as broader occupational and industry categories, contract types and duration,

union membership, and the type and size of firm in which someone is initially employed; all of which are significant determinants of continued employment too. The positive effect of education on job finding probabilities was also found to operate independently from individuals' initial labour market status and recent work experience. It thus seems that higher education levels proxy and/or signal particular skills that are valued by South African employers. Moreover, as pointed out by Leung *et al.* (2014), hiring and firing costs are generally higher for skilled (better-educated) workers, which may protect them from job separation, in normal times and during a recession. This does not explain, however, why better-educated individuals are more likely to find work. Even if the quality of secondary schooling continues to be very poor and unevenly distributed in South Africa (van der Berg, 2009; Spaull, 2013), matriculation (and by extension, post-matric education) clearly still improves men's and women's opportunities in the labour market (see Branson *et al.*, 2013). In addition, there is some evidence, more so in the QLFS than in the NIDS, of younger workers being less likely to keep their job and of older individuals having more difficulty in finding one, holding everything else constant.

Fifth, we do find time variation in the economic significance of some of the transition correlates included in our models, but it remains difficult to link this variation directly to the post-2008 trajectory of South Africa's economy. For example, according to our QLFS estimates, the strength of higher education's buffering effects gradually (and for women, significantly) diminished over the first post-crisis years. A possible explanation could be that, again because of the higher costs of matching skilled workers to jobs, better-educated employees are only made redundant when the economic malaise drags on (as was arguably the case in South Africa), and after employees with lower education have already been shed. To test such preliminary hypotheses a more in-depth analysis would be required, however, preferably using firm-level data.

There are several other directions in which the analysis presented here could be extended. One interesting avenue would be to use more detailed information on specific subsectors and/or job tasks to further disentangle the vulnerability of particular types of workers to job loss, in the trend of Autor *et al.* (2003). Detailed information on job tasks is available in the confidential version of the NIDS, but subsample sizes may be too small for inference. The public QLFS includes occupational codes up to the four-digit level of the SASCO (South African Standard Classification of Occupations) and three-digit Standard Industrial Classification (SIC) codes, which could be employed for these purposes (see Bhorat, Goga*, et al.*, 2014). Another possible extension is to attempt to control for the quality and type of (higher) education and study how it affects our estimation results. To make a start on such analysis, one could potentially use some of the school-level information contained in the NIDS (see Branson and Leibbrandt, 2013) and/or disaggregate the NIDS and QLFS tertiary education variable into diploma and certificate qualifications versus academic degrees. We leave this for future research.

## Appendices

*Table A.1. Labour market mobility measures and decomposition (NIDS), 2008-2010 and 2010-2012 (%)*

| | Immobility | Mobility | | | | |
|---|---|---|---|---|---|---|
| | | Total | Upward (into employment) | Downward (out of employment) | Within employment | Within non-employment |
| All adults | | | | | | |
| 2008-2010 | 49.2 | 50.8 | 12.6 | 14.6 | 6.2 | 17.5 |
| 2010-2012 | 52.1 | 47.9 | 14.8 | 11.7 | 5.0 | 16.5 |
| Male | | | | | | |
| 2008-2010 | 53.6 | 46.4 | 11.6 | 14.7 | 9.3 | 10.8 |
| 2010-2012 | 53.7 | 46.3 | 14.8 | 12.6 | 7.4 | 11.5 |
| Female | | | | | | |
| 2008-2010 | 46.3 | 53.7 | 13.2 | 14.5 | 4.2 | 21.8 |
| 2010-2012 | 51.0 | 49.0 | 14.7 | 11.0 | 3.4 | 19.8 |

Source: Calculated from 2008-2010-2012 NIDS data (SALDRU, various years).
Notes: Based on transition matrices for all three-wave balanced panel members aged 20-55 in 2008 (Table 2) and male and female panel members separately. Total mobility is defined as the percentage of (male and/or female) individuals that change labour market status over 2008-2010 or 2010-2012 and is the complement of immobility (the percentage of individuals that do not change status between two waves). Total mobility is decomposed into upward mobility (the percentage of individuals that change status from searching unemployed, discouraged unemployed or NEA to regular wage, self-, or casual and other employment between two waves), downward mobility (the percentage of individuals that change status from regular wage, self-, or casual and other employment to searching unemployed, discouraged unemployed or NEA between two waves), within employment mobility (the percentage of individuals that switch among regular wage, self-, and casual and other employment statuses between two waves) and within non-employment mobility (the percentage of individuals that switch among searching unemployed, discouraged unemployed and NEA statuses between two waves). For decomposition method, see main text (Section 4.1 and Formula (2)).

*Table A.2. Matching algorithm for QLFS cross-sections*

| | Description | Number of Observations |
|---|---|---|
| Step 1: | Append all QLFS cross-sections (quarters) and keep working-age population (aged 15 to 64). | 1,303,404 |
| Step 2: | Sort on household identifier and quarter and drop households that appear only once. | 1,256,528 |
| Step 3: | For each quarter and within the same household, drop individuals that have the same race, gender and ages differing by at most one year. These '(almost) twins' cannot be uniquely matched between quarters. | 1,201,548 |
| Step 4: | Match the remaining individuals from quarter *t* to quarter *t*+1 using the household identifier, race, gender and $age_t = age_{t+1}$ or $age_t + 1 = age_{t+1}$. | 1,037,436 |
| Step 5: | Impose additional consistency requirements: | |
| | a) Drop individuals with missing value for categorical educational attainment variable (No education/primary/secondary/tertiary). | 1,028,577 |
| | b) Drop individuals whose educational attainment diminishes between quarters. | 997,395 |
| | c) Drop individuals whose educational attainment jumps more than one category between quarters. | 994,066 |
| | d) Drop individuals whose educational attainment changes from 'none (or incomplete primary)' to 'primary (or incomplete secondary)'. | 977,492 |
| | e) Drop individuals aged 21 or older whose educational attainment changes from 'primary (or incomplete secondary)' to 'secondary completed'. | 964,604 |
| | f) Drop individuals aged 24 or older whose educational attainment changes from 'secondary completed' to 'tertiary'. | 959,070 |
| | g) Drop individuals whose marital status changes from 'married', 'widowed' or 'divorced' to 'never married'. | **952,158** |

Source: Adaptation and application to 2008Q1-2013Q4 QLFS data (Statistics South Africa, various years) of the algorithm developed by Ranchhod and Dinkelman (2008).

*Table A.3. Labour market mobility measures and decomposition (QLFS), 2008Q1-2013Q4 (%)*

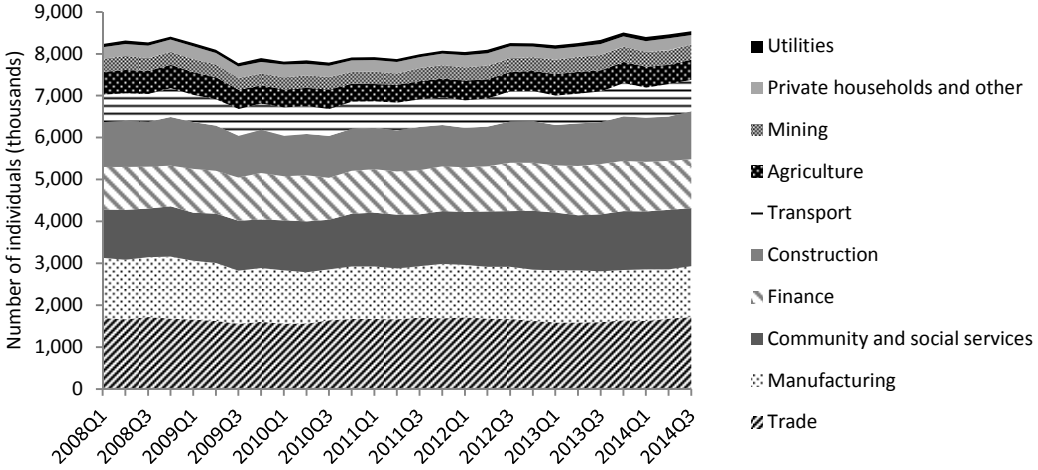
| | Immobility | Mobility | | | | |
|---|---|---|---|---|---|---|
| | | Total | Upward (into employment) | Downward (out of employment) | Within employment | Within non-employment |
| All adults | | | | | | |
| 2008 | 79.0 | 21.0 | 4.8 | 4.0 | 3.3 | 8.9 |
| 2009 | 80.7 | 19.3 | 3.6 | 3.5 | 2.6 | 9.5 |
| 2010 | 81.1 | 18.9 | 3.4 | 3.0 | 2.4 | 10.0 |
| 2011 | 81.3 | 18.7 | 3.2 | 2.9 | 2.4 | 10.2 |
| 2012 | 81.6 | 18.4 | 3.4 | 3.0 | 2.4 | 9.6 |
| 2013 | 80.8 | 19.2 | 3.9 | 3.4 | 2.4 | 9.4 |
| Male | | | | | | |
| 2008 | 80.6 | 19.4 | 4.9 | 4.0 | 4.3 | 6.3 |
| 2009 | 81.6 | 18.4 | 3.8 | 3.6 | 3.3 | 7.6 |
| 2010 | 81.8 | 18.2 | 3.8 | 3.1 | 3.2 | 8.1 |
| 2011 | 82.2 | 17.8 | 3.4 | 3.3 | 3.0 | 8.1 |
| 2012 | 82.2 | 17.8 | 3.6 | 3.2 | 3.1 | 7.9 |
| 2013 | 81.5 | 18.5 | 4.1 | 3.7 | 3.0 | 7.6 |
| Female | | | | | | |
| 2008 | 77.6 | 22.4 | 4.7 | 4.1 | 2.3 | 11.3 |
| 2009 | 79.9 | 20.1 | 3.4 | 3.4 | 2.0 | 11.2 |
| 2010 | 80.4 | 19.6 | 3.1 | 2.9 | 1.7 | 11.9 |
| 2011 | 80.4 | 19.6 | 3.0 | 2.6 | 1.8 | 12.1 |
| 2012 | 81.0 | 19.0 | 3.2 | 2.9 | 1.8 | 11.1 |
| 2013 | 80.2 | 19.8 | 3.7 | 3.1 | 1.9 | 11.1 |

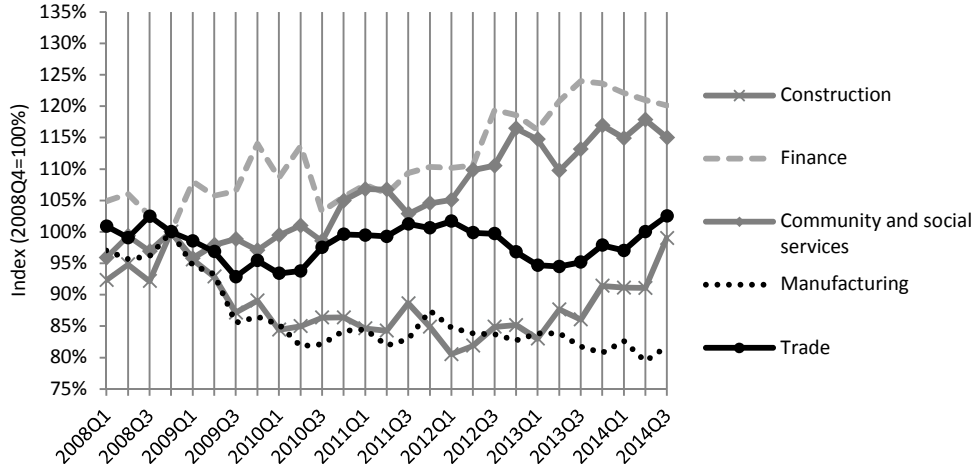
Source: Calculated from matched 2008Q1-2013Q4 QLFS data (Statistics South Africa, various years).

Notes: Based on yearly pooled transition matrices for all quarter-to-quarter matched individuals aged 20-55 in initial quarter (Table 7) and male and female matched individuals separately. Total mobility is defined as the percentage of (male and/or female) individuals that change labour market status between two consecutive quarters, pooled per year over 2008-2013, and is the complement of immobility (the percentage of individuals that do not change status between two quarters, pooled per year). Total mobility is decomposed into upward mobility (the percentage of individuals that change status from searching unemployed, discouraged unemployed or NEA to formal sector or informal sector employment between two quarters, pooled per year), downward mobility (the percentage of individuals that change status from formal sector or informal sector employment to searching unemployed, discouraged unemployed or NEA between two quarters, pooled per year), within employment mobility (the percentage of individuals that switch among formal sector and informal sector employment statuses between two quarters, pooled per year) and within non-employment mobility (the percentage of individuals that switch among searching unemployed, discouraged unemployed and NEA statuses between two quarters, pooled per year). For decomposition method, see main text (Section 4.1 and Formula (2)).

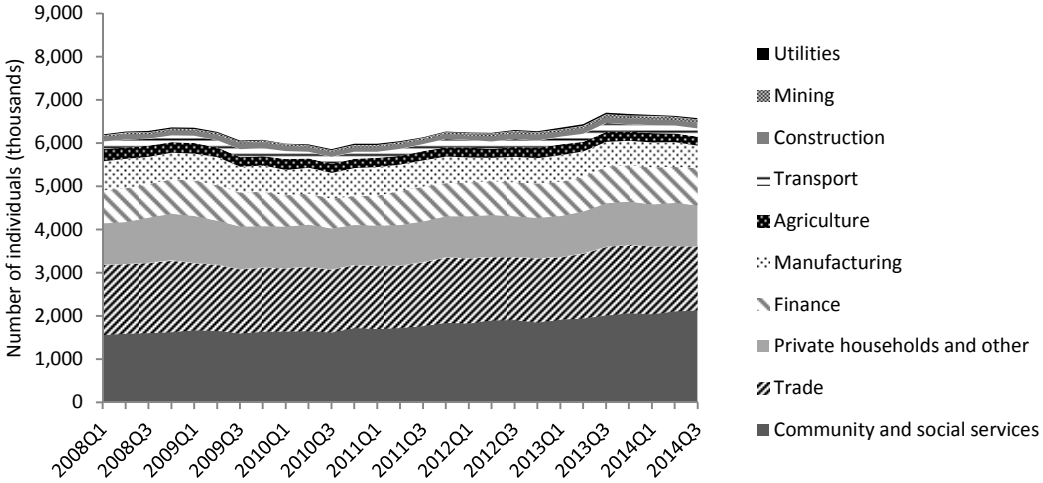
*Figure A.1. Evolution of employment numbers by gender and industry, 2008Q4-2014Q3*

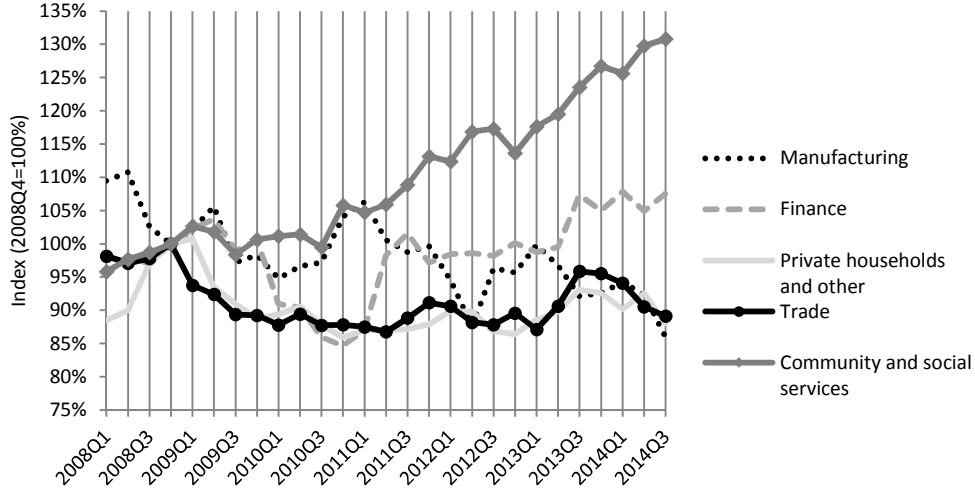
(a) Male




(b) Female

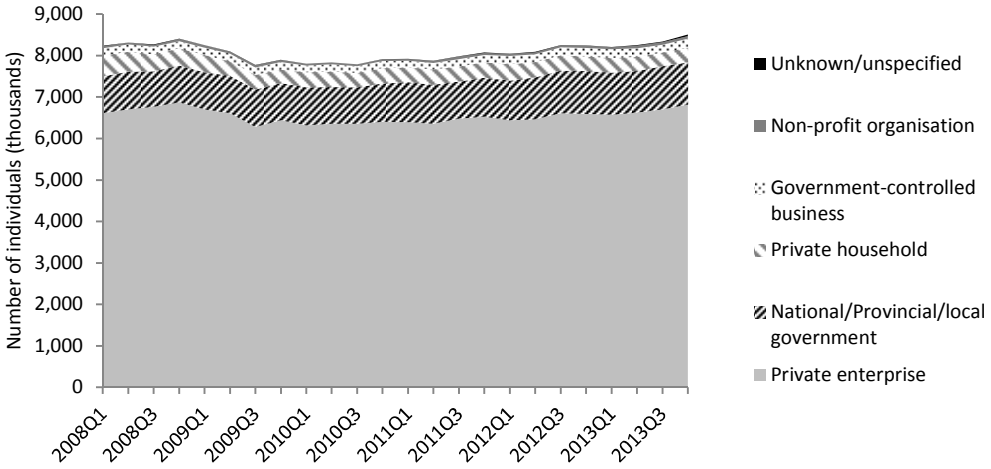


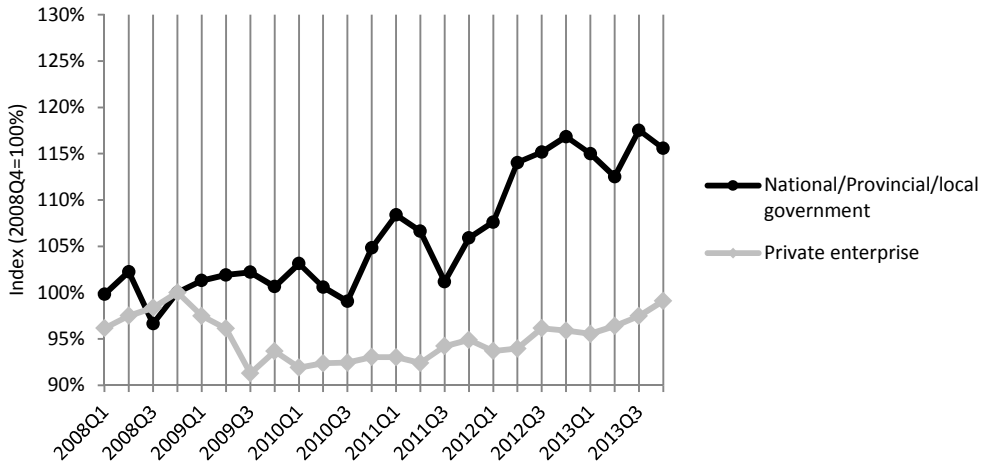




Source: Calculated from 2008Q1-2014Q3 QLFS data (Statistics South Africa, various years).

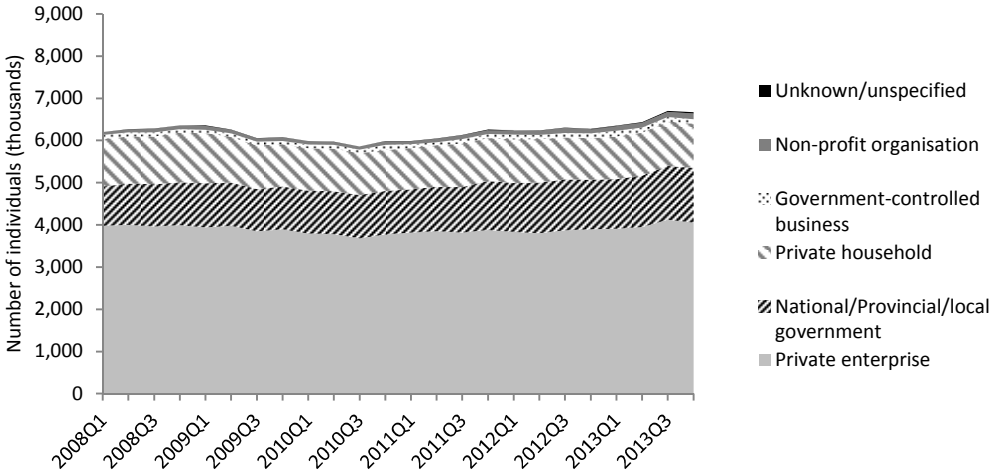
*Figure A.2. Evolution of employment numbers by gender and firm type, 2008Q4-2013Q4*

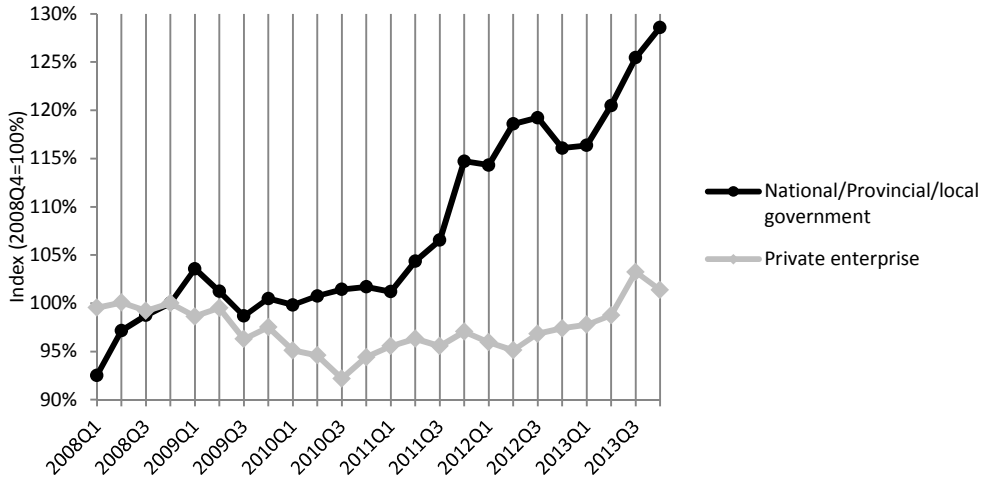
(a) Male




(b) Female




Source: Calculated from 2008Q1-2013Q4 QLFS data (Statistics South Africa, various years).

## References


Autor, D. H., Levy, F., and Murnane, R. J. (2003). The skill content of recent technological change: An empirical exploration. *Quarterly Journal of Economics*, 118(4), 1279-1333.

Baigrie, N., and Eyal, K. (2013). An evaluation of the determinants and implications of panel attrition in the National Income Dynamics Survey (2008-2010). *SALDRU Working Paper*, No. 103.

Banerjee, A., Galiani, S., Levinsohn, J., McLaren, Z., and Woolard, I. (2008). Why has unemployment risen in the New South Africa? *Economics of Transition*, 16(4), 715-740.

Bergin, A., Kelly, E., and McGuinness, S. (2014). Changes in labour market transitions in Ireland over the Great Recession. *IZA Discussion Paper*, No. 8401.

Bhorat, H. (2009). Consequences of the global economic crisis: Early reflections for South Africa. *The Thinker*, No. 6.

Bhorat, H., Goga, S., and Stanwix, B. (2014). Skills-biased labour demand and the pursuit of inclusive growth in South Africa. *UNU-WIDER Working Paper*, No. 2014/130.

Bhorat, H., Goga, S., and van der Westhuizen, C. (2012). Institutional wage effects: Revisiting union and bargaining council wage premia in South Africa. *South African Journal of Economics*, 80(3), 400-414.

Bhorat, H., Hirsch, A., Kanbur, R., and Ncube, M. (2014). Economic policy in South Africa: Past, present and future. In: H. Bhorat, A. Hirsch, R. Kanbur, and M. Ncube (Eds.), *The Oxford companion to the economics of South Africa* (pp. 1-25). Oxford: Oxford University Press.

Bhorat, H., and Hodge, J. (1999). Decomposing shifts in labour demand in South Africa. *South African Journal of Economics*, 67(3), 155-168.

Branson, N., Ardington, C., Lam, D., and Leibbrandt, M. (2013). Changes in education, employment and earnings in South Africa: A cohort analysis. *SALDRU Working Paper*, No. 105.

Branson, N., and Leibbrandt, M. (2013). Education quality and labour market outcomes in South Africa. *OECD Economics Department Working Paper*, No. 1021.

Brown, M., Daniels, R. C., de Villiers, L., Leibbrandt, M., and Woolard, I. (2012). *National Income Dynamics Study wave 2 user manual*. Cape Town: Southern Africa Labour and Development Research Unit.

Cho, Y., and Newhouse, D. (2012). How did the Great Recession affect different types of workers? *World Development*, 41(1), 31-50.

Cichello, P. L., Fields, G. S., and Leibbrandt, M. (2005). Earnings and employment dynamics for Africans in post-apartheid South Africa: A panel study of KwaZulu-Natal. *Journal of African Economies*, 14(2), 143-190.

Cichello, P. L., Leibbrandt, M., and Woolard, I. (2014). Winners and losers: South African labour-market dynamics between 2008-2010. *Development Southern Africa*, 31(1), 65-84.

Clark, K. B., and Summers, L. H. (1981). Demographic differences in cyclical employment variation. *Journal of Human Resources*, 16(1), 61-79.

Cornwell, K., and Inder, B. (2004). Migration and Unemployment in South Africa: When motivation surpasses the theory. *Monash University EBS Working Paper*, No. 2/04.

de Villiers, L., Brown, M., Woolard, I., Daniels, R. C., and Leibbrandt, M. (2013). *National Income Dynamics Study wave 3 user manual*. Cape Town: Southern Africa Labour and Development Research Unit.

Dinkelman, T. (2004). How household context affects search outcomes of the unemployed in KwaZulu-Natal, South Africa: A panel data analysis. *South African Journal of Economics*, 72(3), 484-521.

Dinkelman, T., and Pirouz, F. (2002). Individual, household and regional determinants of labour force attachment in South Africa: Evidence from the 1997 October Household Survey. *South African Journal of Economics*, 70(5), 865-891.

Ebrahim, A., Woolard, I., and Leibbrandt, M. (2013). Unemployment and household formation. *NIDS Discussion Paper*, No. 2013/8.

Fallon, P. R., and Lucas, R. E. B. (2002). Impact of financial shocks on labor markets, household incomes, and poverty: A review of evidence. *World Bank Research Observer*, 17(1), 21-45.

Fedderke, J. W. (2012). The cost of rigidity: The case of the South African labor market. *Comparative Economic Studies*, 54(4), 809-842.

Fedderke, J. W. (2014). South Africa's growth perfomance. In: H. Bhorat, A. Hirsch, R. Kanbur, and M. Ncube (Eds.), *The Oxford companion to the economics of South Africa* (pp. 39-50). Oxford: Oxford University Press.

Finn, A., and Leibbrandt, M. (2013). The dynamics of poverty in the first three waves of NIDS. *NIDS Discussion Paper*, No. 2013/1.

Finn, A., and Ranchhod, V. (2013). Genuine fakes: The prevalence and implications of fieldworker fraud in a large South African survey. *SALDRU Working Paper*, No. 115.

Fourie, F. C. v. N. (2012). The South African unemployment debate: Three worlds, three discourses? *SALDRU Working Paper*, No. 63 (revised version).

Haltiwanger, J., Scarpetta, S., and Schweiger, H. (2008). Asessing job flows across countries: The role of industry, firm size and regulations. *NBER Working Paper*, No. 13920.

Hausmann, R. (2008). Final recommendations of the international panel on ASGISA. *Harvard University CID Working Paper*, No. 161.

Heintz, J., and Posel, D. (2008). Revisiting informal employment and segmentation in the South African labour market. *South African Journal of Economics*, 76(1), 26-44.

Hinks, T. (2008). Poverty, networks and location: The determinants of job search in South Africa. *Journal of International Development*, 20(2), 117-131.

Hodge, D. (2009). Growth, employment and unemployment in South Africa. *South African Journal of Economics*, 77(4), 488-504.

Hofmeyr, J. F. (2000). The changing pattern of segmentation in the South African labour market. *Journal for Studies in Economics and Econometrics*, 24(3), 109-128.

Hofmeyr, J. F., and Lucas, R. E. B. (2001). The rise in union wage premiums in South Africa. *Labour*, 15(4), 685-719.

Hoynes, H. W., Miller, D. L., and Schaller, J. (2012). Who suffers during recessions? *Journal of Economic Perspectives*, 26(3), 27-48.

IMF. (2014). South Africa: 2014 article IV consultation. *IMF Country Report*, No. 14/338.

Kerr, A., Wittenberg, M., and Arrow, J. (2014). Job creation and destruction in South Africa. *South African Journal of Economics*, 82(1), 1-18.

Keswell, M. (2000). Labour market dynamics in South Africa: Evidence from KwaZulu-Natal province. Paper presented at the Trade and Industry Policy Secretariat 2000 Annual Forum, Johannesburg, 17-20 September.

Khanna, G., Newhouse, D., and Paci, P. (2014). Fewer jobs or smaller paychecks? Aggregate crisis impacts in selected middle-income countries. In: A. Banerji, D. Newhouse, P. Paci, and D. Robalino (Eds.), *Working through the crisis: Jobs and policies in developing countries during the Great Recession* (pp. 17-36). Washington, DC: World Bank.

Kingdon, G., and Knight, J. (2004). Unemployment in South Africa: The nature of the beast. *World Development*, 32(3), 391-408.

Kingdon, G., and Knight, J. (2006). The measurement of unemployment when unemployment is high. *Labour Economics*, 13(3), 291-315.

Kingdon, G., and Knight, J. (2007). Unemployment in South Africa, 1995-2003: Causes, problems and policies. *Journal of African Economies*, 16(5), 813-848.

Kingdon, G., and Knight, J. (2009). Unemployment: South Africa's Achilles' heel. In: J. Aton, B. Kahn, and G. Kingdon (Eds.), *South African economic policy under democracy* (pp. 300-326). Oxford: Oxford University Press.

Klasen, S., and Woolard, I. (2009). Surviving unemployment without state support: Unemployment and household formation in South Africa. *Journal of African Economies*, 18(1), 1-51.

Kopelman, J. L., and Rosen, H. S. (2014). Are public sector jobs recession-proof? Were they ever? *NBER Working Paper*, No. 20692.

Kucera, D., Roncolato, L., and von Uexkull, E. (2012). Trade contraction and employment in India and South Africa during the global crisis. *World Development*, 40(6), 1122–1134.

Lam, D., Leibbrandt, M., and Mlatsheni, C. (2009). Education and youth employment in South Africa. In: R. Kanbur, and J. Svejnar (Eds.), *Labor markets and economic development* (pp. 90-109). Abingdon: Routledge.

Leung, R., Stampini, M., and Vencatachellum, D. (2009). Does human capital protect workers against exogenous shocks? South Africa in the 2008-2009 crisis. *IZA Discussion Paper*, No. 4608.

Leung, R., Stampini, M., and Vencatachellum, D. (2014). Does human capital protect workers against exogenous shocks? Evidence from panel data on South Africa during the 2008-2009 crisis. *South African Journal of Economics*, 82(1), 99-116.

Mabugu, R., van der Berg, S., Chitiga, M., Decaluwé, B., Maisonnave, H., Robichaud, V., Shepherd, D., and von Fintel, D. (2010). *The impact of the international financial crisis on child poverty in South Africa*. Pretoria: UNICEF South Africa/Financial and Fiscal Commission of South Africa.

Mahajan, S. (2014). *Economics of South African townships: Special focus on Diepsloot*. Washington, DC: World Bank.

Mbatha, C. N., and Roodt, J. (2014). Recent internal migration and labour market outcomes: Exploring the 2008 and 2010 National Income Dynamics Study panel data in South Africa. *Labour Market Intelligence Partnership Working Paper*, No. 3.

Mlatsheni, C., and Leibbrandt, M. (2014). Unemployment in South Africa. In: H. Bhorat, A. Hirsch, R. Kanbur, and M. Ncube (Eds.), *The Oxford companion to the economics of South Africa* (pp. 236-243). Oxford: Oxford University Press.

Naudé, W. (2008). Is there a spatial mismatch in South Africa's metropolitan labour market? *Cities*, 25(5), 268-276.

OECD. (2013). South Africa. *OECD Economic Surveys*, March 2013.

Posel, D., Casale, D., and Vermaak, C. (2014). Job search and the measurement of unemployment in South Africa. *South African Journal of Economics*, 82(1), 66-80.

Ranchhod, V. (2013). Earnings volatility in South Africa. *SALDRU Working Paper*, No. 121.

Ranchhod, V., and Dinkelman, T. (2008). Labour market transitions in South Africa: What can we learn from matched Labour Force Survey data? *SALDRU Working Paper*, No. 14.

Rankin, N. A., and Roberts, G. (2011). Youth unemployment, firm size and reservation wages in South Africa. *South African Journal of Economics*, 79(2), 128-145.

Rodrik, D. (2008). Understanding South Africa's economic puzzles. *Economics of Transition*, 16(4), 769-797.

SALDRU. (various years). National Income Dynamics Study datasets: Wave 1 (version 5.2); wave 2 (version 2.2); wave 3 (version 1.2).

Sandefur, J. (2010). On the evolution of the firm size distribution in an African economy. *CSAE Working Paper*, No. 2010-05.

Shiferaw, A., and Bedi, A. S. (2013). The dynamics of job creation and job destruction in an African economy: Evidence from Ethiopia. *Journal of African Economies*, 22(5), 651-692.

Spaull, N. (2013). South Africa's education crisis: The quality of education in South Africa 1994-2011. Report commissioned by the Centre for Development and Enterprise.

Statistics South Africa. (2014a). Gross domestic product: Second quarter 2014. Statistical Release P0441.

Statistics South Africa. (2014b). *Labour market dynamics in South Africa, 2013*. Pretoria: Statistics South Africa.

Statistics South Africa. (various years). Quarterly Labour Force Survey datasets. Statistical Release P0211.

van der Berg, S. (2009). The persistence of inequalities in education. In: J. Aton, B. Kahn, and G. Kingdon (Eds.), *South African economic policy under democracy* (pp. 327-354). Oxford: Oxford University Press.

Verick, S. (2011). The impact of the global financial crisis on labour markets in OECD countries: Why youth and other vulnerable groups have been hit hard. In: I. Islam, and S. Verick (Eds.), *From*

*the Great Recession to labour market recovery: Issues, evidence and policy options* (pp. 119-147). Basingstoke: Palgrave Macmillan.

Verick, S. (2012). Giving up job search during a recession: The impact of the global financial crisis on the South African labour market. *Journal of African Economies*, 21(3), 373-408.

von Fintel, D., and Burger, R. (2009). The South African labour market in the global financial crisis: Recovering lost gains. In: J. F. Hofmeyr (Ed.), *Transformation audit 2009: Recession and recovery* (pp. 34-41). Cape Town: Institute for Justice and Reconciliation.

# Chapter 7

# General conclusions

## 1. A short recapitulation

In this dissertation we have taken the global financial and economic crisis, and in particular its most acute phase, the 2008-2009 Great Recession, as a vantage point to investigate the vulnerability of developing countries to external shocks. Our research has been organised around three research questions. First, how was the global crisis transmitted to developing countries, and what do the transmission channels tell us about potential vulnerability-reducing strategies? Second, which factors can explain cross-country heterogeneity in economic growth during the crisis? And third, how did the crisis manifest itself at lower levels in developing countries, beyond its macroeconomic consequences? Rather than following a single thread throughout, the five essays collected in this dissertation have attempted to fill a selection of gaps in the enormous literature on the global crisis and on developing country vulnerability to external shocks more generally. This set-up has informed our choice of particular topics, economic subdisciplines, research methodologies and country samples; which vary across the different essays. Therefore, the main results of the dissertation, suggestions for further research, and policy recommendations will be discussed by essay. Where possible, however, we will link and compare the findings of different chapters.

## 2. Main results and avenues for further research

**Chapter 2** started out by briefly sketching the origins of the global crisis in the US housing and mortgage markets and the ensuing financial and economic crises in advanced countries. We showed how also in developing countries, which were long thought to be decoupled from the US and Europe, economic growth slowed sharply during the years 2008-2009, and noted the large variation in growth between emerging market and low-income countries, between geographic regions and within regions. Four broad, more indirect transmission channels were identified through which the crisis affected developing countries, again to varying degrees: a steep decline in world trade (both in price and volume dimensions); greatly reduced net private capital inflows (portfolio investment, international bank lending and other debt, as well as FDI); and in second instance, lower remittances and bilateral aid. These observations led us to frame the global crisis as epitomising developing countries' vulnerability to external shocks.

Next, we conceptualised output vulnerability to shocks as a combination of the *probability and severity of shocks*, where shocks are defined as events that impact economies unexpectedly and exogenously and shock severity is expressed as the relative size of losses; *exposure*, i.e., the extent to which a country is open to outside shocks (or its maximum potential losses); and *resilience*, i.e., the capacity to withstand or adjust quickly from shocks (which largely depends on a country's financial and institutional resources). We pointed out the parallels with similar concepts used in the credit risk literature and proposed the *expected output loss* as one possible summary measure of countries' output vulnerability. Comparing our simple conceptualisation to existing vulnerability measurement efforts indicated that the IMF's Vulnerability Exercises for low-income countries and emerging

market economies (VE-LIC and VEE) indeed take into account all three main components of vulnerability, but could perhaps be improved by more explicitly considering the interaction between exposure and resilience. More generally, further analytical work, especially on the resilience component is needed to construct more theoretically sound and policy-relevant measures of vulnerability.

As output vulnerability to shocks was shown to lead to greater output and consumption volatility, reduced trend growth and lower-tier welfare impacts, we argued for the need of strategies to bring down the probability and severity of shocks, reduce exposure and/or increase resilience. Focussing on the latter two approaches and borrowing from Perry (2009), we introduced a four-category taxonomy of possible ways to deal with output vulnerability: first, *coping*, i.e., leaving vulnerability unchanged and adjusting to shocks after they have occurred, possibly with the help of international financial institutions; second, *prevention* or reducing exposure to shocks beforehand, for example, by export/capital portfolio diversification or building local currency bond markets; third, *self-insurance* or building resilience through international reserves hoarding, stabilisation funds or other sovereign wealth funds; and fourth, *market insurance and hedging*, an alternative way of increasing resilience by making use of derivative instruments, indexed debt, or local currency and contingent financing provided by international financial institutions. We demonstrated how these four strategies all have particular advantages as well as important drawbacks: coping can be painful and is backward-looking; prevention may take a long time to pay off; self-insurance often carries high opportunity costs; and market insurance and hedging may suffer from political economy problems and is largely unavailable to those countries that would benefit most. It thus seems that a multi-layered approach is required to reduce vulnerability, combining the above strategies with attention to the short and longer term, mindful of country specifics, and with roles to play for both countries themselves and international financial institutions.

Finally, we presented a broad, albeit non-exhaustive overview of how vulnerability to external shocks has been dealt with in practice by developing countries and by multilateral development banks and the IMF, concentrating on the years leading up to and of the global crisis. In short, without repeating the more detailed results from this exercise contained in Chapter 2, we illustrated important advancements in a number of areas, including in countries' own and international financial institutions' coping behaviour (which proved much more countercyclical during the global crisis than before) and in the gradual but steady development of local currency bond markets by emerging market countries. Reserves hoarding was also identified as a dominant strategy, again in emerging market economies particularly. We found much less progress, however, in areas such as export product diversification, the use of commodity derivatives and indexed debt, or the provision of local currency and contingent loans by international financial institutions. Especially by and for low-income countries, much more remains to be done. That said, we acknowledge the tentative nature of our general review. More in-depth and focused research is needed with respect to each of the vulnerability-reducing interventions and instruments mentioned. In Chapters 3 and 4 of the dissertation we made a start on such follow-up research by zooming in on local currency bond market development and reserves accumulation, respectively.

**Chapter 3** studied the current state and drivers of local currency bond markets (LCBMs) in Sub-Saharan Africa, a region whose progress in developing such markets has only recently received some attention in the literature, in part due to a lack of data. We argued that besides being a useful preventive strategy of reducing countries' exposure to external capital shocks and 'original sin', well-

developed government LCBMs could help mobilise domestic savings and generate positive financial, macroeconomic and institutional spill-overs. In particular, government bonds can provide a pricing benchmark for other financial products, including perhaps the indexed debt instruments discussed in Chapter 2. Other literature suggested that government LCBMs also have potential downsides, such as the crowding out of private sector credit (although some qualifications apply here), higher debt service costs (especially compared to the long-term concessional loans which many African countries have had and still have access to), and the need for a critical mass of investors and basic infrastructure to flourish. Indeed, the optimal public debt structure is one that balances the various trade-offs between different currencies, creditors, maturities and interest rate structures.

We further showed that domestic public debt, which includes but is not limited to local currency bonded debt, now constitutes an important part of overall public debt stocks in Africa, around 40% on average, largely because of external public debt relief initiatives such as HIPC and MDRI. We then presented a list of detailed quantitative and qualitative LCBM indicators for a cross-section of African countries, hand-collected from various sources, including the OECD, IMF, African Development Bank, commercial banks and country-specific reports and websites; this offered a first impression of the current state of LCBMs in Sub-Saharan Africa. Our overview revealed that quite a few African governments, including several former HIPCs, are now able to regularly issue longer-term, fixed-rate bonds with tenors of ten years and more, and that in several countries non-bank institutional investors, including local pension funds and insurance companies, account for considerable shares of total government bond holdings. That notwithstanding, the available evidence also showed that African LCBMs are typically marked by low liquidity, feature very few corporate bonds, and are often still dominated by local commercial bank investors (which could create negative feedback loops between sovereign and bank balance sheets in crisis times). Only in a handful of LCBMs there seemed to be a non-negligible presence of foreign investors.

Lastly, an econometric analysis of a novel OECD-collected panel dataset on central government LCBM capitalisation in selected African countries was performed, to investigate the determinants of such capitalisation. Our results indicated a negative correlation of LCBM development with governments' fiscal balance and inflation, and a positive correlation with common law legal origins, overall institutional quality and strong democratic political systems. Controlling for unobserved country-specific heterogeneity and market persistence using GMM estimators, we found above all worsening fiscal balances and declining inflation to be associated with increases in government LCBM capitalisation. These findings are generally in line with previous bond market research in the region and elsewhere, and suggest that government LCBM development in Africa is associated with deficit financing (on the supply side) and with greater credibility towards investors (on the demand side). Arguably, factors such as lower inflation, stronger institutions and democracy may also contribute to resilience to external shocks (as defined in Chapter 2) more generally.

Larger country samples and longer time series will be needed to increase the representativeness of our results and achieve better identification of any causal relations (by exploiting additional within-country time variation). The links of LCBM development with capital account openness, bank lending spreads, interest rate variability, past debt relief and alternative financing sources such as aid, for which some (but less robust) support was found, may need further scrutiny. A panel data study of variables such as secondary market turnover, bid-ask spreads, average maturities of outstanding bonds and of bond yields would be another interesting avenue for future research, complementing our hitherto narrow focus on LCBM capitalisation. This would require

(substantial) additional data collection efforts, as such data is, to the best of our knowledge, not readily available for a wider range of African countries.

**Chapter 4** discussed the holding of international reserves as a strategy of self-insurance that increases developing countries' resilience against external shocks (cf. Chapter 2), and the optimal level of reserves more particularly. A review of the empirical and theoretical literature on reserves accumulation in emerging market and low-income countries suggested that self-insurance against different kinds of shocks has indeed been a key driver; although non-precautionary motives, including the mercantilism of China and others, cannot be ignored. We also noted that the majority of theoretical models of optimal reserves concern only emerging market economies, generally with a risk of sudden stops in private capital inflows explaining the reserves hoarding. This makes such models less relevant for low-income countries, where access to foreign capital is much more limited to start with and other, real sector shocks play a more prominent role (as pointed out in Chapter 2). Only a handful of existing optimal reserves models were found to be tailored to a low-income country context.

We started from one of such models, due to Barnichon (2009), to formulate a dynamic, two-good, small open economy populated by a representative agent that is exposed to terms-of-trade shocks. We made two important adaptations to the original model. First of all, we relaxed Barnichon's assumption that the country in question, at all times, takes a positive net foreign assets position. To keep the idea of low-income countries' asymmetric access to international capital markets, however, we assumed a differentiated interest rate, low on positive net foreign assets (i.e., reserves) and high on negative net foreign assets (i.e., market borrowing). As the adapted, infinite-horizon model did not allow for a closed-form analytical solution of optimal net foreign assets, we solved it recursively using simple value function iteration on a discretised grid. Under our benchmark calibration for a 'typical' low-income country, the baseline model still yielded a (small) positive level of net foreign assets in steady state, somewhat below the levels found for the ever-saving countries in Barnichon (2009). Changes in particular parameters, however, were shown to give rise to zero or even negative optimal net foreign assets. Comparative statics further confirmed what we could *a priori* expect from an insurance instrument like reserves, i.e., that optimal reserves are a positive function of shock probability, duration and severity, and of the interest benefits (costs) of positive (negative) net foreign assets. Moreover, dynamic simulations of the model illustrated that the representative agent's behaviour over time, such as the speed of rebuilding net foreign assets after a shock, also depends on parameter choices, as well as on the agent's position vis-à-vis the steady state.

Second, we amended our Barnichon-inspired baseline model with a simple contingent credit line mechanism, one of the market insurance-like instruments discussed in Chapter 2, and studied its interaction with reserves. More specifically, we assumed subsidised, shock-contingent loans that are automatically disbursed to the country in case of a terms-of-trade shock, with loan size proportional to the balance-of-payments impact of the shock. As envisaged, we found that optimal reserves levels further decline in the presence of such contingent credit lines, especially so if coverage of the shock impact by the loan is large, the interest rate on the loan is low, and/or loan repayment takes place over a longer period. Extended model simulations revealed that, with full coverage by the contingent credit line mechanism, the remaining reserves are used only indirectly by the agent, to repay contingent loans when they fall due.

While optimisation models as ours are indeed sensitive to alternative parameterisations, we believe they are better-grounded in theory and more flexible than the simple rules of thumb that still dominate policymaking on reserves adequacy in low-income countries. Admittedly, in our basic, intuitive set-up we brushed aside many aspects that would complicate model dynamics. In further research the asymmetric access to international capital markets of low-income countries could perhaps be made more realistic by limiting roll-over of market borrowing in the aftermath of a shock, by making interest rates endogenous to the level of net foreign assets, or by modelling gross foreign assets and liabilities as two separate choice variables. Whereas our highly stylised representation of contingent credit lines primarily served to formalise the substitution effects between self-insurance by reserves accumulation and an idealised form of contingent support, future work could try to bring it closer to the existing IMF instruments (like the PLL and RCF for low-income countries) we described in Chapter 2. Potentially, one could assume more active roles for the contingent credit line provider (the IMF), which attaches some form of *ex ante* or *ex post* conditionality to the loans it disburses; and for the beneficiary country, which may dislike such conditionality and choose not to make use of the available support. In addition, the models presented in Chapter 4 (and future extensions) should be complemented with a more explicit welfare analysis, comparing the implications of different set-ups for the consumption (and therefore utility) of the representative agent. Also, a comparison between observed and model-simulated reserves levels might lead to a better understanding of the dimensions that are not adequately captured by our and other optimisation models; although data availability and quality may impede good country-specific calibrations for some low-income countries.

In **Chapter 5** we looked deeper into the substantial heterogeneity in economic growth of developing countries during the global crisis, which was documented in Chapter 2. We added to the existing body of empirical cross-country studies by bringing political institutions into the analysis, an overlooked but potentially important dimension of counties' resilience against external shocks. Specifically, we attempted to evaluate the effect of democracy, or typical features thereof, on 'unexpected crisis growth', i.e., the difference between observed real GDP per capita growth in crisis year 2009 and the IMF's pre-crisis forecast of 2009 growth. We began by showing that the influence of democracy on resilience to external shocks, such as during the Great Recession, is theoretically ambiguous. On the one hand, democracies may be less flexible and decisive in their crisis management, because of greater checks and balances (more 'veto players'); and more likely to give in to populist demands (which could lower growth), due to the accountability of elected politicians. On the other hand, autocracies generally lack the credibility that is necessary to implement and maintain policy reforms; may not be as 'benevolent' or growth-promoting as hoped for (with greater room for arbitrariness in policies); and, while not accountable to the general public, could equally fall prey to rent-seeking by interest groups.

Whereas the existing empirical literature on democracy and growth during (globally synchronised) external shocks is very limited, a wider range of related studies was found on the role of political institutions in financial crisis management, structural adjustment and sector-specific reforms. Most of the studies we reviewed seemed to suggest that countries with well-established democratic features have been more (or at least not less) successful in overcoming shocks, keeping up growth and adopting reforms. Yet, many commentators have pointed at the extraordinary size and swiftness of China's response to the crisis and its relatively robust economic growth in 2009 to invoke 'autocratic advantage' arguments.

Interestingly, in a large sample of developing countries and controlling for the macroeconomic, financial and standard institutional factors and pre-crisis trends present in previous work, cross-country OLS estimations suggested a significant *negative* correlation between democracy and crisis growth. Broadly in line with other studies and our own observations in Chapter 2, we also showed that countries with higher per capita income, faster pre-crisis economic and domestic credit growth, greater financial openness and lower external demand growth experienced more severe growth declines during the crisis. The main result on the crisis growth-retarding role of democracy was found to be surprisingly robust to additional control variables, changes in the country sample and alternative measures of crisis growth or democracy. However, once possible endogeneity was taken into account by means of IV estimation, using language, temperature and primary education variables as external instruments for democracy, the negative correlation between democracy and crisis growth disappeared and, in our preferred specifications, even turned *positive*. This appeared to indicate that our OLS estimates were likely tainted by omitted variable bias, and brought our results closer to earlier empirical work showing the resilience of democracies. Nevertheless, we emphasised that strict causality remains difficult to establish in our cross-country set-up and that the validity of the proposed instruments is what makes or breaks our conclusions. Stronger sources of exogenous variation would be helpful in more precisely estimating the average effect of democracy on crisis growth but may prove difficult to find.

Taken at face value, the results of Chapter 5 seem to complement our finding in Chapter 3 that democracy helped build resilience in Sub-Saharan Africa by contributing to government LCBM development. From Chapter 5 it was not clear, however, whether the greater credibility of policy commitments (arguably the main reason why democracy could be linked to larger government LCBMs) was among the mechanisms through which democracy influenced economic growth during the global crisis. Perhaps the overall positive effect (also) ran through the typically lower 'human fallibility' and less distortive rent-seeking in democracies, or through differences in fiscal, monetary and/or exchange rate policies between more and less democratic countries. Further attempts to disentangle the exact channels of political institutions' influence on developing country growth paths during the global crisis (and on the distribution of the costs associated with lower growth) could be a fruitful area for future research.

**Chapter 6** presented a case study of South Africa in which we shifted our attention from the growth and other macroeconomic consequences of the global crisis to its lower-tier manifestations. As alluded to in Chapter 2, there is now a large and growing body of evidence on the micro-level (welfare) impacts of the Great Recession in developing countries. These studies and research on other shock episodes demonstrate how crisis effects tend to be heterogeneous across individuals and households with different demographic characteristics and livelihoods. We selected South African labour markets as a particularly interesting context to test for such heterogeneity. Because of difficulties with attribution and limitations of the data at hand, we did not attempt to assess the *impact* (*stricto sensu*) of the global crisis on South African labour market participants. Rather, we provided an overview and analysis of South African labour market mobility and the determinants of transitions in and out of employment during the height and aftermath of the crisis.

It was shown how, partly because of its strong trade and financial links with Europe, the South African economy experienced a recession from 2008Q4 to 2009Q2 and saw only lacklustre growth thereafter. Unemployment rates, which were already extraordinarily high before the global

crisis and South Africa's recession (for various, mostly historical and structural reasons), further increased between 2008 and 2012.

We investigated individual-level labour market transitions in South Africa since 2008 by means of two nationally representative longitudinal datasets: the National Income Dynamics Study (NIDS), a panel with waves in 2008, 2010 and 2012; and Quarterly Labour Force Survey (QLFS) cross-sections which were matched from quarter to quarter over 2008Q1-2013Q4 using an algorithm similar to that developed by Ranchhod and Dinkelman (2008). In line with previous research on South Africa, we uncovered considerable mobility in labour markets, with large gross flows in and out of employment and between different forms of employment and non-employment, both in the short and medium run. Transition matrices and decomposable labour market mobility measures, especially those based on the QLFS, further showed that overall mobility decreased from 2008 up to 2012, and that the observed net increase in South African unemployment rates should be ascribed more to reduced inflows into employment than to increased outflows from employment. One reason for the dominance of declining job creation over job destruction could be that labour market 'insiders' (with a job), through greater bargaining power and high wage demands, reduced employers' willingness to create jobs for unemployed 'outsiders'.

Next, we estimated a series of binary probit models to gauge which individual, household-level and job-specific variables affected the likelihood of transitioning in or out of regular wage and formal sector jobs (generally the most stable and valued forms of employment) in South Africa. The estimation results suggested that both deliberate individual or household choices and external circumstances were at play, although labour supply and demand effects could not be neatly separated with the available data. The role of external factors was evidenced by the significant effects of a list of skill-related variables on the probabilities of remaining in or finding employment, and was corroborated by individuals' self-reported reasons for moving out of or failing to get into jobs. Our strongest result was that higher educational attainment, i.e., a matric or post-matric level qualification, reduced the chances of job loss and increased job finding prospects over the whole 2008-2013 study period. The higher education effect seemed to operate above and beyond the (mostly significant) influence of other factors, such as occupational and industry categories, contract types and duration, union membership, firm types and sizes, and job tenure (for those initially employed); or the initial labour market status and recent work experience (for those not initially employed). This suggested that education levels proxy and/or signal particular skills that are valued by South African employers.

For our QLFS estimates, we also compared the economic significance of labour market transition correlates over time, to gain further insights into whether the crisis perhaps changed the importance of particular individual or job-specific traits. Most notably, it appeared that the strength of higher education's protection against job loss gradually diminished over the first post-crisis years. A potential explanation, which requires a more in-depth analysis, is that, because of the higher cost of matching better-educated (higher-skilled) workers to jobs, such employees are only made redundant when the economic climate remains sluggish over a longer period (as was the case in South Africa after 2008) and after lower-educated employees have already been shed.

Other directions in which our research on South African labour markets could be extended in the future include a finer-grained analysis of the vulnerability of workers active in particular subsectors or performing specific job tasks; a study of the role of particular types of (higher) education and educational quality, which is very unevenly distributed in South Africa; and the joint estimation of the determinants of job entry and exit. Finally, it would be interesting to complement

Chapter 6 with a more formal crisis impact study. This would require elaborating an identification strategy aimed at linking macroeconomic trends more directly to labour market outcomes, potentially by calibrating a structural (computable general equilibrium) model with actual and projected macroeconomic and labour market data.

## 3. Policy recommendations

The answers we provided to the research questions posed in the different chapters of this dissertation should not be seen as endpoints. Indeed, as is clear from the previous section, our results tend to be only partial and generate new questions and hypotheses. Furthermore, one should be careful in extrapolating any findings on the circumstances of the Great Recession and its consequences for developing countries across time. Compared to other crises episodes, the global financial and economic crisis of 2008-2009 stood out by its extraordinary synchronisation of output trends, due to some of the largest and most connected advanced economies being at its epicentre. The next crisis with developing country implications may well be of a very different nature. Still, external shocks are here to stay, even if their future shapes and sizes will differ from those observed during the Great Recession. Developing countries (and those that intend to help them) will need to devise sensible strategies to deal with their vulnerability to such external shocks, especially when (and preferably *before*) further integrating into the world economy. We do believe a number of more general lessons can be drawn and tentative policy recommendations can be formulated based on the research presented in this dissertation.

The framework presented in **Chapter 2** offers a simple tool for policymakers in developing countries and international financial institutions to structure discussions about vulnerability to external shocks and to compare different vulnerability-reducing strategies in terms of feasibility and desirability. Logically, the optimal policy mix will depend on the nature of shocks countries are exposed to, countries' unique characteristics and starting positions (in terms of human capital and resources), and the planned time horizon.

Countries that use up fiscal space in coping with external shocks, should attempt to rebuild it once the effect of such shocks subsides, even if this may be difficult for political economy reasons. Regional reserves pooling and management deserves more attention as a way of reducing opportunity costs for those countries that have accumulated an 'excessive' level of reserves and as a partial substitute for self-insurance in countries with 'insufficient' reserves. Developing countries that possess a minimum level of institutional and technical capacity could cautiously experiment with derivative financial products for insurance or hedging purposes, while communicating transparently with domestic constituents and international investors. Importantly, all this should not detract from intensifying efforts towards longer-term export and external capital portfolio diversification and domestic capital market development, which are arguably first-best strategies.

From their side, international financial institutions such as the IMF, World Bank and regional development banks should sustain their endeavours, spurred by the global crisis, in making their (emergency) support quicker and more flexible, with less and better-targeted conditionality. They too should experiment more with providing new financial instruments, including local currency financing, derivatives and shock-contingent credit lines, especially to their low-income country clients, as well as rethink the design and presentation of existing instruments with limited uptake. It

should be acknowledged, and internal risk management policies should be revised to reflect that international financial institutions are in much better positions than individual developing countries to bear extra risks (up to certain limits).

The cross-country overview of Sub-Saharan African LCBMs in **Chapter 3** showed that significant progress has been made by several African governments in expanding total LCBM capitalisation, lengthening maximum bond tenors and increasing the role of non-bank institutional investors. But it also suggested that much more remains to be done to ensure government LCBMs in the region can effectively and efficiently perform their various functions, including reducing countries' exposure to external capital shocks and to the dangers of 'original sin'. To address the common problems of secondary market illiquidity and (over)reliance on commercial banks as bond investors, African governments may want to consider focusing their issuance on a limited number of regular benchmark bonds, improving communication and market infrastructure (such as clearing and settlement systems), and examining in greater detail the incentive structures and balance sheets of different types of prospective investors. Whereas allowing foreign investment in LCBMs could drastically expand the overall investor base and boost liquidity, it may concurrently undermine LCBMs' vulnerability-reducing role. A regional approach to LCBMs might be a useful (intermediate) solution. Moreover, international financial institutions should maintain their role as advisors and market developers in African LCBMs and expand it to a wider range of countries. For example, in Chapter 2 we discussed how LCBM flagship programmes such as the World Bank's GEMLOC and ESMID have only covered South Africa, Nigeria, Kenya, Tanzania, Uganda and Rwanda so far. Also the work of the African Development Bank focuses on the largest and most liquid of African government LCBMs.

The results of our econometric analysis of the determinants of government LCBM capitalisation in selected African countries pointed to the importance of keeping inflation under control, improving institutional quality and strengthening accountability (proxied by a democratic political system). These seem necessary steps to build credibility towards bond investors but also have obvious pay-offs in other domains. To the extent that government LCBMs also contribute to a more efficient monetary policy and to building trust between the government and domestic investors, there could perhaps be threshold effects and multiple equilibria in LCBM development (requiring an external impulse or 'big push'). Given the relatively short time dimension of our dataset, we did not test explicitly for this, however. On the supply side, the limited, non-robust evidence of substitution between bonded debt and other sources of finance (such as aid and commercial non-marketable loans) suggests that bilateral/multilateral donor-creditors and international banks should not expect to be displaced by LCBMs anytime soon; although more research is again warranted.

Lastly, the difficulties we experienced in compiling cross-country comparable data on African LCBMs for our research in Chapter 3 testify to the need for increased data collection *and* centralisation efforts. At the moment of writing it very much seemed that organisations such as the OECD, IMF, World Bank and African Development Bank maintain their own databases in parallel and cooperate little (with the exception of the formulation of a joint diagnostic framework on LCBM development).

We believe our stylised model for optimal reserves in low-income countries of **Chapter 4** was helpful in formalising a number of intuitive relations and in conveying the message that, even with

permanent access to market borrowing and a subsidised contingent credit line mechanism, a utility-maximising agent may still decide to hold positive net foreign assets in equilibrium. However, because of the simplicity of its general set-up (such as the lack of investment behaviour and the focus on *net* rather than *gross* foreign assets) as well as its relatively rough cross-country calibration (for example, with respect to the level of subsistence imports), we cannot employ the model to derive precise measures of optimal reserves levels for self-insurance purposes; not at this point at least. Likewise, the absence of a formal welfare analysis prevents us from using the model as a tool for the normative ranking of different contingent credit line arrangements. These limitations should be remediated in future work, for which the current model provides a useful basis.

Chapter 4 further demonstrated how model-generated *steady-state* optimal reserves need to be interpreted with great caution. Indeed, they are generally very sensitive to changes in particular parameters (including ones that are hard to measure, such as the subjective discount factor or risk aversion) and do not well proxy the 'typical' or 'average' net foreign assets position a country should optimally take. At the same time, this parameter sensitivity and the very notion of optimal reserves being a dynamic concept challenges the primacy of one-size-fits-all rules of thumb to evaluate reserves adequacy. There is some evidence, at least for emerging market economies, that optimisation models are slowly finding their way into policymaking on reserves, as a complement to traditional rules of thumb and peer comparisons.

**Chapter 5** does not lend itself to clear policy prescriptions, mainly because our study focused on the *net* effect of democracy on economic growth during the global crisis and left a more in-depth analysis of the underlying forces for future research. If anything, Chapter 5 warns researchers and policymakers against jumping to conclusions about the relation between political institutions and external shocks based on preconceived ideas and single case studies (like that of the crisis response of China, for example), or simple cross-country correlations. The latter is apparent from the rather drastic change in results we observed when moving from standard OLS estimations (where democracy was found *negatively* correlated with crisis growth) to IV estimates that correct for endogeneity (which yielded a *positive* effect of democracy on crisis growth).

The considerable short- and medium-term South African labour market mobility laid bare in **Chapter 6** first of all calls for a qualification of the hardwired image of such labour markets being very rigid and inflexible in every respect. Policymakers need to acknowledge the large movements in and out of employment and between different forms of employment and non-employment that lie behind headline (cross-sectional) statistics such as the unemployment rate. The now available data, most importantly the NIDS panel and matched QLFS we used in our analysis, allow them to adopt a more dynamic perspective.

Our finding that the overall increase in unemployment rates from 2008 to 2012 derives mostly from reduced inflows into employment rather than from increased outflows suggests that, in order to bring down South African unemployment, interventions aimed at job creation and increasing the employability of labour market 'outsiders' (the unemployed) deserve special attention. Instead, the initial reaction to the crisis of the South African government seemed focused primarily on keeping 'insiders' employed. For example, in 2009 a new 'training lay-off scheme' was initiated, subsidising temporary skills development programmes for workers facing retrenchment (von Fintel and Burger, 2009). Whereas the problem of sluggish job creation apparently worsened during the

crisis and its aftermath, it is foremost a structural phenomenon in South Africa, best addressed by longer-term investment in economic growth and the promotion of labour-intensive sectors.

The robust positive effect of secondary and higher educational attainment on the probabilities of retaining or finding (regular wage/formal sector) jobs, evident from our econometric analysis of individual labour market transition determinants, seems to have further policy implications. First, it strengthens the case for continued investment in higher education. This does not mean educational *quality* can be ignored; without quality guarantees greater education levels would probably only lead to increased expectations (and frustrations) rather than improved labour market chances. Second, one could attempt to increase demand for the masses of less-educated/lower-skilled job seekers in South Africa by actively supporting particular industries, like light manufacturing, that rely heavily on lower-skilled workers. Because of increased competition from low-cost countries, it may be difficult, however, to reverse the longer-term structural trends in South African production and employment away from low-skilled labour-intensive (sub)sectors.

## References

Barnichon, R. (2009). The optimal level of reserves for low-income countries: Self-insurance against external shocks. *IMF Staff Papers*, 56(4), 852-875.

Perry, G. (2009). *Beyond lending: How multilateral banks can help developing countries manage volatility*. Washington, DC: Center for Global Development.

Ranchhod, V., and Dinkelman, T. (2008). Labour market transitions in South Africa: What can we learn from matched Labour Force Survey data? *SALDRU Working Paper*, No. 14.

von Fintel, D., and Burger, R. (2009). The South African labour market in the global financial crisis: Recovering lost gains. In: J. F. Hofmeyr (Ed.), *Transformation audit 2009: Recession and recovery* (pp. 34-41). Cape Town: Institute for Justice and Reconciliation.