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

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ABSTRACT: This article studies the current state and drivers of government local currency bond market (LCBM) development in Sub-Saharan Africa. We first show that, increasingly, African governments issue fixed-rate local currency bonds with tenors of ten years and more on a regular basis. However, African LCBMs are also often marked by illiquidity, very few corporate securities and narrow, bank-dominated investor bases. Second, we present an econometric analysis of the drivers of African government LCBMs based on a new high-quality, OECD-compiled panel dataset. LCBM capitalisation is found to be correlated negatively with governments' fiscal balance and inflation, and positively with common law legal origins, institutional quality and democracy.

KEYWORDS: public debt, local currency bonds, Sub-Saharan Africa

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Introduction

Financial stability concerns associated with the external financing of developing countries have led to a renewed interest in the development of their domestic capital markets. In November 2011 the G20 endorsed an action plan and called upon international organisations to support the development of local currency bond markets (LCBMs) in emerging markets and other developing economies. This resulted in a joint 'diagnostic framework' (IMF, World Bank, EBRD and OECD 2013), a toolkit designed to help country authorities analyse the state of their LCBMs and identify reform priorities. Our focus in this article is on government LCBMs in Sub-Saharan Africa, long time a blind spot in bond market research (with a few exceptions, see Blommestein and Horman 2007; Adelegan and Radzewicz-Bak 2009; Mu et al. 2013); mostly due to their relative underdevelopment and a lack of reliable, comparable data.

At least four important reasons can be distinguished for further LCBM development Sub-Saharan Africa. First, the global financial crisis and its spill-overs have demonstrated that developing economies, in Africa and elsewhere, remain vulnerable to external shocks, including sudden stops in private capital flows (Essers 2013). Moreover, developing countries may face a more limited availability of official, concessional finance in the (near) future (Dang et al. 2013; Dabla-Norris et al. 2015). This would especially affect aid-dependent African countries. Well-developed LCBMs can reduce countries' exposure to external financing shocks, acting as a 'spare tyre' that stabilises the domestic economy (Turner 2012).

Second, developing economies 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; Khan 2005). 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. 2005). LCBM

development may 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).

Third, Sub-Saharan Africa is in urgent need of additional funds for growth-enhancing investment, notably in infrastructure (Foster and Briceño-Garmendia 2010; OECD 2012). Part of the funding needs could be fulfilled using government and corporate infrastructure project bonds (Mbeng Mezui and Hundal 2013). More generally, LCBMs could help mobilising Africa's domestic savings by improving financial intermediation, discouraging capital flight and even encouraging capital to return. Much of Africa's private wealth has traditionally been held abroad, making the region a net capital exporter to the rest of the world (Collier et al. 2001; Ndikumana and Boyce 2011).

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 of pricing benchmark; encouraging sound 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 strong legal frameworks and may help building governments' domestic accountability (World Bank and IMF 2001; Kumhof and Tanner 2005; Abbas and Christensen 2010; IMF et al. 2013; Laeven 2014).

LCBMs are no panacea, however. Especially in their initial stages of development, government LCBMs could crowd out private sector credit (Christensen 2005; Mbate 2013). Large holdings of government bonds by domestic banks may reduce their efficiency and shrink their private sector loan portfolios (Emran and Farazi 2009; Hauner 2009; Ismihan and Ozkan 2012). Debt service costs and refinancing/interest rate risks on local currency bonds are higher when compared with non-market funding such as concessional bilateral and

multilateral loans (Beaugrand et al. 2002; Christensen 2005; Hanson 2007). 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 government 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 article to the existing literature on government LCBMs in Sub-Saharan Africa is threefold. First, bringing together cross-country information hand-collected from various sources, we present a detailed account of the current state of African government LCBMs. This large cross-country overview features several LCBM indicators absent from previous work (e.g., Bua et al. 2014), including bond tenors, common bond coupon types and bond auction frequency. We find that several African governments now issue fixed-rate local currency bonds with tenors of ten years and more on a regular basis, but also uncover that African LCBMs are generally marked by secondary market illiquidity, few corporate securities, and narrow investor bases dominated by commercial banks.

Second, we introduce a new high-quality panel dataset, compiled by the OECD (2013), that covers central government debt in 15 selected Sub-Saharan African countries over the period 2003-2012. This dataset was sourced directly from African debt management offices through circulation of a standardised questionnaire, unlike in other papers that tend to mix primary and secondary data (e.g., Mu et al. 2013; Bua et al. 2014), allowing us to construct a fully comparable and consistent measure of government LCBM capitalisation. Our set of sample countries is small but more diverse than the group of African low-income countries on which Bua et al. (2014) present detailed debt structure data, which makes for interesting between-country comparisons.

Third, the current article is the first to conduct an econometric analysis of the drivers of government LCBM capitalisation in Africa based on this alternative OECD dataset. It is closely related to the empirical literature on domestic public debt (Guscina 2008; Mehl and Reynaud 2010; Forslund et al. 2011) and original sin (Hausmann and Panizza 2003; Mehl and Reynaud 2005) and complements earlier work on emerging market LCBMs (Burger and Warnock 2006; Eichengreen and Luengnaruemitchai 2006; Claessens et al. 2007; Eichengreen et al. 2008; Bae 2012; Bhattacharyay 2013). Unlike otherwise comparable studies on African LCBMs by Adelegan and Radzewicz-Bak (2009) and Mu et al. (2013), we include in our analysis explanatory variables such as inflation, democracy and other government debt stock. Moreover, we perform a battery of additional robustness tests. 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.

Taking stock: Sub-Saharan Africa's government LCBMs in perspective

Domestic vs. external public debt

To place government LCBMs in a broader perspective, it is useful to first distinguish between domestic and external public debt, which can be done in three ways (see Panizza 2008): first, based on the currency of the debt; second, based on creditor residency; or 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. That is why, typically, the third method and, in some instances, the first method are used as alternative taxonomies (see e.g., IMF and IDA 2013).

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 non-HIPCs (see Essers and Cassimon 2012). It is clear 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%, of African public debt stocks. On average, the build-up of domestic public debt by African non-HIPCs was larger than by HIPCs. But also HIPCs tapped domestic markets, allegedly since they were limited in their non-concessional external borrowing as part of IMF programmes (Arnone and Presbitero 2010).

Importantly, not all domestic public debt reported in Figure 1 consists of (longer-tenor) government bonds denominated in local currency. According to the definitions applied by international organisations that collect data on domestic public debt, it may include a whole range of financial liabilities, including (but not limited to) securities such as bonds, notes, bills and commercial paper; currency and deposits; insurance technical reserves; financial derivatives; and other accounts payable, such as trade credits and central bank advances (see BIS, Commonwealth Secretariat, ECB, Eurostat, IMF, OECD, Paris Club, UNCTAD, and World Bank 2013). This in turn means that the above-mentioned benefits of government LCBMs do not 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.

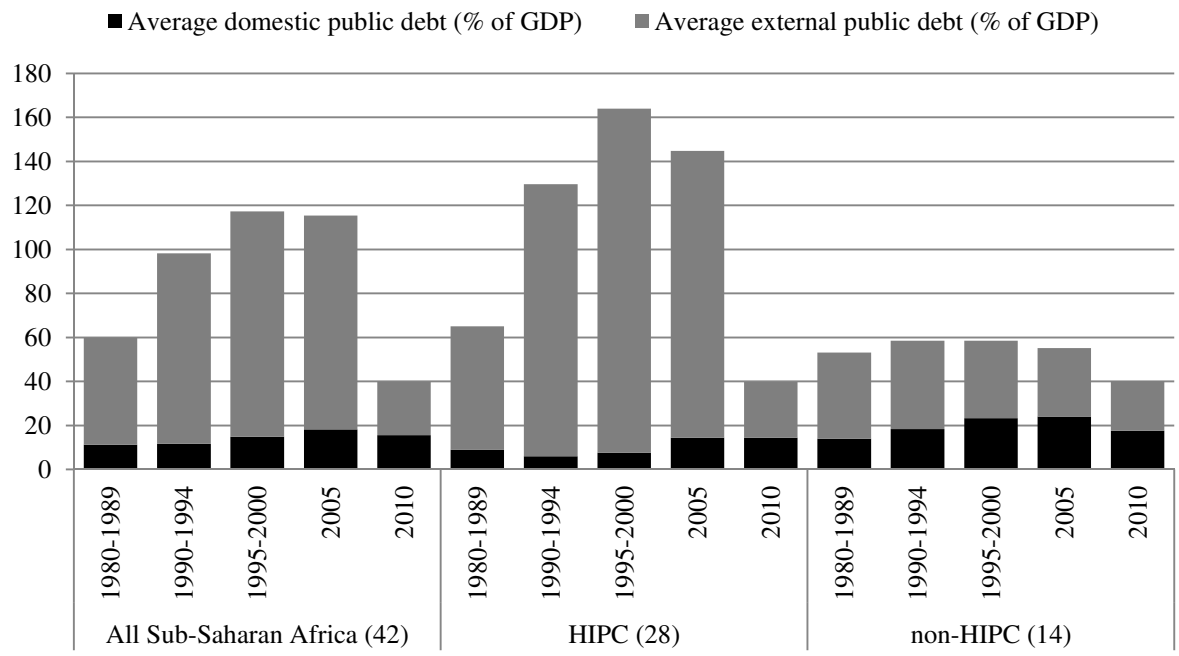

Figure 1. Evolution of average domestic and external public debt (as % of GDP) in Sub-Saharan Africa, 1980-2010

Notes: historical averages are from Christensen (2005); 2005/2010 figures from IMF Country Reports. 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. Comoros, Equatorial Guinea, Eritrea, Djibouti, Mauritania, Somalia and South Sudan are excluded for data availability reasons.

Ideally, one would decompose overall 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, although some useful databases exist. 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 public debt's currency mismatches were initially replaced by domestic public debt's maturity mismatches (Christensen 2005). Using 1996-2011 data on 15 low-income countries (of which ten are Sub-Saharan African), Bua et al. (2014) find that central bank advances are still an important category of domestic public debt (especially in HIPCs) but also that the share of longer-term marketable securities, such as bonds, has grown over time.

Current state of government LCBMs

In the remainder of the article 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 a number of 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, cross-checked 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. To our knowledge, such detailed indicators are not available in panel data format (apart from LCBM capitalisation figures, see below). Table 1, although uneven in terms of data coverage, gives a first impression of the various stages of government LCBM development countries in the region have attained.[1]

South Africa's government LCBM is by far the largest and most developed in Sub-Saharan Africa. In relative terms (as a percentage of GDP), its outstanding central government marketable 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 central government marketable debt stocks in excess of 10% of GDP in 2012.

Note that quite a few African governments are now able to issue longer-term local currency bonds domestically. In addition to South Africa, also Kenya, Namibia and Nigeria have successfully issued bonds with original maturities of 20 years or more; Botswana, Mauritius, Angola, Lesotho, Swaziland and a number of former HIPCs (Tanzania, Uganda, Zambia, Ethiopia and Mozambique) have issued bonds with tenors of at least ten years. Many

of these governments have concrete plans to extend bond maturities even further, thereby reducing original sin in Sub-Saharan Africa (Essers and Cassimon 2012).

Another important feature is that most government bonds have fixed-rate coupons. But there are exceptions, such as Angola, where issuance also includes bonds denominated in and indexed to foreign currency as well as inflation-indexed local currency bonds (OECD 2013). About two thirds of the African countries listed in Table 1 publish an official bond auction calendar and hold government bond auctions at least quarterly; several among them hold such auctions even monthly. Half of the counties have primary dealer systems in place.

In spite of these developments, which have resulted in an expansion 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.[2] Only in South Africa there is currently a vibrant corporate LCBM segment. Ojah and Pillay (2009) show that firms using South Africa's LCBM are typically larger, longer-established, more profitable and less opaque than firms that borrow privately from bank and non-bank debt providers. Other African corporate LCBMs 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.

Table 1. Government 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 local 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 local 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); commercial banks (40%); also central bank, retail investors	limited (<1% in 2013)	No	50-100bps (2013)	0.16 (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 local 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 others	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, only nationals and EAC foreigners can invest in bonds	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 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 documents. 'Indexed' = bond coupon indexed to domestic inflation rate. 'Floating' = bond coupon linked to domestic or international reference interest rate. 'N/A' = not available.

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 (Lesotho, Sierra Leone, Swaziland and Burundi). In some cases this reflects regulatory or supervisory requirements for banks to hold government debt in portfolio, but it may also mirror other forms of financial repression (Blommestein and Horman 2007). The dominance of local commercial banks matters for several reasons. First, a sound banking system is thought to be a key precondition for LCBM development (Ozkan et al. 2010; IMF et al. 2013). Second, in the event of a domestic banking crisis, local banks' bond holdings become overnight government debt (Panizza 2010). Third, with banks as the dominant investor class, government LCBMs will no longer act as a 'spare tyre' when countries are facing a banking stress-induced credit crunch. Fourth, excessive holdings of local currency government debt by local banks increase the likelihood of crowding out private sector credit. This last point is of particular relevance in the African context, where private companies rely primarily on bank lending, partly due to the underdevelopment of corporate LCBMs (Christensen 2005). 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, while they account for non-negligible shares in Kenya, Nigeria, Uganda, Zambia and others. As these institutional investors seek to match long-term assets with long-term liabilities, their expansion has gone hand-in-hand with the lengthening of government bond maturities.

Another dimension covered (although very unevenly) by Table 1 is the presence of foreign investors in government LCBMs and the existence of restrictions thereon. We observe a diverse pattern. For example, in Ethiopia foreigners are banned completely from investing in

infrastructure bonds. Both Angola and Mozambique operate strict exchange controls, whereas Botswana and Malawi apply quotas to foreign investment in certain government bond issues. Tanzania has only very recently opened up its LCBMs to residents of the East African Community (EAC). De facto, only South Africa, Ghana, Nigeria and Uganda have markets with a considerable foreign presence. Foreign bond investment in emerging government LCBMs has both pros and cons. Foreign investor participation expands the investor base, increasing liquidity and demand for longer-maturity bonds (IMF et al. 2013). Also, it may put extra pressure on improving financial intermediation and market infrastructure, thereby strengthening market functioning (World Bank and IMF 2001; Peiris 2010). Conversely, reliance on foreign investors increases the vulnerability of host countries to international shocks, especially when fundamentals are weaker (Ebeke and Lu 2014).

Drivers of government LCBMs in Sub-Saharan Africa

Model specification

We estimate a series of panel data models which, in their most general form, 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[3] time-varying and time-invariant explanatory variables described in more detail below; μ_i are country-specific effects; π_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 different panel data estimation techniques and model specifications. For our baseline estimations we rely on (i) pooled ordinary least squares (POLS) estimation, 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) and (iv) the random effects (RE) estimator. Due to limited within-country variation in our sample (see below) and relatively small sample size, some of the traditional diagnostic tests we present 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 explicitly control for persistence in LCBM capitalisation by adding a lag of the dependent variable, $Y_{i,t-1}$, to Equation (1) and estimating the autoregressive relation by means of the 'system' generalised method of moments (GMM) estimator.

Sample, data sources and descriptive statistics

As the source for our dependent variable we use 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 all, the African Yearbook sources all its data on debt stocks directly from African debt management offices 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 (e.g., Mu et al. 2013; Bua et al. 2014). Data collection is accomplished through a standardised questionnaire that follows the methodology of the Statistical Yearbook on Central Government Debt for OECD countries, which contributes to the cross-country comparability of debt stock data. Second, the African Yearbook explicitly covers only *central government* debt (excluding the debts of state and local governments, 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.[4] 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 (see above). Other datasets classify government (marketable) debt based on creditor residency (Bua et al. 2014) or the place of issuance (Mu et al. 2013) and do not explicitly take into account currency denomination.

The fourth edition of the African Yearbook covers 17 countries 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 the 15 Sub-Saharan African countries only, leaves us with government LCBM capitalisation figures for an almost balanced panel sample of 137 observations. We cannot claim that our results will be fully representative of government LCBMs in Sub-Saharan Africa but nevertheless believe that our diverse set of African low-income, lower-middle-income and upper-middle-income countries makes for interesting comparisons.

In the working paper version of this article (Essers et al. 2015) our dependent variable is evaluated against figures from Mu et al. (2013), which in principle should be similar (except that the latter do not exclude domestically issued *foreign currency* marketable debt). We show the data generally correspond well but, unlike in the African Yearbook data, we find large, hard-to-explain breaks in Mu et al.'s (2013) government debt series for some countries, including Uganda and Sierra Leone. Our analysis of an alternative dataset therefore constitutes a useful check of Mu et al.'s (2013) findings. We do not discern a clear common trend in the evolution of absolute and relative sizes of government LCBMs 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. In absolute (nominal US$) terms, the most notable government LCBM expansions are those of South Africa, Nigeria (2003-2012) and Angola (2008).[5] Government LCBMs' shares of total central government debt also follow 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 end 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 (see Appendix of Essers et al. 2015). We come back 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. Table A.1 in Appendix lists all baseline variables, their labels, definitions, sources and descriptive statistics. Below we discuss the rationale for incorporating each of these variables in our models as potential determinants of government LCBM capitalisation.

Country size

Larger-sized economies have scale advantages in developing deep and liquid LCBMs since the greater availability of potential buyers and sellers reduces price volatility and encourages investment, and because of important fixed costs (Eichengreen and Luengnaruemitchai 2006; Claessens et al. 2007). Also, LCBMs of larger economies more easily attract foreign investors due to the greater diversification benefits they offer (Hausmann and Panizza 2003). Alternatively, smaller countries may need to rely more on domestic public funding, lacking the creditworthiness to borrow heavily from abroad (Mu et al. 2013). We use

log GDP at purchasing power parity (PPP) as our preferred measure of economic size (*ln_gdp_ppp*). We complement it with a geographic measure of size, log surface area in squared kilometres (*ln_area*).

Economic development

Financial development, in its various aspects, co-evolves with broader economic development (see e.g., Calderón and Liu 2003; Levine 2005). Financial intermediation makes capital formation and investment possible by bringing together savers and borrowers. But as an economy grows, the demand for financial services and instruments is also expected to increase. We take log GDP per capita (PPP) as a broad measure of economic development (*ln_gdppc_ppp*). To the extent that GDP per capita is correlated with better governance and policies, it may also capture some aspects of institutional quality not fully covered by the other proxies we consider (see below).

Trade openness

The expected relationship of government LCBM development with trade openness is ambiguous. On the one hand, Rajan and Zingales (2003) argue that in countries 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. On the other hand, however, for given financing needs, less integrated countries may be more incentivised to develop domestic bond markets (Mu et al. 2013). We measure trade openness as the ratio of total exports of goods and services to GDP (*x_gdp*).

Banking sector size

Bank- and (bond) market-based finance can be either substitutes or complements (see e.g., Levine 2002; Song and Thakor 2010). If banks already cater directly to the government there may be no immediate need to set up deep government LCBMs. But, at the same time, local banks often serve as primary dealers and market makers (Eichengreen et al. 2008). In most African countries banks are also important government bond investors themselves (see

above). We follow the literature in taking as a proxy for banking sector size domestic credit provided to the private sector (as a percentage of GDP) (*domcred_gdp*).

Fiscal balance

Another potentially important driver is the fiscal balance. Ceteris paribus, countries running fiscal deficits have greater need for issuing government bonds than those with surpluses. That said, the fiscal balance may well be endogenous to government LCBM development. Especially in Africa, many governments face constraints in their ability to borrow so that the size of fiscal deficits 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. To smooth out transient factors we use a three-year moving average of the general government fiscal balance, defined as the difference between revenue and total expenditure including the net acquisition of non-financial assets by the government (and expressed as a percentage of GDP) (*av_fiscbal_gdp*).

Inflation

A lack of monetary policy credibility, as evident from high and/or volatile inflation rates, has been empirically established as a key impediment to developing government LCBMs (see e.g., Burger and Warnock 2006; Claessens et al. 2007). If creditors fear that their claims may be inflated away by the government, they will not be willing to buy longer-term, fixed-rate local currency bonds, unless governments resort to financial repression of course (Forslund et al. 2011). Also, in countries with high inflation, governments may not need to issue large debts as they derive revenues from the 'inflation tax'. However, inflation may be endogenous too. Eichengreen and Hausmann (1999) propose better-developed LCBMs may create a political constituency opposed to inflationary and other debt-diluting policies. In support of this assertion, Rose (2014) finds that the existence of a longer-term government

LCBM significantly lowers inflation, although only so in inflation-targeting countries. We consider here the inflation rate based on the consumer price index (*infl_cp*).

Capital account openness

The effect of capital account openness on LCBM development is again theoretically ambivalent. 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 trait to attract foreign investors. Conversely, governments may use capital controls to prevent domestic capital from leaving the country and create a captive investor base (Forslund et al. 2011). We employ a time-varying index of de jure capital account openness developed by Chinn and Ito (2006) (*kaopen*). Higher values of the index signify less capital controls and thus a more open capital account.

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 much better protected than in countries with civil law-based legal systems, in particular French civil law. These legal origins may be especially important for LCBMs (Claessens et al. 2007). We use a dummy variable indicating whether the country in question has common law legal origins or not (*comlaw*). In our sample, nine out of 15 are common law countries (Kenya, Malawi, Namibia, Nigeria, Sierra Leone, South Africa, Tanzania, Uganda and Zambia); the other six all have a French civil law tradition.

Other government debt

Some factors we have considered so far may be correlated with both LCBMs and other government debt; but, for given financing needs, there could be substitution effects too. Moreover, with the exception of South Africa, Mauritius, Namibia and Angola, all our sample countries have enjoyed substantial debt relief or at least debt restructuring in recent years, mostly under the HIPC initiative and MDRI. Since HIPC granted debt relief on non-

marketable debt owed to foreign multilateral, bilateral and commercial creditors, while at the same time 'forcing' countries to use their domestic debt markets (Arnone and Presbitero 2010), we would again expect a negative relation between government LCBMs and other government debt. To ensure consistency with the 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 African Yearbook (*othdebt_gdp*). This measure 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., securities, irrespective of the place of issuance).

Institutional quality

Many institutional arrangements could possibly have an effect on the functioning and development of government LCBMs, including 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 indicators of the International Country Risk Guide (ICRG) (*comprisk_icrg*): investment profile, law and order, bureaucracy, and corruption. Higher values of the composite index indicate better overall institutional quality.[6]

Democracy

The strength of democratic political systems is often believed to have a distinct impact on policy choice. 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, constraints on the power of democratic governments are said to increase political stability and enhance the credibility of commitments towards investors/creditors (North and Weingast 1989). We follow Claessens et al. (2007) in using as

an explanatory variable the institutionalised democracy index of the Polity IV database (*democ*) (see Marshall et al. 2013). This 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.

From 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. The scatter plots in panels (a)-(k) of Figure A.1 in Appendix suggest a positive relation of government LCBM capitalisation with economic development, trade openness, private sector domestic credit, capital account openness, common law legal origins, institutional quality and the strength of democracy; and a negative relation with country surface area, past fiscal balances, inflation and other government debt. Some of these relations however hinge on the inclusion of South Africa and/or Mauritius, which are outliers in a number of dimensions.

To control for common global conditions (π_t in Equation (1)) we also include in our estimations the Chicago Board Options Exchange (CBOE) Volatility Index or VIX, a general measure of global investor sentiment calculated from stock index option prices (*vix*) (with higher values indicating higher global risk aversion).[7]

Results and discussion

Baseline estimation results

Table 2 presents the estimation results for different specifications of Equation (1), estimated by POLS and FE. POLS estimates, which capture jointly between- and within-country variation and ignore country-specific effects, show that having better past fiscal balances is negatively correlated with LCBM capitalisation, probably because of 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. Countries with a common law tradition have government LCBMs that are significantly larger than countries with civil law legal origins, again conform with the literature. POLS models further suggest the banking sector and government LCBMs are complements (in three out of four 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 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. We do not detect any clear effects of GDP, GDP per capita, capital account openness or the VIX.

The picture that emerges from the FE estimates in Table 2, concentrating on within-country variation, is somewhat different. Worsening fiscal balances and declining inflation are still associated with increases in government LCBM capitalisation and also the positive correlation with institutional quality is preserved. Contrary to POLS, however, the FE estimator seems to point at substitution effects between banks and bonds. Furthermore, none of the other coefficients is significantly different from zero. Breusch-Pagan LM tests and Hausman-type overidentification tests clearly reject the respective null hypotheses of no country-specific effects and of such country effects being uncorrelated with other regressors. The FE estimator thus seems preferable over POLS and RE. However, such diagnostic tests may perform poorly in small samples and when within-country time variation of variables is limited, as in our panel. 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 is therefore imperative to also study and compare the results of other estimators, like simple POLS.

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 Appendix Table A.1. 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. ***$p < 0.01$; **$p < 0.05$; *$p < 0.10$; +$p<0.20$.

General robustness tests and additional government LCBM correlates

There are many ways in which our baseline findings can be tested for robustness. To save space, we limit ourselves here to a short summary discussion and refer to Essers et al. (2015) for the full robustness results. First, 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, such as those of trade openness and banking sector size,

seem not particularly robust. Second, excluding outliers South Africa and/or Mauritius from our sample reduces the significance of the fiscal balance coefficient, but leaves other results intact. Third, our results are also robust to replacing consumer price-based inflation with a GDP deflator-based measure, taking a simple one-year lag of the fiscal balance, or using alternative indices for democracy and institutional quality. Inserting the different ICRG subcomponents separately rather than as part of a composite index shows it is not straightforward to pinpoint the effect of overall institutional quality to one particular dimension. Fourth, following Mu et al. (2013), we have augmented our baseline model, in turn, with bank lending spreads (over the LIBOR), interest rate variability (of monthly treasury bill rates) and exchange rate variability (against the US dollar). The first two variables enter our regressions with negative signs, whereas the exchange rate variability coefficient is only very imprecisely estimated. The inclusion of the bank lending spread renders the inflation coefficient insignificant, because of high collinearity between spreads and inflation in our sample. Otherwise, the results are again very similar. Fifth, we have looked more closely at the role of debt relief in government LCBM development (cf. Arnone and Presbitero 2010). African Yearbook data confirms that non-marketable debt owed to multilateral, bilateral and commercial creditors declined drastically upon reaching HIPC completion point for the five countries that did so during 2003-2012: Madagascar (2004), Zambia (2005), Cameroon (2006), Malawi (2006) and Sierra Leone (2006). Only in Malawi and Zambia, however, government LCBM capitalisation appears to have increased following the completion of HIPC. Adding a set of completion point dummies to our regressions, we find no immediate response of LCBM capitalisation to HIPC debt relief, but a (small) positive coefficient for the two-year lagged dummy. More research is needed to fully disentangle the links between debt relief and government LCBMs.[8] Lastly, we have tested the substitutability between government LCBMs and alternative sources of finance. The negative fiscal balance

effect on LCBM capitalisation seems only marginally affected by the inclusion of variables such as past net aid inflows, foreign currency marketable debt or foreign currency non-marketable loans from commercial creditors.

Dynamic panel estimations

So far we have not allowed for the likely possibility that government LCBM development is a cumulative process. LCBM capitalisation in one period is expected to be an important determinant of capitalisation in the next; most obviously because it is a stock variable (with longer-maturity bonds staying on governments' books for several years), but perhaps also due to the typically gradual nature of market infrastructure adaptations, or the persistence of bond repayment reputations. The most straightforward way to introduce these dynamics is by adding a one-year lag of the dependent variable, $Y_{i,t-1,}$ to Equation (1). POLS and standard FE estimators are known to be biased and inconsistent for this autoregressive model, 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.[9] Difference GMM applies a first-difference transformation to the dynamic model and then instruments the first-differenced lagged dependent variable, and other potentially non-exogenous regressors, with suitable lags of the untransformed (level) explanatory variables. The difference GMM estimator may, however, produce large finite sample bias and very imprecise estimates, in particular when the process under study is highly persistent; when time series are short; and/or when the variance of fixed effects is large relative to that of idiosyncratic errors. In these cases, Blundell and Bond (1998) suggest using the more efficient system GMM estimator, which complements the first-

differenced equation with the original level equation instrumented by lagged differences. The validity of the additional moment conditions of system GMM rests on the assumption that deviations of the dependent variable from its long-run conditional mean are not systematically related to the fixed effects; in other words, countries should not be too far from their steady states at the beginning of the sample period (Roodman 2009).

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]
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]
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]
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. ***$p < 0.01$; **$p < 0.05$; *$p < 0.10$; +$p<0.20$.

Table 3 presents the results of two-step system GMM estimations of the autoregressive LCBM capitalisation model, with small sample statistics and the Windmeijer (2005) correction for standard errors. Importantly, GMM estimations with too many instruments tend to 'overfit' the endogenous variables and weaken the power of Hansen tests for instrument validity (Roodman 2009). To keep the total instrument count below (or at least close to) the number of cross-sectional units we take just one instrument lag; 'collapse' the instrument matrix; 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).[10] 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. Following Mu et al. (2013) and our prior intuitions (spelled out in the discussion of baseline variables) 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 predetermined, 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.[11]

Table 3 clearly demonstrates the high degree of persistence in government LCBMs, with an estimated autoregressive parameter on the lagged dependent variable (*L.lc_mdebt_gdp*) of around 0.7 to 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.

The Arellano-Bond AR(2) tests at the bottom of Table 3 reassure us that there is no second-order autocorrelation in differenced residuals and therefore no first-order correlation in the level residuals. The Hansen test of overidentifying restrictions never rejects the null of joint validity of our instruments. Re-estimating the specifications of Table 3 using the difference GMM estimator, which is less efficient than system GMM but also makes fewer assumptions (see above), or applying system GMM to the alternative specifications we have considered before, produces results that are overall very similar (see Essers et al. 2015). Again, controlling for persistence in LCBM capitalisation, the fiscal balance and inflation stand out as the most robust correlates.

Conclusion

This article 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 government LCBMs could reduce countries' exposure to external shocks; help overcome 'original sin'; facilitate

domestic savings mobilisation; and may have important financial, macroeconomic and institutional spill-over effects. With detailed information collected from various sources, we have first shown that quite a few 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. 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 generally still have relatively narrow investor bases dominated by commercial banks.

The second part of our article has presented an econometric analysis of the drivers of African government LCBMs based on a new high-quality panel dataset of central government debt in 15 African countries, which was sourced directly from these countries' debt management offices and compiled by the OECD. Our estimations 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. These results are robust to the use of different estimators, the exclusion of outliers, alternative measures for key variables and the inclusion of additional potential correlates of government LCBMs. There are some indications that LCBM capitalisation may also be linked to lower bank lending spreads, lower interest rate variability, past debt relief and alternative financing sources, including aid, although such links were seemingly not 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. Some of the differences in results between the current article and Mu et al. (2013), for example the lack of significance of exchange rate variability and trade or capital account 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 and to achieve better identification of any causal relations.

Moreover, the econometric work in this article has narrowly focused on government LCBM *capitalisation*, ignoring other dimensions of LCBM development. Our detailed cross-sectional overview made it clear that African government LCBMs differ in many other aspects too. Panel data analysis of variables such as secondary market turnover, bid-ask spreads, average maturity and bond yields would complement the current article 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.

Notes

[1] All countries in Table 1 are non-CFA (Communauté Financière Africaine); for overviews of the regionally organised 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).

[2] Similar observations are made by Didier and Schmukler (2014) in their study of the LCBMs of emerging economies in Asia, Latin America and Eastern Europe.

[3] The reasons for using lagged variables here are twofold. First, our dependent variable extends to the year 2012, whereas some explanatory variables were only available up to 2011 at the time of writing. Second, the use of lagged regressors also diminishes endogeneity concerns.

[4] '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).

[5] In April 2014 Nigeria revised its GDP base year, resulting in a 89% increase in its 2013 GDP estimate. Here 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.

[6] Note that Mauritius is not rated on these ICRG dimensions by the PRS Group.

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

[8] Ideally, one would account for the concessionality of the debt involved in debt relief operations and for whether the relief consists of outright forgiveness or concessional rescheduling by using Net Present Value (NPV) measures of debt relief. Such NPV estimates have been constructed by Depetris Chauvin and Kraay (2005) but, to our knowledge, have not been updated beyond 2003.

[9] Mu et al. (2013) also report system GMM estimations. They use GMM estimators primarily to attempt to control for the potential endogeneity of some of their regressors and do not seem to account explicitly for persistence in LCBM capitalisation with an autoregressive factor.

[10] Models with a higher instrument count lead to very inefficient estimates and unreliable diagnostic tests.

[11] 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, 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.

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Appendices

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

Variable	Label	Definition	Source	Period	Obs.	Mean	Min	Max	Std. Dev.		
									overall	between	within
Dependent											
Local currency bond market (LCBM) capitalisation	*lc_mdebt_gdp*	Year-end outstanding local currency marketable central government debt (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
Area size	*ln_area*	Natural logarithm of 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', 'bureaucratic 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*	Yearly 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

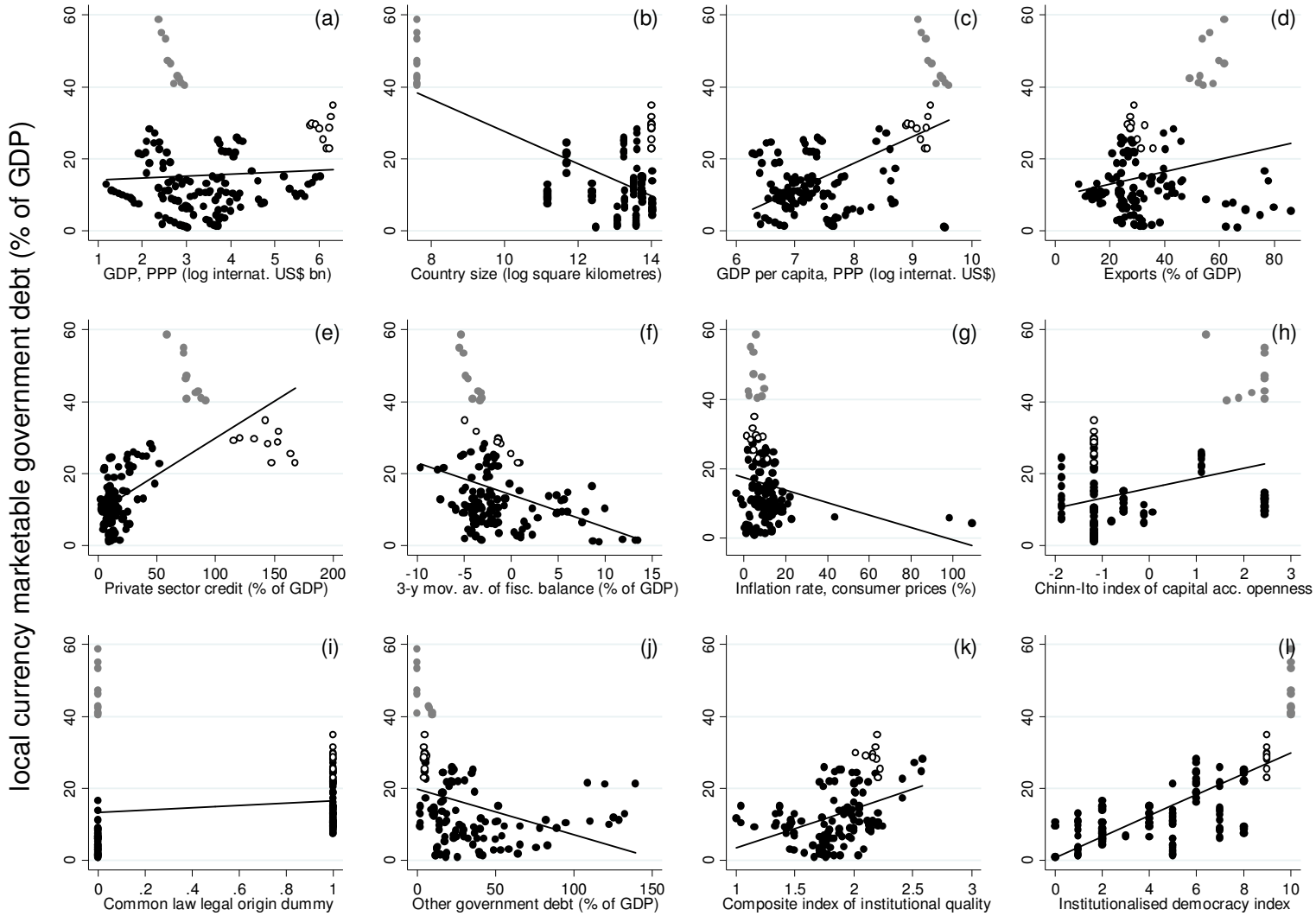

Figure A.1. Bivariate scatter plots: government LCBM capitalisation vs. baseline explanatory variables

Notes: Sample countries, years and variables as defined in the text and Appendix Table A.1. 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.