Remittances, ICT and doing business in Sub-Saharan Africa

Reference:
Asongu Simplice, Biekpe Nicholas, Tchamyou Vanessa Simen.- Remittances, ICT and doing business in Sub-Saharan Africa
The journal of economic studies - ISSN 0144-3585 - 46:1(2019), p. 35-54
Full text (Publisher's DOI): https://doi.org/10.1108/JES-06-2017-0146

Remittances, ICT and Doing Business in Sub-Saharan Africa

Simplice Asongu and Nicholas Biekpe and Vanessa Tchamyou

January 2018

A G D I Working Paper

WP/18/010

Remittances, ICT and Doing Business in Sub-Saharan Africa

Forthcoming: Journal of Economic Studies

Simplice A. Asongu
Development Finance Centre
Graduate School of Business,
University of Cape Town, Cape Town, South Africa.
E-mails: asongusimplice@yahoo.com
asongus@afridev.org

Nicholas Biekpe
Development Finance Centre
Graduate School of Business,
University of Cape Town, Cape Town, South Africa.
E-mail: nicholas.biekpe@gsb.uct.ac.za

Vanessa S. Tchamyou
Faculty of Applied Economics,
University of Antwerp, Stadscampus Prinsstraat 13, 2000,
Antwerp, Belgium
E-mails: simenvanessa@yahoo.com
simenvanessa@afridev.org

Research Department

Remittances, ICT and Doing Business in Sub-Saharan Africa

Simplice A. Asongu, Nicholas Biekpe & Vanessa S.Tchamyou

January 2018

Abstract

Purpose – This study examines how linkages between information and communication technology (ICT) and remittances affect the doing of business.

Design/methodology/approach – The focus is on a panel of 49 sub-Saharan African countries for the period 2000-2012. The empirical evidence is based on Generalised Method of Moments.

Findings – While we establish some appealing results in terms of net negative effects on constraints to the doing of business (i.e. time to start a business and time to pay taxes), some positive net effects are also apparent (i.e. number of start-up procedures, time to build a warehouse and time to register a property). We also establish ICT penetration thresholds at which the unconditional effect of remittances can be changed from positive to negative, notably: (i) for the number of start-up procedures, an internet level of 9.00 penetration per 100 people is required while (ii) for the time to build a warehouse, a mobile phone penetration level of 32.33 penetration per 100 people is essential. Practical and theoretical implications are discussed.

Originality/value – To the best of our knowledge, this is the first study to assess linkages between ICT, remittances and doing business in Sub-Saharan Africa.

JEL Classification: F24; F63; L96 O30; O55
Keywords: Remittances; ICT; Doing business; Development; Africa

1. Introduction

Four main trends in contemporary literature motivate an inquiry into linkages between information and communication technologies (ICT) and remittances in the doing of business in Sub-Saharan Africa (SSA), namely: (i) growing trends of remittances in SSA; (ii) the high potential for ICT penetration in the sub-region; (iii) the importance of doing business and private enterprises in addressing issues of unemployment associated with SSA's growing population and (iv) gaps in the literature on doing business.

First, since the year 2000, remittance inflows into Africa have been increasing. Recent literature is consistent with the position that remittances are as important as other external flows (i.e. foreign direct investment and foreign aid) in reinvigorating development in Africa, notably by boosting: output per worker (Ssozi & Asongu, 2016a); total factor productivity (Ssozi & Asongu, 2016b) and industrialization (Efobi et al., 2016). Other documented economic rewards include: cyclical features and less volatility in capital which increase reliability in external flows. In a nutshell, the importance of remittances in the development of the continent has been the preoccupation of many practitioners. For example, the Joint African Union-Economic Commission for Africa (ECA) in 2013 has recently emphasised the imperative for countries in the continent to leverage on development potentials that are associated with growing remittance inflow (Efobi et al., 2016).

Second, the potential for ICT penetration in SSA is substantially higher compared to other more developed regions of the world (i.e. North America, Asia and Europe) that are experiencing saturation levels in such penetration (see Penard et al., 2012; Asongu, 2015). Such potential for ICT penetration can therefore be leveraged by policy in order to tackle germane socio-economic concerns such as unemployment and need for Small and Medium sized Enterprises (SMEs).

Third, doing business by means of private enterprising will be critical to address concerns related to population growth and unemployment in Africa. The United Nation's population prospects project that the population in Africa is going to double by 2036 and account for about a fifth of the world's population by the year 2050 (UN, 2009). In essence, one of the main challenges to contemporary and future development is high unemployment. The African Economic Research Consortium (AERC, 2014) has maintained that youth unemployment is one of the most critical post-2015 policy syndromes in Africa that merits urgent policy attention. Moreover, there is an important body of literature which has documented that in the long-run, issues related to population growth like youth unemployed will be more associated with the private sector compared to the public sector of the economies in Africa (see Asongu, 2013a; Brixiova et al., 2015). According to Grater et al. (2016), ICT has created booming small enterprises which are key drivers of job creation. Whereas from intuition, remittances and ICT can be synergised to improve conditions for doing business and private enterprise development, the empirical evidence on such linkages is sparse in the African business literature.

Fourth, as far as we have reviewed, contemporary African business literature has focused on *inter alia*: legal challenges to doing business (Taplin & Synman, 2004); the cost

of doing business (Eifert et al., 2008); determinants of doing business in East Africa (Khavul et al., 2009); the influence of labour regulation externalities on the cost of doing business (Paul et al., 2010); intensity by which trade influences business cycle synchronization (Tapsoba, 2010); the importance of information technology in social outcomes (Amankwah-Amoah & Sarpong, 2016; Amankwah-Amoah, 2015, 2016); the long-term effect of entrepreneurial training in the mitigation of poverty (Mensah & Benedict, 2010); the relationship between youth entrepreneurship and financial literacy (Oseifuah, 2010); linkages between social networks and gender in entrepreneurship (Kuada, 2009); motivations behind female entrepreneurs (Singh et al., 2011); entrepreneurial intensions by undergraduate students (Gerba, 2012; Ita et al., 2014); insights into project failures in entrepreneurship (Ika & Saint-Macary, 2014; Hashim, 2014; Ofori, 2014; Joseph et al., 2014); the relevance of cross-border inter-firm knowledge generation on doing business in Africa (Kuada, 2015); a classification of the research agenda on entrepreneurship in Africa (Kuada, 2015) and the role of knowledge economy in doing business (Tchamyou, 2016).

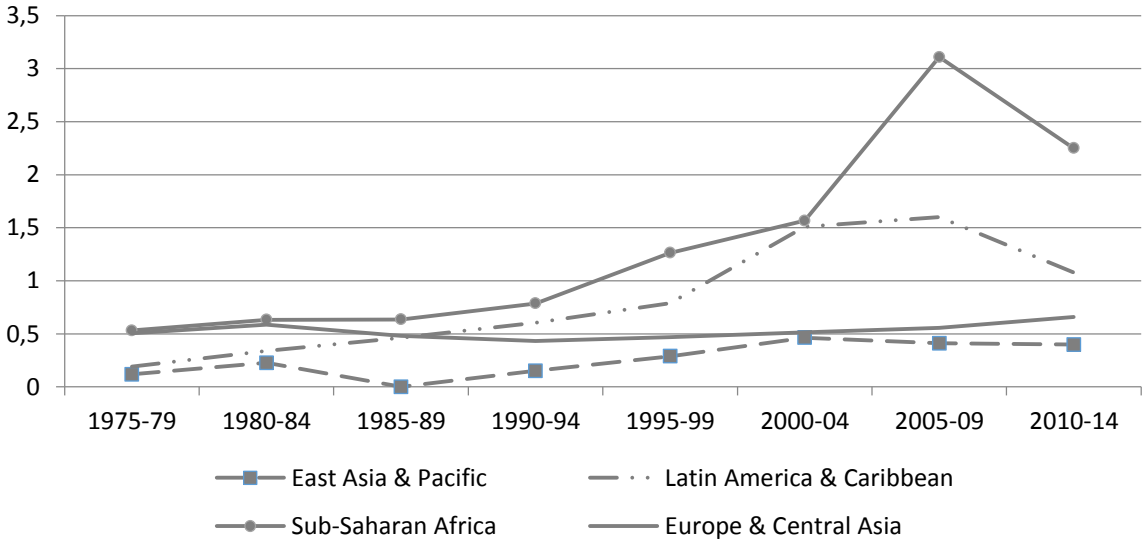
This study aims to unite the above main strands by assessing how linkages between remittances and ICT influence the doing of business in SSA. Accordingly, this study investigates how the high potential of ICT in the sub-region (discussed in the second strand) can be leveraged to enhance the effect of remittances, which are constantly rising (engaged in the first strand) in order to address issues of entrepreneurship (identified in the third strand). The positioning of the inquiry steers clear of the extant literature highlighted in the fourth strand. In the light of these insights, the research question addressed by the study is the following: how does ICT modulate the effect of remittances on doing business in SSA? The rest of the study is structured as follows. Section 2 presents stylized facts, theoretical underpinnings, intuition and related literature while Section 3 discusses the data and methodology. The empirical results and presented in Section 4 while Section 5 concludes with policy implications.

2. Stylize facts, theoretical underpinnings, intuition and related literature

Stylized facts in this section are engaged in two main strands, notably: the evolving trend of remittances inflow on the one hand and the growing depth of ICT on the other hand. First, as shown in Figure 1 from World Development Indicators (2016), compared to other regions of the world (East Asia & the Pacific, Europe & Central Asia and Latin America & the Caribbean) remittances inflow into SSA has been consistently higher. The graph clearly shows that since the beginning of the third millennium, corresponding remittances into SSA

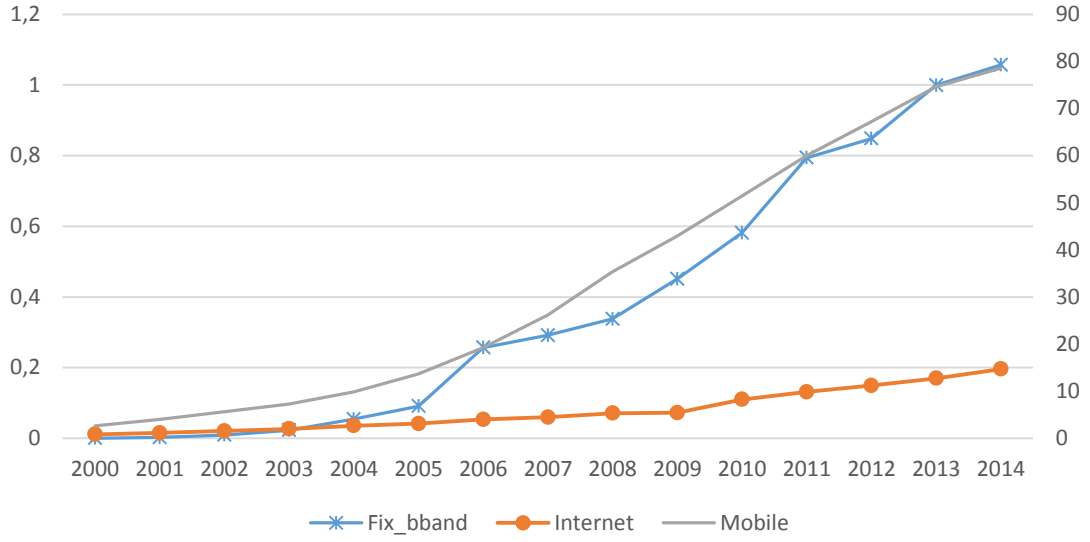
have stood above 1.5 as a percentage of GDP (Efobi et al., 2016). Second, as apparent in Figure 2, one of the principal characteristics over the past decade in SSA has been the substantial rise in the penetration of ICT, notably in: mobile phone penetration, internet penetration and fixed broadband subscriptions. Externalities from such rise in ICT vary from socio-cultural to economic changes in society that have the potential of reducing economic vulnerability and unemployment on the one hand and increasing business opportunities on the other hand.

Figure 1: Remittance Inflow as a Percentage of GDP (1975-2014)



Source: Authors' mapping with data from World Development Indicators (2016).

Figure 2: Some Technology Usage Indicators for SSA (2000-2014)



Note: The axis at the right of Figure 2 is for the fixed broadband usage, while that of the left is for both internet and mobile phone usage per 100 persons. (Source: Authors' mapping from World Development Indicators (2016))

The intuition motivating the inquiry is typically consistent with the cross-country income convergence literature that has been examined and extensively documented within the framework of neoclassical growth models (Swan, 1956; Solow, 1956; Baumol, 1986; Barro, 1991; Barro & Sala-i-Martin, 1992, 1995; Mankiw et al., 1992). Such intuition has recently been extended to other fields of economic development with the Generalised Method of Moments technique (see Fung, 2009; Bruno et al., 2012; Asongu, 2013b; Andrés & Asongu, 2013, 2016). Within the context of the study, the theoretical underpinnings of the income catch-up literature are extended to the literature on doing business.

It is relevant to substantiate the above theoretical underpinnings with three fundamental theories on 'innovation and entrepreneurship'. According to Parker (2012), three broad categories have been documented, notably: models of creative destruction; models of innovation and implementation cycles and models of production within the framework of information asymmetry.

The first strand emphasises Schumpeter's theory of business cycles and creative destruction (Schumpeter, 1927, 1939). With regard to the theory, history is marked by episodes in which talented entrepreneurs introduce innovation of revolutionary quality which substantially enhances existing technologies. Economic booms are characteristic of these periods and because of the diffusion of innovation, imitators are motivated to enter the market and consequently reduce the profits that were previously enjoyed by pioneers of the innovation. Old technologies are subsequently replaced by ones in the ensuing process. This is partly because new technologies depend on old technologies for their introduction. Some examples of 'creative destruction' include, among others: the replacement of the telegraph by the telephones; of postal mails by electronic mails and of steam locomotive by diesel and electric trains. There has been an evolving stream of the literature with substantial analysis on disruptive Schumpeterian innovations and creative destruction (Aghion & Howitt, 1998; Parker, 2012).

With respect to the strand articulating "innovation and implementation cycles", two main shortcomings are apparent in Schumpeter's theory. First, cycles fundamentally rest on assumption. Moreover, they are supply-driven, exclusively exogenous and with no emphasis is made on demand and demand expectations. In essence, Schumpeter's theory is connected to long-wave cycles as opposed to short-wave cycles that have more economic, practical and policy relevance. Models have been documented to tackle the highlighted issues (see Shleifer, 1986). It is important to note that an innovation is not the same as an invention because once

an invention is made; firms could postpone the commercialization of the said invention to a later date. The process of commercialization is known as innovation.

Concerning the third strand on 'models of production within the framework of information asymmetry', a plethora of models suggest that from an aggregate perspective, entrepreneurs are deterred by information asymmetry from engaging in projects that either exaggerate existing business cycles or create new ones. Three principal mechanisms of information asymmetry affect the entrepreneurial behaviour, namely: (i) adverse selection, when lenders cannot distinguish between genuine entrepreneurs and those entrepreneurs that have some hidden agenda; (ii) moral hazard, when entrepreneurs decide to hide the benefits accruing from mandated projects with the principal objective of avoiding compliance with financial obligations they have towards lenders and (iii) high cost incurred by lenders in verifying what profits entrepreneurs are generating from funded projects. This third theoretical underpinning is closest to the present inquiry because ICT may go beyond facilitating the transaction of remittances. Accordingly ICT can also facilitate the sharing of information to reduce information asymmetry associated with entrepreneurship (i.e. starting and doing of business). The role of ICT in reducing information asymmetry has been established in recent literature (Asongu et al., 2017a).

We now complement the entrepreneurship literature engaged in the introduction with studies on remittances. Whereas remittances have fundamentally been acknowledged as some kind of altruism that is designed to have some social insurance externalities (Agarwal & Horowitz, 2002; Kapur, 2004), advantages of remittances are not exclusively limited to rewards in households. According to Efobi et al. (2016), a substantial bulk of the literature in the field is consistent with the position that remittances are used beyond immediate consumption requirements. Furthermore, in societies where formal banking services and capital markets are not available, remittances could be an adequate source of capital for entrepreneurial ventures and business start-ups. This stance is in accordance with Woodruff and Zentano (2001) in the view that close to 30% of businesses in Mexico depend on remittances from the Diaspora for liquidity needs. According to the same authors, the corresponding remittances constitute about 20% of capital that is invested in the country for the development of enterprises.

It follows from the above that one can logically expect remittances to decrease constraints to doing business in developing countries. Such logic is in accordance with a substantial body of the literature, notably that, remittances are essential for: the growth and expansion of Mexican enterprises (Woodruff & Zenteno, 2001; Massey & Parrado, 1998);

investment in entrepreneurship by Filipinos (Yang, 2008); positive long run investment in Bangladesh (Hossain & Hasanuzzaman, 2015); increasing agricultural investments that are market-oriented (Syed & Miyazako, 2013); enhancing farm and non-farm production in Ghana (Tsegai, 2004); boosting manufacturing growth (Dzansi, 2013); increasing per worker output (Ssozi & Asongu, 2016a) and augmenting total factor productivity (Barajas et al., 2009; Ssozi & Asongu, 2016b).

While the above literature has articulated direct relationships between remittances and macroeconomic outcomes, it is relevant to emphasise that indirect effects have also been established in the literature. These include the following channels: exchange rate (see Rajan & Subramanian, 2005; Lartey et al., 2008; Acosta et al., 2009; Barajas et al., 2009; Selaya & Thiele, 2010; Dzansi, 2013; Amuedo-Dorantes, 2014) and financial sector development (Aggarwal et al., 2011; Bettin et al, 2012; Osabuohien & Efobi, 2013; Efobi et al, 2014; Kaberuka & Namubiru, 2014; Karikari et al., 2016; Efobi et al., 2016).

This highlighted perspective on indirect effects is essential for our inquiry because we are going to use ICT as a moderating or policy variable in the empirical assessment. Hence, while the discussed literature is consistent on the significant direct and indirect roles of remittances in influencing entrepreneurship, to the best of our knowledge the role of ICT in influencing remittances in order to improve conditions for doing business has not been engaged in the literature. In the empirical section that follows, we contribute to the extant literature by bridging the identified gap. It is logical to hypothesise that ICT can influence the flow of remittances for doing business purposes because 'mobile money transfer' substantially relies on ICT facilities. *Inter alia*, ICT facilities like the mobile phone and internet are employed by users to communicate details of money transfer associated with remittances. Moreover, ICT can also decrease informational rents associated with the creation of businesses that were previously enjoyed by a few.

3. Data and methodology

3.1 Data

The inquiry investigates a panel of 49 countries in SSA with data from World Development Indicators (WDI) of the World Bank for the period 2000-2012. The focus on sub-Saharan Africa is consistent with the motivation of the study discussed in the introduction. Country-specific characteristics are not relevant for the purpose of the study because they are inconsistent with the adopted estimation approach. These country-specific characteristics are eliminated in the estimation process to avoid a concern of endogeneity,

notably: their potential correlation with the lagged outcome variables. In accordance with recent doing business literature (Asongu & Tchamyou, 2016), nine dependent variables on entrepreneurship are used, namely: (i) cost of business start-up procedure; (ii) procedure to enforce a contract; (iii) start-up procedures to register a business; (iv) time required to build a warehouse; (v) time required to enforce a contract; (vi) time required to register a property; (vii) time required to start a business; (viii) time to export and (ix) time to prepare and pay taxes. In the assessment, a decrease in these variables implies positive conditions for entrepreneurship.

While remittances is proxied with personal remittances received (as percentage of GDP), two main ICT variables are employed, namely: internet penetration per 100 persons and mobile phone penetration per 100 persons. The internet penetration and mobile phone penetration capture the proportion of individuals that use the respective means of communication on a yearly basis. Contrary to other indicators of technological progress like 'access to personal computers', the selected ICT indicators comprehensively cover a wider and complete data span.

Consistent with Tchamyou (2016), four institutional and macroeconomic variables are used to control for variable omission bias, notably: political stability, development assistance, foreign direct investment and population. With the exception of foreign aid whose sign cannot be established ex-ante; positive signs are anticipated for other control indicators on doing business. Note should be taken of the fact that the impact on doing business could be contingent on market dynamism and expansion. For example, the effect of external financial flows on a specific dimension of doing business depends on the manner in which resources are oriented to affect specific business dimensions.

We cannot account for more than four control variables in the conditioning information set because a preliminary assessment suggests that this will lead to the proliferation of instruments and bias estimations. We invite the interested reader to confirm this concern in the results presented in Section 4. Accordingly adding another control variable will lead to over-identification (or instrument proliferation) and bias post-estimation output. This is essentially because, in the corresponding estimations, for the most part, after estimations, the difference between the number of instruments and countries is one degree of freedom.

Appendix 1, Appendix 2, Appendix 3 and Appendix 4 respectively present the definition of variables, summary statistics, correlation matrix and the persistence of doing business variables. The summary statistics shows that the variables are quite comparable and

from the corresponding standard deviations, the variations indicate that we should be confident that reasonable estimated linkages would emerge. Mean values of the policy variables (ICT) from the summary statistics are also used to compute the net effect of the role of ICT in modulating the effect of remittances on doing business. Moreover, the ranges (minimum to maximum) provided by the summary statistics also enable the study to assess whether computed thresholds make economic sense. In essence, such thresholds should have economic relevance exclusively when they are within the minimum and maximum limits imposed by the summary statistics. The correlation matrix is used to avoid concerns of mutilicollinearity which affect the signs of estimated coefficients after estimation. It should be noted that in interactive regressions, such concerns about multicollinearity do not apply in the variables being interacted (see Brambor et al., 2006). The purpose of Appendix 4 is discussed in the methodology section.

3.2 Methodology

3.2.1 Specification

Consistent with recent ICT literature, the Generalised Method of Moments (GMM) is adopted for five main reasons (Boateng et al., 2016; Asongu & Nwachukwu, 2016a). First, the number of cross sections is higher than the number of years in each cross section. Second, Asongu and Nwachukwu (2016b) have recently established that the nine doing business indicators adopted in the study are persistent because the correlation between all nine doing business variables and their corresponding first lags is higher than the rule of thumb threshold of 0.800 which is employed to ascertain persistence in a dependent variable (see Appendix 4). Third, the GMM approach accounts for cross-country variations in the estimation process because the estimation is by definition consistent with a panel data structure. Fourth, inherent biases that are associated with the *difference* estimator are considered when a *system* estimator is adopted. Fifth, the estimation has some bite on endogeneity because it accounts for simultaneity on the one hand and controls for the unobserved heterogeneity on the other hand.

Borrowing from Bond et al. (2001), the *system* GMM estimator from Arellano and Bond (1995) and Blundell and Bond (1998) has more efficient properties when compared with the *difference* estimator from Arellano and Bond (1991). Within the framework of this inquiry, an extension of Arellano and Bover (1995) by Roodman (2009a, 2009b) is adopted because it has been established to reduce instrument proliferation that is susceptible of biasing corresponding estimations (see Boateng et al., 2016; Baltagi, 2008; Love & Zicchino, 2006). Therefore, the improved estimation technique employs forward orthogonal differences instead

of first differences. Moreover, in the specification, compared to the *one-step* procedure that accounts for homoscedasticity, a *two-step* approach is adopted because it controls for heteroscedasticity.

The following equations in level (1) and first difference (2) summarise the standard *system* GMM estimation procedure (see Narayan et al, 2011; Williams, 2016; Sakyi et al., 2017).

$$B_{i,t} = \sigma_0 + \sigma_1 B_{i,t-\tau} + \sigma_2 I_{i,t} + \sigma_3 R_{i,t} + \sigma_4 IR_{i,t} + \sum_{h=1}^{4} \delta_h W_{h,i,t-\tau} + \eta_i + \xi_t + \varepsilon_{i,t} \quad (1)$$

$$\begin{aligned} B_{i,t} - B_{i,t-\tau} = {} & \sigma_1 (B_{i,t-\tau} - B_{i,t-2\tau}) + \sigma_2 (I_{i,t} - I_{i,t-\tau}) + \sigma_3 (R_{i,t} - R_{i,t-\tau}) + \sigma_4 (IR_{i,t} - IR_{i,t-\tau}) \\ & + \sum_{h=1}^{4} \delta_h (W_{h,i,t-\tau} - W_{h,i,t-2\tau}) + (\xi_t - \xi_{t-\tau}) + \varepsilon_{i,t-\tau} \end{aligned} \quad (2)$$

where, $B_{i,t}$ is a doing business indicator in country i at period t, σ_0 is a constant, I is ICT (mobile phone and internet penetration), R represents remittances, IR is the interaction between an ICT variable and remittances, W is the vector of control variables (population growth, foreign direct investment, private domestic credit and foreign aid), τ represents the coefficient of auto-regression, ξ_t is the time-specific constant, η_i is the country-specific effect and $\varepsilon_{i,t}$ the error term. It is also important to note that the choice of the GMM approach is consistent with recent literature on the use of ICT to complement macroeconomic variables for development outcomes (Asongu et al., 2017b, 2017c).

3.2.2 Identification, simultaneity and exclusion restrictions

A sound GMM specification requires emphasis on three main specification characteristics, namely: identification, simultaneity and exclusion restrictions. First, concerning the identification procedure, all independent variables are considered to be suspected endogenous or predetermined while only the time invariant indicators are acknowledged to exhibit strict exogeneity. This identification procedure has been adopted in recent empirical literature (Boateng et al., 2016; Asongu & Nwachukwu, 2016b) because according to Roodman (2009a, 2009b), it unlikely for time-invariant omitted variables to become endogenous after first difference[1].

Second, the concern about simultaneity is addressed with lagged regressors that are used as instruments for forward-differenced variables. In essence, fixed impacts that are likely to influence the examined relationships are removed by employing Helmet transformations on

[1] Hence, the procedure for treating *ivstyle* (years) is 'iv (years, eq(diff))' whereas the *gmmstyle* is employed for predetermined variables.

the regressors (see Arellano & Bover, 1995; Love & Zicchino, 2006). Such transformations encompass forward mean-differencing of the indicators: the mean of all future observations is subtracted from the variables, contrary to the subtracting past observations from present observations. These transformations entail parallel and orthogonal conditions between lagged values and forward-differenced indicators. Irrespective of the number of lags, in order to minimise the loss of data, the underlying transformations are done for all observations, with the exception of the last observation for each cross section. Furthermore, "*because lagged observations do not enter the formula, they are valid as instruments*" (see Roodman, 2009b, p. 104; Asongu & De Moor, 2017).

Third, in the light of the above emphasis, the strictly exogenous or time invariant indicators affect the dependent exclusively via suspected endogenous or predetermined indicators. Moreover, the statistical validity of the exclusion restriction is examined with the Difference in Hansen Test (DHT) for instrument exogeneity. It follows that, the null hypothesis of the DHT should not be rejected for the time-invariant indicators to elucidate the doing business variables exclusively via of endogenous explaining indicators. Therefore, in the results that are reported in the subsequent section, the assumption of exclusion restriction is confirmed if the alternative hypothesis of the DHT associated with instrumental variables (IV) (year, eq(diff)) is not accepted. This interpretation is consistent with the standard IV procedure in which, a rejection of the null hypothesis of the Sargan Overidentifying Restrictions (OIR) test is an indication that the instruments influence indicators of doing business variables beyond the suggested channels or predetermined variable (see Asongu & Nwachukwu, 2016c).

4. Presentation of results

The empirical results are presented in Tables 1-3. Table 1 shows results related to the 'cost of starting business', 'contract enforcement procedure' and 'number of start-up procedures' while Table 2 is concerned with the 'time to build a warehouse', 'time to enforce a contract' and 'time to register a property'. Table 3 focuses on the 'time to start a business', 'time to export' and 'time to pay taxes'. For all tables: (i) four information criteria are employed to assess the validity of the GMM model with forward orthogonal deviations[2] and (ii) a net effect is computed to assess the impact of ICT in remittances for doing business.

[2] "*First, the null hypothesis of the second-order Arellano and Bond autocorrelation test (AR (2)) in difference for the absence of autocorrelation in the residuals should not be rejected. Second the Sargan and Hansen over-identification restrictions (OIR) tests should not be significant because their null hypotheses are the positions that instruments are valid or not correlated with the error terms. In essence, while the Sargan OIR test is not robust but not weakened by instruments, the Hansen OIR is robust but weakened by instruments. In order to restrict identification or limit the proliferation of instruments, we have ensured that instruments are lower than the number of cross-sections*

For example in the last column of Table 1, the net effect from the interaction between the internet and remittance is 0.014 ([-0.003× 4.152] + [0.027]), where: the mean value of internet penetration is 4.152, the unconditional effect of remittances is 0.027 while the conditional effect from the interaction between remittances and internet penetration is -0.003. The computation of this net effect which is consistent with recent literature (Asongu et al., 2017a), is important because it is in line with the problem statement, notably: it shows the net effect of ICT in modulating the effect of remittances on a doing business variable.

Consistent with recent doing business literature (Asongu et al., 2017a), the signs of the control variables are contingent on specific business dynamics. For instance, foreign aid and foreign direct investment may either reduce or increase constraints in doing business contingent on specific economic sectors to which such external flows are allocated for the most part. In the same vein, population can either mitigate or enhance business avenues contingent on specificities of doing business. For instance, we have established that population growth increases the time to build a warehouse and decreases the time to enforce a contract. The former effect can be apparent when conditions (building material and contractors) for constructing warehouses are lacking (contingent on an increase entrepreneurial population vis-à-vis overall population growth) while the latter effect may depend on businesses adopting recent technologies to facilitate contract enforcement. The contingency of openness (e.g. foreign direct investment) is also consistent with recent literature (see Asongu & Nwachukwu, 2018). In a nutshell, what is relevant to note in the control variables is their significances and not their directions (positive versus negative) of significance. This is essentially because nine different outcome variables have been employed. The doing business indicators which are heterogeneous by definition can be classified as doing business constraints.

in most specifications. Third, the Difference in Hansen Test (DHT) for exogeneity of instruments is also employed to assess the validity of results from the Hansen OIR test. Fourth, a Fischer test for the joint validity of estimated coefficients is also provided" (Asongu & De Moor, 2017, p. 200).

Table 1: ICT, Remittances and doing business (1)

	Dependent variables: cost of starting business, contract enforcement procedure and number of start-up procedures					
	Cost of starting business		Contract enforcement procedure		Start-up procedure	
	Mobile	Internet	Mobile	Internet	Mobile	Internet
Constant	3.316	**-90.262*** **	0.257	0.248	-0.087	**-0.907** **
	(0.701)	**(0.000)**	(0.344)	(0.466)	(0.851)	**(0.036)**
Cost of starting business (-1)	**0.791*** **	**0.860*** **	---	---	---	---
	(0.000)	**(0.000)**				
Contract enforcement (-1)	---	---	**0.990*** **	**0.990*** **	---	---
			(0.000)	**(0.000)**		
Start-up procedure (-1)	---	---	---	---	**1.034*** **	**1.024*** **
					(0.000)	**(0.000)**
Remittances (Remit)	-0.170	**0.958*** **	**0.010*** **	**0.010*** **	-0.001	**0.027***
	(0.274)	**(0.003)**	**(0.000)**	**(0.000)**	(0.891)	**(0.059)**
Mobile phones (Mobile)	-0.102	---	0.0002	---	-0.002	---
	(0.219)		(0.742)		(0.296)	
Internet	---	**0.532** **	---	**0.005*** **	---	0.014
		(0.041)		**(0.007)**		(0.210)
Remit. × Mobile	**0.011***	---	**-0.0002*** **	---	-0.00008	---
	(0.067)		**(0.000)**		(0.801)	
Remit ×Internet	---	0.019	---	**-0.0009*** **	---	**-0.003***
		(0.709)		**(0.006)**		**(0.063)**
Population Growth	**9.329*** **	**43.461*** **	0.027	0.005	-0.012	0.156
	(0.005)	**(0.000)**	(0.275)	(0.784)	(0.796)	(0.118)
Foreign Direct Investment	-0.005	0.035	0.0009	0.001	-0.003	-0.001
	(0.953)	(0.790)	(0.392)	(0.338)	(0.244)	(0.539)
Foreign Aid	**-0.888*** **	**-1.405*** **	-0.0001	**-0.0006***	**-0.012*** **	**-0.015*** **
	(0.000)	**(0.000)**	(0.759)	**(0.053)**	**(0.000)**	**(0.000)**
Political Stability	-4.176	10.072	0.028	-0.0003	**0.345** **	0.043
	(0.398)	(0.109)	(0.479)	(0.996)	**(0.019)**	(0.779)
Thresholds						
Net Effects	na	na	0.005	0.006	na	0.014
AR(1)	**(0.143)**	**(0.188)**	(0.039)	(0.059)	(0.006)	(0.004)
AR(2)	**(0.916)**	**(0.293)**	(0.080)	(0.077)	**(0.590)**	**(0.644)**
Sargan OIR	**(0.378)**	**(0.433)**	**(0.375)**	**(0.403)**	(0.003)	(0.000)
Hansen OIR	**(0.220)**	**(0.478)**	**(0.543)**	**(0.656)**	**(0.727)**	**(0.605)**
DHT for instruments						
(a)Instruments in levels						
H excluding group	**(0.252)**	**(0.579)**	**(0.395)**	**(0.086)**	**(0.502)**	**(0.520)**
Dif(null, H=exogenous)	**(0.276)**	**(0.380)**	**(0.579)**	**(0.973)**	**(0.730)**	**(0.565)**
(b) IV (years, eq(diff))						
H excluding group	**(0.145)**	**(0.653)**	**(0.463)**	**(0.702)**	**(0.593)**	**(0.519)**
Dif(null, H=exogenous)	**(0.538)**	**(0.228)**	**(0.563)**	**(0.416)**	**(0.719)**	**(0.591)**
Fisher	**15536.1*** **	**14015.7*** **	**196292*** **	**446476.6*** **	**6314.37*** **	**5218.84*** **
Instruments	38	38	38	38	38	38
Countries	38	38	38	38	38	38
Observations	268	266	268	266	268	266

*,**,***: significance levels of 10%, 5% and 1% respectively. DHT: Difference in Hansen Test for Exogeneity of Instruments' Subsets. Dif: Difference. OIR: Over-identifying Restrictions Test. The significance of bold values is twofold. 1) The significance of estimated coefficients and the Fisher statistics. 2) The failure to reject the null hypotheses of: a) no autocorrelation in the AR(1) and AR(2) tests and; b) the validity of the instruments in the Sargan and Hansen OIR tests. na: not applicable because at least one estimated coefficient required for the computation of net effects is not significant.

Table 2: ICT, Remittances and doing business (2)

	Dependent variables: time to build a warehouse, time to enforce a contract and time to register a property					
	Ware house time		Time to enforce a contract		Time to register a property	
	Mobile	Internet	Mobile	Internet	Mobile	Internet
Constant	**16.954****	-0.709	**45.609*****	**-43.264*****	**10.692****	12.607
	(0.025)	(0.788)	**(0.000)**	**(0.001)**	**(0.031)**	(0.104)
Ware house time (-1)	**0.874*****	**0.964*****	---	---	---	---
	(0.000)	**(0.000)**				
Time to enforce a contract (-1)	---	---	**1.017*****	**1.078*****	---	---
			(0.000)	**(0.000)**		
Time to register a property (-1)	---	---	---	---	**0.811*****	**-0.786*****
					(0.000)	**(0.000)**
Remittances (Remit)	**0.485****	**-0.543*****	-0.500	-0.293	**0.149****	0.166
	(0.036)	**(0.001)**	(0.140)	(0.189)	**(0.049)**	(0.295)
Mobile phones (Mobile)	**0.150****	---	**-0.342*****	---	-0.024	---
	(0.017)		**(0.001)**		(0.534)	
Internet	---	-0.003	---	0.138	---	**-0.464*****
		(0.976)		(0.727)		**(0.000)**
Remit. × Mobile	**-0.015*****	---	-0.001	---	**0.009*****	---
	(0.001)		(0.871)		**(0.003)**	
Remit ×Internet	---	-0.012	---	0.042	---	**0.058****
		(0.367)		(0.521)		**(0.026)**
Population Growth	2.176	**2.817****	**-13.543*****	-2.145	0.168	1.624
	(0.267)	**(0.025)**	**(0.000)**	(0.275)	(0.884)	(0.557)
Foreign Direct Investment	0.065	**0.166*****	0.097	-0.194	**-0.257*****	**-0.224*****
	(0.194)	**(0.005)**	(0.239)	(0.445)	**(0.002)**	**(0.003)**
Foreign Aid	**-0.277*****	**-0.304*****	**0.221****	-0.063	0.094	0.077
	(0.000)	**(0.000)**	**(0.016)**	(0.555)	(0.261)	(0.298)
Political Stability	-1.324	**-6.131*****	6.270	8.866	-1.855	1.208
	(0.311)	**(0.000)**	(0.196)	(0.123)	(0.423)	(0.603)
Thresholds						
Net Effects	0.134	na	na	na	0.359	na
AR(1)	(0.094)	(0.082)	(0.024)	(0.036)	(0.067)	(0.041)
AR(2)	**(0.153)**	**(0.217)**	**(0.979)**	**(0.951)**	**(0.369)**	**(0.100)**
Sargan OIR	(0.008)	(0.067)	**(0.726)**	**(0.807)**	**(0.990)**	**(0.949)**
Hansen OIR	**(0.716)**	**(0.928)**	**(0.580)**	**(0.962)**	**(0.809)**	**(0.897)**
DHT for instruments						
(a)Instruments in levels						
H excluding group	**(0.693)**	**(0.817)**	**(0.227)**	**(0.587)**	**(0.492)**	**(0.459)**
Dif(null, H=exogenous)	**(0.594)**	**(0.849)**	**(0.775)**	**(0.977)**	**(0.836)**	**(0.945)**
(b) IV (years, eq(diff))						
H excluding group	**(0.578)**	**(0.861)**	**(0.771)**	**(0.880)**	**(0.640)**	**(0.767)**
Dif(null, H=exogenous)	**(0.763)**	**(0.810)**	**(0.231)**	**(0.902)**	**(0.846)**	**(0.872)**
Fisher	**53500*****	**13374.7*****	**10945.7*****	**8007.39*****	**3532.50*****	**8596.65*****
Instruments	36	36	38	38	37	37
Countries	37	37	38	38	38	38
Observations	213	209	268	266	243	240

*,**,***: significance levels of 10%, 5% and 1% respectively. DHT: Difference in Hansen Test for Exogeneity of Instruments' Subsets. Dif: Difference. OIR: Over-identifying Restrictions Test. The significance of bold values is twofold. 1) The significance of estimated coefficients and the Fisher statistics. 2) The failure to reject the null hypotheses of: a) no autocorrelation in the AR(1) and AR(2) tests and; b) the validity of the instruments in the Sargan and Hansen OIR tests. na: not applicable because at least one estimated coefficient required for the computation of net effects is not significant.

Table 3: ICT, Remittances and doing business (3)

	Dependent variables: time to start a business, time to export and time to pay taxes					
	Time to start a business		**Time to export**		**Time to pay taxes**	
	Mobile	Internet	Mobile	Internet	Mobile	Internet
Constant	6.679	-12.712	4.226	Omitted	**25.161*** **	**27.006*** **
	(0.324)	(0.139)	(0.757)		**(0.001)**	**(0.000)**
Time to start a business (-1)	**1.329*** **	**1.260*** **	---	---	---	---
	(0.000)	**(0.000)**				
Time to export (-1)	---	---	0.596	**0.802*** **	---	---
			(0.177)	**(0.000)**		
Time to pay taxes (-1)	---	---	---	---	**0.961*** **	**0.963*** **
					(0.000)	**(0.000)**
Resolving an insolvency (-1)	---	---	---	---	---	---
Remittances (Remit)	**-1.109*** **	**-0.865*** **	-0.042	-0.017	**-2.402*** **	**-2.107*** **
	(0.000)	**(0.005)**	(0.825)	(0.901)	**(0.000)**	**(0.000)**
Mobile phones (Mobile)	**-0.234*** **	---	-0.025	---	**-0.138*** **	---
	(0.000)		(0.889)		**(0.003)**	
Internet	---	0.053	---	-0.235	---	**-1.099*** **
		(0.890)		(0.307)		**(0.000)**
Remit. × Mobile	**0.012*** **	---	0.0002	---	**0.042*** **	---
	(0.004)		(0.964)		**(0.000)**	
Remit ×Internet	---	0.047	---	0.017	---	**0.182*** **
		(0.215)		(0.571)		**(0.000)**
Population Growth	-1.720	0.213	-0.680	1.038	-1.985	0.449
	(0.405)	(0.856)	(0.429)	(0.645)	(0.256)	(0.696)
Foreign Direct Investment	0.089	**0.164** **	-0.002	0.037	0.008	0.078
	(0.217)	**(0.015)**	(0.961)	(0.701)	(0.856)	(0.199)
Foreign Aid	**-0.081*** **	**-0.081** **	0.0002	-0.025	**0.048** **	**0.072*** **
	(0.007)	**(0.023)**	(0.987)	(0.533)	**(0.012)**	**(0.000)**
Political Stability	3.181	3.624	-0.113	1.357	3.361	**12.677*** **
	(0.518)	(0.279)	(0.975)	(0.397)	(0.147)	**(0.000)**
Thresholds						
Net Effects	-0.828	na	na	na	-1.420	-1.351
AR(1)	(0.033)	(0.037)	**(0.137)**	**(0.223)**	(0.056)	(0.059)
AR(2)	**(0.785)**	**(0.761)**	**(0.915)**	**(0.615)**	**(0.251)**	**(0.185)**
Sargan OIR	(0.000)	(0.000)	**(0.986)**	**(0.886)**	**(1.000)**	**(0.988)**
Hansen OIR	**(0.616)**	**(0.823)**	**(1.000)**	**(1.000)**	**(0.901)**	**(0.636)**
DHT for instruments						
(a)Instruments in levels						
H excluding group	**(0.379)**	**(0.411)**	**(1.000)**	**(1.000)**	**(0.689)**	**(0.834)**
Dif(null, H=exogenous)	**(0.681)**	**(0.894)**	**(1.000)**	**(1.000)**	**(0.865)**	**(0.406)**
(b) IV (years, eq(diff))						
H excluding group	**(0.840)**	**(0.800)**	**(1.000)**	**(1.000)**	**(0.860)**	**(0.700)**
Dif(null, H=exogenous)	**(0.200)**	**(0.593)**	**(1.000)**	**(1.000)**	**(0.688)**	**(0.345)**
Fisher	**6186.74*** **	**1083.67*** **	**334.31*** **	**21906*** **	**21079*** **	**7602.52*** **
Instruments	38	38	40	40	36	36
Countries	38	38	16	16	37	37
Observations	268	266	77	78	213	209

*,**,***: significance levels of 10%, 5% and 1% respectively. DHT: Difference in Hansen Test for Exogeneity of Instruments' Subsets. Dif: Difference. OIR: Over-identifying Restrictions Test. The significance of bold values is twofold. 1) The significance of estimated coefficients and the Fisher statistics. 2) The failure to reject the null hypotheses of: a) no autocorrelation in the AR(1) and AR(2) tests and; b) the validity of the instruments in the Sargan and Hansen OIR tests. na: not applicable because at least one estimated coefficient required for the computation of net effects is not significant.

The following findings can be established from Table 1. Based on the criteria for the validation of models, estimations related to the number of contract enforcement procedures

are invalid because the null hypothesis of the second order autocorrelation in difference test is not rejected. The net effect from the role of the internet in remittance for the number of start-up procedure is positive. In Table 2, we observe that the mobile phone interacts with remittances to engender positive net effects on the time to build a warehouse and the time to register a property. Conversely, in Table 3: (i) the role of ICT in remittances has a net negative effect on the time required to pay taxes and (ii) mobile phones interact with remittances to reduce the time required to start a business.

For some net negative effects, some promising thresholds which we discuss in the section that follows are apparent. In the meantime, we clarify to concept of threshold to be employed. The notion of threshold used in this study represents cut-off points at which ICT completely neutralises the positive effect of remittances on constraints to doing business. Above established thresholds, ICT can interact with remittances to reduce doing business constraints. This conception and definition of threshold is consistent with Cummins (2000) in the perspective that a certain stage in language proficiency needs to be attained, before advantages that are associated with another language can be enjoyed. Moreover, the concept of threshold is also in accordance with the theory of critical mass that has been documented in the economic development literature (see Roller & Waverman, 2001; Ashraf & Galor, 2013). A more contemporary application of the critical mass theory or notion of threshold from interactive empirical specifications can be found in Batuo (2015). Accordingly, within the setting of this inquiry, the notion of threshold is similar to: critical masses for appealing effects (Batuo, 2015; Roller & Waverman, 2001); the minimum conditions for reaping expected effects (Cummins, 2000) and the requirements for Kuznets and U shapes (Ashraf & Galor, 2013).

Within the framework of this study, the method employed for the computation of threshold is consistent with recent empirical literature, notably: (i) information and communication technology policy thresholds at which environmental degradation can be reduced (Asongu et al., 2017b) and/or the negative effect of environmental degradation on human development can be mitigated (Asongu et al., 2017c). The computation of threshold is important for policy when the net effect has an unexpected sign. For instance, in cases where ICT modulates remittances to have a net increase on a constraint to doing of business, if the corresponding conditional (or interacting) effect is negative, an ICT threshold at which the net positive effect is neutralised can be computed. Beyond this threshold, a higher ICT penetration modulates remittances to have a net negative effect on the doing business

constraint. For these thresholds to make economic sense, they must be within the range (minimum to maximum) limit of the policy ICT variable disclosed in the summary statistics.

5. Concluding implications and future research directions

We set-out to investigate the relevance of ICT in the role of remittances in boosting the doing of business in Africa. Nine doing business variables are used. While remittances is proxied with personal remittances received (as percentage of GDP), two main ICT variables are employed, namely: internet penetration per 100 persons and mobile phone penetration per 100 persons. The empirical evidence is based on Generalised Method of Moments (GMM). While we have established some appealing results in terms of net negative effects on constraints to the doing of business (i.e. time to start a business and time to pay taxes), some positive net effects have also been apparent (i.e. number of start-up procedures, time to build a warehouse and time to register a property). Fortunately, two of the three corresponding conditional effects are negative, which implies that for certain thresholds of ICT penetration, the unconditional effect of remittances can be changed from positive to negative, notably: (i) for the number of start-up procedures, an internet level of 9.00 (0.027/003) penetration per 100 people is required for a negative effect while (ii) for the time to build a warehouse, a mobile phone penetration level of 32.33(0.485/0.015) penetration per 100 people is essential for a negative impact. These thresholds are within policy limits because they are within the ranges of ICT penetration disclosed in the summary statistics, namely: 0.005 to 43.605 for internet penetration and 0.000 to 147.202 for mobile phone penetration. The thresholds in ICT penetration when compared with their maximum limits imply that comparatively low levels of mobile phone and internet penetration levels are required to reduce constraints in the doing of business corresponding to variables for which positive effects have been established.

The main practical implication of this study is that ICT complements remittances to reduce constraints in doing business and in situations where the net effect on doing business constraints in not negative, ICT penetration can be enhanced beyond some thresholds that are within policy limits in order to achieve the desired objective of reducing business constraints. Accordingly, ICT can be increased by tackling issues linked to inadequate infrastructure and affordability. In the light of the summary statistics, more than half of mobile phones are yet to be connected to the internet because the range of internet penetration (0.005 to 43.606) is substantially lower when compared with the range of mobile phone penetration (0.000 to 147.202). Hence, if an enabling environment is created for more mobile phones to be

connected to the internet, doing business constraints are very likely to be reduced in the Sub-Saharan Africa. Policy makers can take measures like the provision of universal access schemes to articulate the role of the internet as an interface between mobile phones and entrepreneurs. ICT policies should therefore be oriented toward increasing: access, reach, efficiency, adoption, cost effectiveness and interactions. In the light of the motivation of this study, the policy recommendations are achievable to reduce constraints in doing business because Sub-Saharan Africa is the region in the world with the least ICT penetration and at the same time the sub-region with the highest growth rate in ICT penetration.

The main theoretical contribution of the study is that ICT can play the role of information sharing in reducing information asymmetry that is associated with doing business constraints. If remittances are considered as resources that could potentially be used for investment purposes, ICT can help in the reduction of informational rents that constraint the doing of business. This narrative is consistent with the theoretical framework of financial allocation efficiency by means of information sharing bureaus like public credit registries and private credit bureaus (see Triki & Gajigo, 2014; Asongu et al., 2016; Tchamyou & Asongu, 2017). Hence, from analogy, the theoretical framework of sharing information for financial allocation efficiency in the financial industry can be extended to the complementarity between remittances and ICT in order to improve efficiency in doing business.

Appendices

Appendix 1: Variable Definitions

Variables	Signs	Variable Definitions (Measurement)	Sources
Cost of starting business	Costostart	Cost of business start-up procedures (% of GNI per capita)	World Bank (WDI)
Contract enforcement	Contractenf	Procedures to enforce a contract (number)	World Bank (WDI)
Start-up procedure	Startupproced	Start-up procedures to register a business (number)	World Bank (WDI)
Ware house time	Timewarehouse	Time required to build a warehouse (days)	World Bank (WDI)
Time to enforce a contract	Timenforcontr	Timenforcontr: Time required to enforce a contract (days)	World Bank (WDI)
Time to register a property	Timeregprop	Time required to register a property (days)	World Bank (WDI)
Time to start a business	Timestartbus	Time required to start a business (days)	World Bank (WDI)
Time to export	Timexport	Time to export (days)	World Bank (WDI)
Time to pay taxes	Timetaxes	Time to prepare and pay taxes (hours)	World Bank (WDI)
Remittances	Remit	Personal remittances, received (% of GDP)	World Bank (WDI)
Mobile phones	Mobile	Mobile phone subscriptions (per 100 people)	World Bank (WDI)
Internet	Internet	Internet penetration (per 100 people)	World Bank (WDI)
Population growth	Popg	Population growth rate (annual %)	World Bank (WDI)
Foreign investment	FDI	Foreign Direct Investment inflows (% of GDP)	World Bank (WDI)
Foreign aid	Aid	Total Development Assistance (% of GDP)	World Bank (WDI)
Political Stability	PolSta	"Political stability/no violence (estimate): measured as the perceptions of the likelihood that the government will be destabilized or overthrown by unconstitutional and violent means, including domestic violence and terrorism"	World Bank (WDI)

WDI: World Bank Development Indicators.

Appendix 2: Summary statistics (2000-2012)

	Mean	SD	Minimum	Maximum	Observations
Cost of starting business	156.079	219.820	0.300	1540.2	445
Contract enforcement	39.305	5.224	23.000	54.000	445
Start-up procedure	9.856	3.005	3.000	18.000	445
Ware house time	195.760	98.496	48.000	599	367
Time to enforce a contract	683.024	277.839	230.000	1715	445
Time to register a property	82.592	74.197	9.000	389	412
Time to start a business	49.884	43.658	5.000	260	445
Time to export	33.789	14.344	10	78	375
Time to pay taxes	319.382	196.048	66	1120	375
Mobile phone penetration	23.379	28.004	0.000	147.202	572
Remittances	3.977	8.031	0.000	64.100	434
Internet Penetration	4.152	6.450	0.005	43.605	566
Population growth	2.361	0.948	-1.081	6.576	588
Foreign Direct Investment inflows	5.332	8.737	-6.043	91.007	603
Foreign aid	11.687	14.193	-0.253	181.187	606
Political Stability	-0.543	0.956	-3.323	1.192	578

S.D: Standard Deviation.

Appendix 3: Correlation matrix

Doing Business									ICT			Control Variables				
Cost-ostart	Contra-ctenf	Startup-proced	Timeware-house	Timen-forcontr	Time-regprop	Time-startbus	Time-xport	Time-taxes	Remit	Mobile	Internet	Popg	FDI	Aid	PolSta	
1.000	0.268	0.303	0.120	-0.110	0.169	-0.032	0.463	0.241	-0.140	-0.541	-0.385	0.389	-0.135	0.133	-0.350	Costostart
	1.000	0.180	0.025	0.080	-0.040	0.028	0.216	0.345	0.196	-0.324	-0.093	0.144	0.149	0.049	-0.482	Contractenf
		1.000	-0.037	-0.065	-0.093	0.311	0.204	0.129	-0.165	-0.275	-0.164	0.100	-0.128	-0.136	-0.289	Startupproced
			1.000	0.150	0.221	0.094	0.012	-0.022	0.223	0.086	-0.121	-0.093	-0.059	0.125	-0.072	Timewarehouse
				1.000	-0.213	0.344	-0.197	-0.060	0.217	0.047	0.098	-0.212	0.184	0.209	0.179	Timenforcontr
					1.000	-0.129	-0.054	-0.009	0.132	-0.193	-0.056	0.039	-0.179	0.040	0.046	Timeregprop
						1.000	-0.011	0.158	0.116	0.043	0.046	-0.263	0.236	-0.093	0.207	Timestartbus
							1.000	0.212	-0.138	-0.554	-0.476	0.327	-0.063	0.031	-0.411	Timexport
								1.000	0.294	-0.141	-0.161	0.103	0.027	-0.164	-0.355	Timetaxes
									1.000	-0.051	-0.027	-0.187	0.123	-0.010	0.066	Remit
										1.000	0.661	-0.458	0.063	-0.259	0.329	Mobile
											1.000	-0.431	0.067	-0.207	0.346	Internet
												1.000	0.116	0.497	-0.255	Popg
													1.000	0.342	0.007	FDI
														1.000	-0.103	Aid
															1.000	PolSta
																Mobile

Costostart: cost of business start-up procedure. Contractenf: Procedure to enforce a contract. Startupproced: Start-up procedures to register a business. Timewarehouse: Time required to build a warehouse. Timenforcontr : Time required to enforce a contract. Timeregroup: Time required to register a property. Timestartbus : Time required to start a business. Timexport: Time to export. Timetaxes: Time to prepare and pay taxes. Remit: Remittances. Internet: Internet penetration. Mobile: Mobile Phone penetration. Popg: Population growth. FDI: Foreign Direct Investment inflows. Aid: Foreign aid. PolSta: political stability.

Appendix 4: Persistence of the dependent variables

	Cost-ostart	Contra-ctenf	Startup-proced	Timeware-house	Timen-forcontr	Time-regprop	Time-startbus	Time-xport	Time-taxes	Time-resinsolv
Costostart (-1)	0.9284									
Contractenf (-1)		0.9970								
Startupproced (-1)			0.9400							
Timewarehouse (-1)				0.9640						
Timenforcontr (-1)					0.9883					
Timeregprop (-1)						0.9187				
Timestartbus (-1)							0.9263			
Timexport (-1)								0.9767		
Timetaxes (-1)									0.9923	
Timeresinsolv (-1)										0.9997

Costostart: cost of business start-up procedure. Costostart (-1): lagged cost of business start-up procedure. Contractenf: Procedure to enforce a contract. Startupproced: Start-up procedures to register a business. Timewarehouse: Time required to build a warehouse. Timenforcontr : Time required to enforce a contract. Timeregroup: Time required to register a property. Timestartbus : Time required to start a business. Timexport: Time to export. Timetaxes: Time to prepare and pay taxes. Timeresinsolv : Time to resolve insolvency.

References

Acosta, P. A., Lartey, E.K.K., & Mandelman, F.S., (2009), "Remittances and the Dutch Disease", *Journal of International Economics*, 79(1), pp. 102-116.

African Economic Research Consortium (AERC, 2014). "Youth Employment: Opportunities and Challenges", 40th Plenary Session of the AERC's Biannual Research Workshop, Lusaka, Zambia (November, 30th). http://aercafrica.org/index.php/news-events/212-aerc-biannual-workshop-climate-change-and-economic-development-2 (Accessed: 06/01/2015).

Agarwal, R., & Horowitz, A. W., (2002), "Are International Remittances Altruism or Insurance? Evidence from Guyana Using Multiple-Migrant Households", *World Development*, 30(11), pp. 2033-2044.

Aggarwal, R., Demirguc-Kunt, A., & Peria, M. S. M., (2011). "Do Remittances Promote Financial Development? Evidence from a Panel of Developing Countries." *Journal of Development Economics*, 96(2), pp. 255-264.

Aghion, P., & Howitt, P., (1998). "Market structure and the growth process", *Review of Economic Dynamics*, 1(1), pp. 276-305.

Amankwah-Amoah, J., (2015). "Solar energy in sub-Saharan Africa: The challenges and opportunities of technological leapfrogging". *Thunderbird International Business Review*, 57(1), pp. 15-31.

Amankwah-Amoah, J., (2016). "Global business and emerging economies: Towards a new perspective on the effects of e-waste". *Technological Forecasting and Social Change*, 105 (April), pp. 20-26.

Amankwah-Amoah, J., & Sarpong, D., (2016). "Historical pathways to a green economy: The evolution and scaling-up of solar PV in Ghana, 1980-2010". *Technological Forecasting and Social Change*, 102(January), pp. 90-101.

Amuedo-Dorantes, C., (2014), "The good and the bad in remittance flows", IZA World of Labour, Retrieved from http://wol.iza.org/articles/good-and-bad-in-remittance-flows.pdf (Accessed: 06/02/2017).

Andrés, A. R., & Asongu, S. A., (2013). "Global dynamic timelines for IPRs harmonization against software piracy", *Economics Bulletin*, 33(1), pp. 874-880.

Andrés, A. R., & Asongu, S. A., (2016). "Global trajectories, dynamics, and tendencies of business software piracy: Benchmarking IPRs harmonization", *Journal of Economic Studies*, 43(5), pp. 780-800.

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

Arellano, M., & Bover, O., (1995). "Another look at the instrumental variable estimation of error components models", *Journal of Econometrics,* 68(1), pp. 29-52.

Ashraf, Q., & Galor, O., (2013). "The Out of Africa Hypothesis, Human Genetic Diversity, and Comparative Economic Development". *American Economic Review*, 103(1), pp. 1-46.

Asongu, S. A., (2013a). "How Would Population Growth Affect Investment in the Future? Asymmetric Panel Causality Evidence for Africa", *African Development Review*, 25, (1), pp. 14-29.

Asongu, S. A., (2013b). "Harmonizing IPRs on Software Piracy: Empirics of Trajectories in Africa", *Journal of Business Ethics*, 118(3), pp. 667-682.

Asongu, S. A., (2015). "Conditional Determinants of Mobile Phones Penetration and Mobile Banking in Sub-Saharan Africa", *Journal of the Knowledge Economy*.
DOI: 10.1007%2Fs13132-015-0322-z

Asongu, S. A., Anyanwu, J. C., & Tchamyou, V. S., (2017). "Technology-driven information sharing and conditional financial development in Africa", *Information Technology for Development*. DOI: 10.1080/02681102.2017.1311833.

Asongu, S. A., & De Moor, L., (2017). "Financial Globalisation Dynamic Thresholds for Financial Development: Evidence from Africa", *European Journal of Development Research*, 29(1), pp. 192–212

Asongu, S. A., Nwachukwu, J. C., & Orim, S-M, I., (2017a). "Mobile phones, institutional quality and entrepreneurship in Sub-Saharan Africa", *Technological Forecasting and Social Change*, DOI: 10.1016/j.techfore.2017.08.007.

Asongu, S. A., & Nwachukwu, J. C., (2018). "Openness, Information Technology and Entrepreneurship in Sub-Saharan Africa", *Information Technology & People*, DOI: DOI: 10.1108/ITP-02-2017-0033.

Asongu, S. A., Le Roux, S., & Biekpe, N., (2017b). "Enhancing ICT for environmental sustainability in sub-Saharan Africa", *Technological Forecasting and Social Change*, DOI: 10.1016/j.techfore.2017.09.022.

Asongu, S. A., Le Roux, S., & Biekpe, N., (2017c). "Environmental degradation, ICT and inclusive development in Sub-Saharan Africa", *Energy Policy*, 111(December), pp. 353-361.

Asongu, S. A, & Nwachukwu, J. C., (2016a). "The Mobile Phone in the Diffusion of Knowledge for Institutional Quality in Sub Saharan Africa", *World Development*, 86(October), pp. 133-147.

Asongu, S. A, & Nwachukwu, J. C., (2016b). "Mobile phones, Institutional Quality and Entrepreneurship in Sub-Saharan Africa", *African Governance and Development Institute Working Paper* No. 16/044, Yaoundé.

Asongu, S. A, & Nwachukwu, J. C., (2016c). "Foreign aid and governance in Africa", *International Review of Applied Economics*, 30(1), pp. 69-88.

Asongu, S. A., Nwachukwu, J. C., & Tchamyou, V. S., (2016). "Information asymmetry and financial development dynamics in Africa", *Review of Development Finance*, 6(2), pp. 126-138.

Asongu, S. A., & Tchamyou, V. S., (2016). "The impact of entrepreneurship on knowledge economy in Africa", *Journal of Entrepreneurship in Emerging Economies*, 8(1), pp. 101-131.

Baltagi, B. H., (2008). "Forecasting with panel data", *Journal of Forecasting*, 27(2), pp. 153-173.

Barajas, A., Chami, R., Fullenkamp, C., Gapen, M., & Montiel, P., (2009), "Do Workers' Remittances Promote Economic Growth?" IMF *Working Paper* WP/09/153, Washington.

Barro, R., (1991). "Economic Growth in a Cross Section of Countries", Quarterly *Journal of Economics*, 196 (2/May), pp. 407–443.

Barro, R. J., & Sala-i-Martin, X., (1992). "Convergence", *Journal of Political Economy*, 100(2), pp. 223-251.

Barro, R. J., & Sala-i-Martin, X., (1995). Economic Growth. The MIT Press, Cambridge, MA.

Baumol, W. J., (1986). "Productivity, growth, convergence and welfare: what the long run data show", *American Economic Review*, 76(5), pp. 1072-1085.

Bettin, G., Lucchetti, R., and Zazzaro, A., (2012), "Endogeneity and sample selection in a model for remittances," *Journal of Development Economics,* 99(2), pp. 370-384.

Boateng, A., Asongu, S. A., Akamavi, R., & Tchamyou, V. S., (2016). "Information Asymmetry and Market Power in the African Banking Industry", *African Governance and Development Institute Working Paper* No. 16/032, Yaoundé.

Batuo, M. E., (2015). "The role of telecommunications infrastructure in the regional economic growth of Africa," *Journal of Developing Areas*, 49(1), pp. 313-330.

Bond, S., Hoeffler, A., & Tample, J. (2001) "GMM Estimation of Empirical Growth Models", University of Oxford.

Brixiova Z., Ncube, M. & Bicaba, Z., (2015). "Skills and Youth Entrepreneurship in Africa: Analysis with Evidence from Swaziland", *World Development* , 67(3), pp.11-26.

Bruno, G., De Bonis, R., & Silvestrini, A., (2012). "Do financial systems converge? New evidence from financial assets in OECD countries". *Journal of Comparative Economics*, 40(1), pp. 141-155.

Cummins, J. (2000). Language, power and pedagogy: Bilingual children in the crossfire. Clevedon, England: Multilingual Matters.

Dzansi, J., (2013), "Do Remittance Inflow Promote Manufacturing Growth?" *The Annals of Regional Science*, 51(1), pp. 89-111.

Eifert, B., Gelb, A., & Ramachandran, V., (2008). "The Cost of Doing Business in Africa: Evidence from Enterprise Survey Data", *World Development*, 36(9), pp. 1531-1546.

Efobi, U., Asongu, S. A., Okafor, C., Tchamyou, V., & Tanankem, B., (2016). "Diaspora Remittance Inflow, Financial Development and the Industrialisation of Africa", *African Governance and Development Institute Working Paper* No. 16/037, Yaoundé.

Efobi, U., Osabuohien, E.S., & Oluwatobi, S., (2015), "One Dollar, One Bank Account: Remittance and Bank Breadth in Nigeria", *Journal of International Migration and Integration*, 16(3), pp. 761-781.

Gerba, D. T. (2012). "Impact of entrepreneurship education on entrepreneurial intentions of business and engineering students in Ethiopia", *African Journal of Economic and Management Studies*, 3(2), pp. 258-277.

Grater, S., Parry, A., & Viviers, W., (2016). "SMEs in the services sector: New drivers of growth in Africa's LDCs?" International Centre for Trade and Sustainable Development, http://www.ictsd.org/bridges-news/bridges-africa/news/smes-in-the-services-sector-new-drivers-of-growth-in-africa%E2%80%99s-ldcs (Accessed: 05/12/2016).

Gui-Diby, S. R., & Renard, M., (2015). "Foreign Direct Investment Inflows and the Industrialization of African Countries", *World Development*, 74(October), pp. 43-57.

Fung, M. K., (2009). "Financial development and economic growth: convergence or divergence?". *Journal of International Money and Finance*, 28(1), pp.56-67.

Hashim, N., (2014). "How Knowledge, Policy Planning, and Implementation Succeed or Fail: The Jatropha Projects in Tanzania", *Journal of African Business*, 14(3), pp. 169-183.

Hossain, A.K.M., & Hasanuzzaman, S., (2015), "Remittances and investment nexus in Bangladesh: an ARDL bounds testing approach", *International Review of Economics*, 60 (4), pp. 387-407.

Ika, L., & Saint-Macary, J., (2014). "Special Issue: Why Do Projects Fail in Africa?", *Journal of African Business*, 14(3), pp. 151-155.

Ita, J. J., Singh P., & Adelosa, S., (2014). "Factor that Influence Entrepreneurial Intentions Among Undergraduates of South-South and Southeast Nigeria", Oxford Brookes University. http://dx.doi.org/10.2139/ssrn.2506268 (Accessed: 08/12/2014).

Joseph, N., Erasmus, W., & Marnewick, C., (2014). "The Idle State of Information and Communication Technology Project Management", *Journal of African Business*, 14(3), pp. 184-196.

Kaberuka, W., & Namubiru, R., (2014). "The effect of remittances on gross domestic savings in Uganda (1999-2011)", *International Journal of Business Management and Administration*, 3(2), pp. 29-39.

Kapur, D., (2004), "Remittances: The New Development Mantra? United Nations Conference on Trade and Development, G-24 Discussion Paper Series", Retrieved from http://www.cities-localgovernments.org/committees/fccd/Upload/library/gdsmdpbg2420045_en_en.pdf (Accessed: 12/07/2017).

Karikari, N.K., Mensah, S. and Harvey, S.K., (2016), Do Remittance Promote Financial Development in Africa? Springer Plus, 5. Retrieved from http://link.springer.com/article/10.1186/s40064-016-2658-7 (Accessed: 12/07/2017).

Khavul, S., Bruton, J. D., & Wood, E., (2009). "Informal Family Business in Africa", *Entrepreneurship: Theory & Practice*, 33(6), pp. 1219-1238.

Kuada, J. (2014). "Cross- border interfirm knowledge generation and enterprise development in Africa", in Nwankwo, S. and Ibeh, K. (Eds), The Routledge Companion to Business in Africa, Routledge, London and New York, pp. 352-370.

Kuada, J., (2015), "Entrepreneurship in Africa – a classificatory framework and a research agenda", *African Journal of Economic and Management Studies*, 6(2) pp. 148-163.

Kuada, J., (2009). "Gender, social networks, and entrepreneurship in Ghana", *Journal of African Business*, 10 (1), pp. 85-103.

Lartey, E. K., Mandelman, F. S., & Acosta, P. A. (2008). Remittances, exchange rate regimes, and the Dutch Disease: a panel data analysis. Technical report, Working Paper, Federal Reserve Bank of Atlanta.

Love, I., & Zicchino, L., (2006). "Financial Development and Dynamic Investment Behaviour: Evidence from Panel VAR" .*The Quarterly Review of Economics and Finance*, 46(2), pp. 190-210.

Mankiw, N. G., Romer, D., & Weil, D. N., (1992). "A contribution to the empirics of economic growth", *Quarterly Journal of Economics*, 107(2), pp. 407–437.

Massey, D., & Parrado, E., (1998), "International Migration and Business Formation in Mexico", *Social Science Quarterly*, 79(1), pp. 1-20.

Mensah, S. N., & Benedict, E., (2010). "Entrepreneurship training and poverty alleviation: Empowering the poor in the Eastern Free State of South Africa", *African Journal of Economic and Management Studies*, 1(2), pp. 138-163.

Naude, W., Szirmai, A., and Lavopa, A., (2013), "Industralisation Lessons from BRICS: A Comparative Analysis", IZA Discussion Paper No. 7543. Retrieved from http://repec.iza.org/dp7543.pdf (Accessed: 12/02/2017).

Ofori, D., (2014). "An Exploratory Study of Project Management Competency in Ghana", *Journal of African Business*, 14(3), pp. 197-210.

Osabuohien, E., and Efobi, U.R., (2013), "Africa's Money in Africa", *South African Journal of Economics*, 81(2), pp. 291-306.

Oseifuah, E. K., (2010). "Financial literacy and youth entrepreurship in South Africa", *African Journal of Economic and Management Studies*, 1(2), pp. 164-182.

Parker, S. C., (2012). "Theories of entrepreneurship, innovation and the business cycle", *Journal of Economic Surveys*, 26(3), pp. 377-394.

Paul, B., Bhorat, H., & Cheadle, H., (2010). "The cost of "doing business and labour regulation: The case of South Africa", *International Labour Review*, 149(1), pp. 73-91.

Penard, T., Poussing, N., Yebe, G. Z., & Ella, P. N., (2012). "Comparing the Determinants of Internet and Cell Phone Use in Africa : Evidence from Gabon ", *Communications & Strategies*, 86(2), pp. 65-83.

Rajan, R. G. & Subramanian, A., (2005). "What undermines aid's impact on growth?" Technical report, National Bureau of Economic Research, Cambridge.

Roller, L-H., & Waverman, L. (2001). "Telecommunications infrastructure and economic development: a simultaneous approach", *American Economic Review*, 91(4), pp. 909-923.

Roodman, D., (2009a). "A Note on the Theme of Too Many Instruments", *Oxford Bulletin of Economics and Statistics*, 71(1), pp. 135-158.

Roodman, D., (2009b). "How to do xtabond2: An introduction to difference and system GMM in Stata", *Stata Journal*, 9(1), pp. 86-136.

Sakyi, D., Villaverde, J., Maza, A., & Bonuedi, I., (2017). "The Effects of Trade and Trade Facilitation on Economic Growth in Africa", *African Development Review*, 29(2), pp. 350–361.

Schumpeter, J. A., (1927). "The explanation of the business cycle". *Economica* 21(December), pp. 286-311.

Schumpeter, J. A., (1939). Business Cycles: A Theoretical, Historical and Statistical Analysis of the Capitalist Process. NY: McGraw-Hill.

Selaya, P., & Thiele, R., (2010). "Aid and sectoral growth: Evidence from panel data". *Journal of Development Studies*, 46(10), pp. 1749–1766.

Singh, S., Simpson, R., Mordi, C., & Okafor, C., (2011). "Motivation to become an entrepreneur : a study of Nigerian women's decisions", *African Journal of Economic and Management Studies*, 2(2), pp. 202-219.

Solow, R. M., (1956). "A contribution to the theory of economic growth", *Quarterly Journal of Economics*, 70(1), pp. 65-94.

Ssozi, J., & Asongu, S. A., (2016a). "The Effects of Remittances on Output per Worker in Sub-Saharan Africa: A Production Function Approach", *South African Journal of Economics*, 84(3), pp. 400-421.

Ssozi, J., & Asongu, S. A., (2016b). "The Comparative Economics of Catch-up in Output per Worker, Total Factor Productivity and Technological Gain in Sub-Saharan Africa", *African Development Review*, 28(2), pp. 215-228.

Swan, T., (1956). "Economic growth and capital accumulation". *Economic Record*, 32(2), pp. 334-361.

Syed, S., & Miyazako, M., (2013), "Promoting Investment in Agriculture for Increased Production and Productivity", Italy: CAB International and Food and Agriculture Organisation.

Taplin, R., & Snyman, M., (2004). "Doing business in South Africa's new mining environment: A legal perspective", *CIM Bulletin*, 97(1078), pp. 91-98.

Tapsoba, S. J-A., (2010). "Trade Intensity and Business Cycle Synchronicity in Africa", *African Development Review*, 22(1), pp. 149-172.

Tchamyou, V. S., (2016). "The role of knowledge economy in African business", *Journal of the Knowledge Economy*, DOI: 10.1007/s13132-016-0417-1.

Tchamyou, V. S., & Asongu, S. A., (2017). "Information Sharing and Financial Sector Development in Africa", *Journal of African Business*, 18(1), pp. 24-49.

Triki, T., & Gajigo, O., (2014). "Credit Bureaus and Registries and Access to Finance: New Evidence from 42 African Countries", *Journal of African Development*, 16(2), pp. 73-101.

Tsegai, D., (2004). “Effects of migration on the source communities in the Volta Basin of Ghana: Potential links of migration, remittances, farm and non-farm self-employment activities”. Working paper, Economics and Technological Change. Bonn, Germany: University of Bonn.

United Nations (2009). “Worlds Population Prospects”. United Nations.

Williams, K., (2016). “Remittances and Financial Development: Evidence from Sub-Saharan Africa”, *African Development Review*, 28(3), pp. 357–367.

Woodruff, C., & Zenteno, R.M., (2001), “Remittances and Microenterprises in Mexico,” Mimeo, UC San Diego.

Yang, D. (2008). “International migration, remittances and household investment: Evidence from Philippine migrants’ exchange rate shocks”. *Economic Journal*, 118(528), pp. 591–630.