African Development Review

Revue africaine de développement

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Vol. 28 No. 2 *June/Juin 2016*

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Revue professionelle semestrielle consacrée à l'étude et l'analyse des questions de développement en Afrique. Les avis exprimés dans cette revue sont ceux des auteurs et n'engagent nullement la responsabilité ni de la Banque africaine de développement, ni du Conseil des gouverneurs, ni du Conseil d'administration, ni des gouvernements qu'ils représentent.

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Information for subscribers: *African Development Review* is published in four issues per year. Institutional subscription prices for 2016 are: Print & Online: US$514 (US), US$593 (Rest of World), €389 (Europe), £305 (UK). Prices are exclusive of tax. Asia-Pacific GST, Canadian GST and European VAT will be applied at the appropriate rates. For more information on current tax rates, please go to www.wileyonlinelibrary.com/tax-vat. The price includes online access to the current and all online back files to January 1st 2008, where applicable. For other pricing options, including access information and terms and conditions, please visit wileyonlinelibrary.com/access.

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Periodical ID Statement: AFRICAN DEVELOPMENT REVIEW (ISSN: 1017-6772) is published quarterly in March, June, September and December. US mailing agent: Mercury Media Processing, LLC 1850 Elizabeth Avenue, Suite #C, Rahway, NJ 07065 USA. Periodical postage paid at Rahway, NJ.

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Abstracting and Indexing Services: The Journal is indexed by ASSIA Net (Applied Social Sciences Index & Abstracts), AgBiotech News and Information, CSA Worldwide Political Science Abstracts (Cambridge Scientific Abstracts), GEOBASE, Index to International Statistics, International Bibliography of the Social Sciences, Journal of Economic Literature, Nutrition Abstracts and Reviews, PAIS International in Print (Annual) (Public Affairs Information Service), Periodicals Contents Index, Postharvest News and Information, Rural Development Abstracts, Scopus Social Sciences Citation Index, Social Sciences Index, Soils and Fertilizers, Wheat, Barley and Triticale Abstracts, World Agricultural Economics and Rural Sociology Abstracts.

1017-6772 (Print)
1467-8268 (Online)

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Printed in Singapore by Markono Print Media Pte Ltd.

24018

African Development Review, Vol. 28, No. 2, 2016, 157–169

What Drives Structural Transformation in Sub-Saharan Africa?

Justice Tei Mensah, George Adu, Anthony Amoah, Kennedy Kwabena Abrokwa and Joseph Adu*

***Abstract*:** This paper provides an empirical assessment of the driving forces behind structural transformation in sub-Saharan Africa, and to further access the role of structural reforms in accounting for cross-country differences in transformation. Evidence from this paper reveals that country specific fundamentals, institutions and policy reforms as well as governance and fiscal reforms are the key drivers of transformation in the region. A set of policy strategies is proposed to engender sustained transformation and development in the region.

1. Introduction

There has been an increased emphasis on structural change as a conduit for growth and development, as experts argue that it induces efficiency and productivity via the reallocation of resources across various sectors of the economy. Evidence of the effects of structural change have been felt all over the world. In the nineteenth and twentieth century, the now developed world escaped poverty to prosperity characterized by raising relative wealth and income levels of the poorer population, although the process was slow and gradual (Kuznets, 1955). Over the last four decades, several developing economies including but not limited to China, Thailand and India, have moved from lower income status to middle income status owing to major structural and economic transformation policies. The evidence from these countries shows that countries that tend to go through structural and economic transformation are characterized by conditions such as a declining share of agriculture in GDP and employment; a rural-to-urban migration underpinned by rural and urban development; the rise of a modern industrial and service economy; and a demographic transition from high rates of births and deaths to low rates of births and deaths (Breisinger and Diao, 2008).

Interestingly, despite the common characteristic features among economies undergoing structural transformation, evidence suggests marked differences across regions and income in terms of the process and pace of the transformation (Dabla-Norris *et al.*, 2013). For instance, most Western economies (especially Europe), were characterized by transition from agrarian to industrial based economies, and further transitioned towards service oriented economies. The transformation in Asia has also been bolstered by a burgeoning manufacturing sector. On the contrary, the transformation in most sub-Saharan African (SSA) economies has been marked with not only a decline in the agriculture sector shares in output and employment, but also with an ailing manufacturing/industrial sector; thus leapfrogging the middle stage of the transformation ladder — industrialization — towards a service sector dominated economy (IMF, 2012).

The chain of reforms implemented in SSA during the 1980s–90s is often credited to spurring the process of economic transformation in the region. The reforms led to liberalization of the host economies towards market-oriented economies from the hitherto state-dominated economies. The resulting paradigm shift contributed to a gradual shift from agrarian based towards service based economies. Critics, however, assert that these reforms contributed to the decline in the industrial base of most SSA economies as the existing firms at the time were not adequately prepared to match the competition from foreign firms that ensued as a result of liberalization of the economies and the trade sector, for example (Taylor, 1993).

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This paper seeks answers to three policy relevant questions: (1) What are the key drivers of transformation in SSA? (2) What role has the myriad of structural reforms implemented in the region played in spurring the process of transformation across economies in SSA? (3) What is the way forward for policy aimed at economic transformation?

The paper makes important contributions to the literature on structural transformation in the sub-Saharan African region. First, to the best of our knowledge, this is the first study that provides empirical estimates on the determinants of structural transformation in SSA, with particular reference to the 21 countries included in the African Transformation Report which has become the blueprint of transformation in the region. Second, as part of our search for the drivers of structural transformation in SSA, we examine the impact of policy reforms — that were specifically directed at restructuring the economies of SSA to promote sustainable economic growth — on economic transformation. The rate of success of different reform programs in transforming the economies of SSA is an important factor in the design of future reform policies.

The literature on structural transformation is relatively scanty but growing. Studies in this area mainly have their theoretical underpinnings on the works of Kuznets (1955) which describe structural transformation as often associated with the canonical shift in the economic structure as a country transitions from developing to a developed economy. Also, the new growth theories spearheaded by Schumpeter (1934), Solow (1957), Grossman and Helpman (1991), Romer (1990), Aghion and Howitt (2009) offers good exposition on the drivers of transformation and growth. These studies unequivocally assert physical and human capital (see Romer, 1990), and technological change and innovations (Schumpeter, 1934) as key drivers of transition from developing to a developed economy (i.e. economic growth). For instance, Christiaensen *et al.* (2006) and Diao *et al.* (2007) assert that technology, rapid accumulation of human and physical capital, and the roles of market, institutions, and governments are key drivers of transformation. Thus, policies aimed at enhancing the spread of adoption and use of technology and quality education of indigenes offers a potent approach towards transformation. From the empirical perspective, studies such as Bah (2011), Timmer *et al.* (2012), Duarte and Restuccia (2010), McMillan and Rodrik (2011), and Dabla-Norris *et al.* (2013) are notable. For instance, Dabla-Norris *et al.* (2013) using data on 168 countries over the period 1970–2010 with real value added of agriculture, manufacturing and services as indicators of structural transformation, provides estimates of the determinants of structural transformation. Their results reveal large differences in sector shares across and within regions and finds that large country variation in sector shares can be accounted for by country characteristics such as demographic structure, population size and real income per capita. Their results further indicate that policy and institutional variables such as trade openness, product market reforms, human capital and so on, are key drivers of structural transformation across countries. Also, McMillan and Rodrik (2011) analyzing the link between labor productivity growth, structural change and globalization provides evidence of a shift of workers from low productivity sectors to high productivity sectors in some Asian economies, contrary to countries in Latin America and SSA where a reverse trend was observed. The empirical approach used in this paper shares some semblance to the work of Dabla-Norris *et al.* (2013) but differs in terms of countries and econometric (estimation) procedures. Abdulai and Rieder (1996) and Blunch and Verner (2006) have both reported strong evidences of strong interdependencies in sectoral growth in selected SSA countries.

Findings from this paper reveal that country specific fundamentals such as natural resource and human capital endowments are key factors behind the cross country differences in sectoral real value added output. It also emphasizes the key role of institutions and policy reforms such as education, trade openness, financial development, real and financial sector reforms in driving economic transformation. Finally, the paper shows that governance and fiscal reforms are important determinants of transformation in SSA. Thus, efforts aimed at promoting good governance and building institutions are key instruments in promoting structural transformation in the region. The historically poor score of most of the countries in the region in terms of governance and institutional quality measures partly explains the region's slow pace in structural transformation and consequently, the slow pace of economic growth and development.

The remainder of this paper is structured as follows: Section 2 presents the theoretical model and empirical approach used in the paper. A description of the data used in the study is presented in Section 3. The analysis and discussions of results are undertaken in Section 4. Section 5 concludes the paper.

2. The Model and Empirical Strategy

The theoretical underpinnings behind structural transformation stems from traditional growth theories, particularly of Lewis (1954) and Chenery (1960), which emphasize the canonical transition in aggregate output and labor from the low technology based agrarian economy to a service based economy via an era of manufacturing. Thus structural/economic transformation therefore describes the evolution of an economy across these stages of development.

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Given this background, we set up our empirical model within the framework of the neoclassical growth model where output of each sector (Y^j_{it}), that is, agriculture, industry, manufacturing and service sectors, is expressed as a function of inputs and a set of policy reform variables as shown in Equation (1).

$$Y^j_{it} = \alpha + \beta X^j_{it} + \phi Z^j_{it} + \mu^j_{it} \tag{1}$$

where X_{it} is a vector of growth fundamentals, Z^j_{it} a vector of policy reform indices, μ_{it} is the idiosyncratic error term, while i and t refers to country and time period respectively; and j indicates the sector.

2.1 Endogeneity

Estimating the parameters in the model in Equation (1) is not without a challenge. In particular, the institutional and structural reforms indices are potentially endogenous, which could hinder efficient identification of the true causal impact of institutions and reforms on structural transformation in SSA. For example, countries with fertile arable lands are more likely to be engaged in agricultural activities and hence increase output of the agricultural sector, boost incomes and further provide raw materials to feed the industrial sector. Moreover, countries with higher industrial output shares could demand greater trade reforms to boost exports and consequently, income. This is a potential threat to identification of the causal impact of reforms and institutions on structural transformation.

To overcome the above challenge to identification, we employ the system generalized method of moments (system GMM) estimator which allows the 'true' causal effects to be estimated when some regressors are (potentially) endogenous. This technique, proposed by Arellano and Bond (1991), Arellano and Bover (1995) and Blundell and Bond (1998) is one of the efficient econometric techniques in accounting for endogeneity in panel data. The method uses the country fixed effect to account for idiosyncratic time invariant country effects and addresses endogeneity among the variables by instrumenting them with their own lagged values (in levels and first differences). Thus, the system GMM in principle imposes homogeneity on all slope coefficients in the estimated model. For the sake of brevity, theoretical representation of the system GMM estimators is, however, not discussed in the present study. Interested readers may refer to Wooldridge (2010) and Baltagi (2013).

The empirical approach of this study is outlined as follows: First, to account for the individual country effects such as income, natural resource endowment, population and so on, we examine the role of country fundamentals on the sectoral output. Second, we examine the role of policy reforms and institutional factors on sectoral output. At this level of our investigations, we augment the baseline model with policy and institutional drivers to estimate the influence of the latter on the sectoral output shares. Four main policy indicators are used. These include indices of market-oriented structural reforms in trade, agriculture, financial market and infrastructure. Our argument here is that these indices of policy and institutional reforms can influence structural transformation in the form of production, distribution and consumption, by enhancing or obstructing the resource allocation to the various sectors of the economy (Dabla-Norris *et al.*, 2013). We also include indicators of trade openness, human capital (proxied by educational attainment), financial development (proxied by domestic credit to private sector as a percentage of GDP) and foreign direct investment inflows. In the final stage, we examine the role of governance and fiscal reforms in driving economic transformation.

3. Data

Our analysis of the drivers of structural transformation is based on a combination of data on key macroeconomic indicators and structural reform indices on 21 countries in SSA over the period 1970–2012. The choice of these economies for this study is motivated by the availability of relevant data on structural transformation as considered in the African Transformation Report. In this paper, we follow Dabla-Norris *et al.* (2013) and measure the degree of economic transformation by the real value added output in agriculture, service, industry and manufacturing. Data on these indicators were sourced from the United Nations Statistics Division. Data on indices of structural reforms describing the degree of regulation and liberalization in key sectors of the economy were compiled by the Research Department of the IMF and used in studies such as Giuliano *et al.* (2013) and Dabla-Norris *et al.* (2013). The indices cover six main sectors of the economy ranging from the real sector to the financial sectors. The essence of these indices in this study is to delineate the role of the myriad of reforms on the ongoing structural transformation in the region. We complement our analysis with a set of variables including population, per capita income, dependency ratio, trade openness, mineral rents (percentage of GDP) as a proxy for natural (mineral) resource endowment and credit to private

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sector (percentage of GDP) as a proxy for financial development obtained from the World Bank's World Development indicators (WDI; World Bank, 2013). Data on educational attainment were also used as a measure of human capital and is based on Barro and Lee's (2010) international data on educational attainment. Stock of physical capital was excluded, however, due to limited availability over the sample period and countries considered in the study. Further, data on degree of democracy and governance indices from Giuliano *et al.* (2013) were also included in the study.

4. Results and Discussions

This section is organized into three subsections. As a baseline regression, we examine the role of country fundamentals on structural transformation. Next, we assess the role of policy reforms and institutions. Finally, we investigate the role governance and fiscal reforms in structural transformation. In each stage, we estimate four separate models, using the log of real value added of agriculture, service, industry and manufacturing sectors as respective dependent variables.

4.1 Baseline Model: Role of Country Fundamentals

This baseline model examines the influence of a broad set of cross country fundamentals such as population; arable land (percentage of total land area) and mineral rents (percentage of GDP); demographic change (young as a percentage of total population); and real income per capita. The motivation behind the use of these factors stems from the fact that these factors can be viewed as initial conditions that cannot be influenced directly (at least in the short run) by policy makers but remain fundamental to the growth of every economy (Dabla-Norris *et al.*, 2013).

Results from the system GMM estimates suggest varying effects of these country fundamentals on the sectoral performance (see Table 1). First, it shows that the stock of a country's mineral rents as a percentage of GDP, arable land and demographic change account for the cross country differences in real output of the industrial sector. In the manufacturing sector, the results suggest that only income and arable land are the significant factors determining real value added of the sector. Similar results were derived for the service sector. These results suggest that income, demographic structure, size of arable land and to some extent, mineral endowments, are significant factors accounting for cross-country variations in the real value added output of the manufacturing, industrial and service sectors and their respective shares in real GDP. Surprisingly, none of these factors were shown to have a significant impact on agriculture value added output.

Table 1: Role of country fundamentals

Variables	(1) Agric	(2) Industry	(3) Manufacturing	(4) Service
log of population	−0.00088	0.03435	0.11149	0.05119*
	(0.024)	(0.035)	(0.081)	(0.027)
log of per capita income	−0.01597	0.11498	0.26101**	0.15392**
	(0.062)	(0.084)	(0.114)	(0.068)
age dependency, young (% of total)	0.00041	0.00783*	0.00872	0.00847***
	(0.003)	(0.004)	(0.005)	(0.003)
Mineral rents (% of GDP)	0.00366	0.00754*	0.00196	0.00695
	(0.004)	(0.004)	(0.006)	(0.006)
Arable land (% of land area)	0.00010	0.00534**	0.00596*	0.00663***
	(0.002)	(0.002)	(0.003)	(0.002)
Lagged dependent variable	1.00938***	0.94928***	0.94020***	0.97053***
	(0.014)	(0.024)	(0.029)	(0.031)
Observation	162	162	162	162
Hansen test	17.5[0.89]	18.4[0.86]	18.2[0.82]	19.5[0.82]
AR(1)	−2.85[0.04]	−1.77[0.08]	−1.40[0.16]	−1.35[0.18]
AR(2)	0.45[0.65]	−1.03[0.3]	−0.89[0.4]	−1.936[0.05]

Notes: Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$; dependent variables are real value added of the respective sectors and expressed in logs.

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4.2 Role of Institutions and Policy Reforms

In this section, we augment the baseline model with policy indicators such as education, financial development, foreign direct investment, trade openness, and some measures of policy reforms mainly in real and financial sectors. The underlying idea is to assess the role of the myriad of structural policies implemented in the study countries in engendering structural transformation.

Agriculture

After accounting for the possible effects of these policy reforms on the real value added output of the sector, we observe that factors such as population, demographic structure and arable lands achieve some level of significance (see Table 2). Notably, the results suggest that countries with a larger share of youthful population (youth bulge) tend to have higher agricultural output relative to countries with an ageing population. This result in practice seems true in the sense that the agricultural sector in SSA still remains labor intensive with a high proportion of youthful population, particularly children, used as farm labor. Notable examples of countries with this phenomenon include Ghana and Ivory Coast where children and young adults form a significant share of labor used in cocoa and cash crop plantations (see Bøås and Huser, 2006; World Vision, 2012).

In terms of the policy variables, the results indicate that whereas higher educational attainment exerts a negative effect on the real output of the sector, reform indices such as agriculture, trade and infrastructure show a positive effect on agricultural value-added. In other words, we observe that the quest for higher educational attainment in the region is associated with a decline in output shares of the agrarian sector. This result is in line with the structural change ideology of Chenery (1960) and Lewis (1954) that a growing literate society will result in a gradual shift from low technology requirement economic activities such as agriculture towards the industrial and service sectors. Further, contrary to the findings of Dabla-Norris *et al.* (2013), our results indicate that policy reforms in the agricultural sector have yielded some positive impact on output of the sector. The implications of our results suggest that the chain of reforms implemented during the era of the Structural Adjustment Programs in SSA aimed at liberalizing various sectors of the economy (including agriculture) such as the removal of farm subsidies and price controls, divestiture of state-owned enterprises, towards a free market economy yielded some marginal impact towards enhancing output from the agricultural sector. The trade reform index captured, among other things, efforts aimed at boosting trade openness through the harmonization of tariffs, removal of trade barriers and so on, to enhance the flow of goods and services across countries. Since most of African economies are exporters of agro-products — albeit as raw materials — such as cocoa, coffee, rubber; trade liberalization is expected to generate greater benefits to the exporting economies and particularly the agricultural sector. This is confirmed by the results of the trade reform index where a positive nexus is obtained.

Another noticeable result is the impact of the infrastructural/network index in boosting productivity of the agricultural sector. The implication of this result is that improvement in social amenities offers great potential to the agricultural sector as access to electricity can help in the transition towards a more mechanized and technology based agriculture in the sub-region. Likewise, access to reliable and efficient telecommunication services can boost output of the sector by enhancing market accessibility via reducing the informational asymmetries in the market for agricultural produce and postharvest losses.

Service Sector

In terms of the service sector (see Table 3), results on the impact of country fundamentals (i.e. population, income, size arable land, and mineral endowments) in driving real output of the service sector are significantly positive. This suggests, for instance, the possibility of significant backward linkages from the extractive sector to the service sector in terms of service contracts such as catering, telecommunications, cleaning, etc.

On the policy front, our results show a significantly positive relationship between the various reform indices and service sector productivity. The result of the financial reform index suggests that the liberalization of the financial sector in the respective economies has contributed positively to the expansion of the service sector in SSA. This impact can be analyzed from the point of view of facilitating the process of financial intermediation among economic agents and further reducing the barriers to accessing financial services thereby boosting investment and output of the service sector.

Interestingly, contrary to the impact of the financial reform on service output, the results suggest a negative effect of domestic credit on output of the sector. This can be attributed to the myriad of challenges facing the private sector in securing credit from

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Table 2: Role of policy reforms: agriculture

Variables	(1) agric	(2) agric	(3) agric	(4) agric	(5) agric	(6) agric	(7) agric	(8) agric	(9) agric
Lagged dept. variable	1.01850***	0.98553***	0.98658***	1.01698***	1.00327***	0.99075***	1.00503***	0.99455***	0.99370***
	(0.017)	(0.010)	(0.007)	(0.017)	(0.011)	(0.011)	(0.009)	(0.007)	(0.007)
log of population	−0.00887	−0.02952*	−0.02078	−0.06704	−0.01952	−0.01871	−0.01423	−0.01063	−0.00882
	(0.026)	(0.014)	(0.023)	(0.166)	(0.041)	(0.017)	(0.035)	(0.016)	(0.014)
log of per capita income	−0.12874	0.02722	0.01315	0.02668	0.03472	0.01455	0.02304	−0.01817	0.00427
	(0.084)	(0.031)	(0.017)	(0.034)	(0.045)	(0.030)	(0.036)	(0.036)	(0.028)
age dependency, young (% of total)	−0.00282	0.00558***	0.00467***	0.00238	0.00136	0.00340	0.00042	0.00206	0.00268
	(0.005)	(0.002)	(0.001)	(0.002)	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)
Mineral rents (% of GDP)	0.00344	−0.00092	−0.00255	−0.01030	−0.00421	0.00002	−0.00299	0.00081	0.00155
	(0.003)	(0.004)	(0.006)	(0.014)	(0.007)	(0.003)	(0.006)	(0.003)	(0.002)
Arable land (% of land area)	0.00220	0.00210	0.00179	−0.00723*	−0.00212	0.00164	−0.00224	0.00168	0.00160
	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)
educational attainment	0.00311	−0.02531**	−0.02549*	−0.01179	−0.01712*	−0.02096**	−0.01595*	−0.01199	−0.01648**
	(0.009)	(0.010)	(0.012)	(0.016)	(0.008)	(0.008)	(0.008)	(0.008)	(0.006)
agric reform index		0.07448	0.05339	−0.04334	0.00006	0.08270	−0.00690	0.11273*	0.07765
		(0.053)	(0.060)	(0.076)	(0.044)	(0.053)	(0.044)	(0.059)	(0.050)
trade reform index		0.25430***	0.15106*	0.14965	0.09669	0.14795***			
		(0.053)	(0.082)	(0.101)	(0.116)	(0.049)			
financial reform index			0.09121	0.04385					
			(0.055)	(0.134)					
infrastructure index				0.31364*	0.11213		0.12695		
				(0.124)	(0.107)		(0.093)		
Domestic credit to private sector (% of GDP)					−0.00109	−0.00052	−0.00103	−0.00014	0.00027
					(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
openness								0.00011	−0.00014
								(0.001)	(0.001)
FDI % of GDP									0.00323
									(0.003)
Observations	111	111	82	45	64	108	64	108	108
Hansen test	12.9[0.91]	7.5 [1]	0 [1]	0[1]	0 [1]	5.9[1]	0[1]	11.98[1]	7.9[1]
AR(1)	−2.5[0.01]	−2.2[0.02]	−2.01[0.05]	−1.49[0.14]	−0.16[0.11]	−2.2[0.03]	−1.61[0.1]	−2.28[0.02]	−2.3[0.02]
AR(2)	−1.39[0.05]	−1.12[0.14]	−0.94[0.35]	1.24[0.22]	1.48 [0.14]	1.48[0.14]	1.62[0.1]	−1.57[0.12]	1.5[0.13]

Notes: Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Figures in brackets are p-values for diagnostic tests. Dependent variable is real value added of the agricultural sector and expressed in logs.

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Table 3: Role of policy reforms: service sector

Variables	(1) service	(2) service	(3) service	(4) service	(5) service	(6) service	(7) service	(8) service	(9) service
Lagged dept. variable	0.97969***	0.97211***	0.96711***	0.97400***	0.98493***	0.98343***	0.98810***	0.98148***	0.98289***
	(0.013)	(0.012)	(0.011)	(0.020)	(0.005)	(0.009)	(0.005)	(0.007)	(0.007)
log of population	0.03435***	0.01385	−0.00036	0.08433	0.03140	0.02776*	0.04813**	0.03790**	0.03390*
	(0.011)	(0.014)	(0.027)	(0.200)	(0.018)	(0.014)	(0.019)	(0.014)	(0.016)
log of per capita income	0.05427	0.05781	0.04166	0.02347	0.07997**	0.00099	0.03944	−0.00087	−0.00081
	(0.053)	(0.039)	(0.034)	(0.039)	(0.027)	(0.036)	(0.032)	(0.035)	(0.028)
age dependency, young (% of total)	0.00531	0.00588**	0.00599	0.00597**	0.00678***	0.00196	0.00396**	0.00402**	0.00377**
	(0.003)	(0.003)	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Mineral rents (% of GDP)	0.00591*	0.00517	0.00432	−0.00104	−0.00215	0.00660**	0.00196	0.00479*	0.00400*
	(0.003)	(0.003)	(0.004)	(0.016)	(0.003)	(0.003)	(0.002)	(0.003)	(0.002)
Arable land (% of land area)	0.00739***	0.00702***	0.00716**	0.00378	0.00170	0.00631***	0.00165	0.00631***	0.00636***
	(0.001)	(0.001)	(0.002)	(0.005)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
educational attainment	0.00254	−0.00179	−0.01605	−0.00701	−0.01302	0.00136	−0.00733	0.00119	0.00162
	(0.007)	(0.007)	(0.009)	(0.020)	(0.010)	(0.007)	(0.010)	(0.007)	(0.007)
agric reform index		0.11090**	0.03557	0.05884	0.07461*	0.06862	0.05797	0.05422	0.04761
		(0.049)	(0.079)	(0.109)	(0.033)	(0.047)	(0.045)	(0.045)	(0.043)
trade reform index		0.03065	0.05563	0.19918	0.26455**	−0.02321			
		(0.089)	(0.058)	(0.115)	(0.081)	(0.089)			
financial reform index			0.21585***	0.06934					
			(0.041)	(0.052)					
infrastructure index				0.03234	0.11086		0.13440*		
				(0.131)	(0.062)		(0.067)		
Domestic credit to private sector (% of GDP)					−0.00097*	0.00014	−0.00084	0.00058	0.00060
					(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
openness								0.00172*	0.00137
								(0.001)	(0.001)
FDI % of GDP									0.00434
									(0.004)
Observations	111	111	82	45	64	108	64	108	108
Number of code	15	15	11	6	9	15	9	15	15
Hansen test	11.7[1]	7.7 [1]	0 [1]	0[1]	0 [1]	3.84[1]	0[1]	0.93[1]	0.35[1]
AR(1)	−1.2[0.2]	−1.3[0.2]	−1.1[0.25]	0.51[0.6]	−0.17[0.86]	−1.06[0.3]	−0.7[0.5]	−0.97[0.3]	−0.98[0.3]
AR(2)	−1.4[0.2]	−1.1[0.3]	−0.9[0.33]	−2.2[0.6]	−2.61[0.09]	−1.10[0.3]	−1.5[0.13]	−1.28[0.2]	−1.3[0.19]

Notes: Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Values in brackets are p-values for diagnostic test. Dependent variable is real value added of the service sector and expressed in logs.

the financial sector, as issues such as exorbitant interest rates, high inflation, currency depreciation and a general macroeconomic instability in most SSA countries, make the cost of credit too high for the average African firm to afford.

Consistent with Dabla-Norris *et al.* (2013), we find a positive and significant effect of agricultural reforms on service sector output and, thus, suggest that the liberalization of the agriculture sector contributed to freeing up of resources for other sectors of the economy. In other words, there are some spillover effects of reforms in the agricultural sector on other sectors including services. These spillover effects from agricultural sector reforms on the services sector could partly be attributed to increase in the demand for financial services due to the income effect of increase in agricultural value-added. The effect of the trade reforms, likewise that of openness, confirm the assertion that the liberalization of the external trade sector has led to a booming service sector.

This follows the fact that the declining manufacturing sector in SSA is largely attributed to the increasing competition as a result of an increasing degree of trade openness, which has created a window of opportunity for trading in goods and services thereby boosting output of the service sector. This trend is evident across most economies in SSA as the influx of cheap imports from Asia (particularly China) has led to an increasing trend in businesses related to buying and selling of final product and services especially within the informal sector. The effect of foreign direct investment is, however, insignificant.

Industry

The results for the industrial value added equation (Table 4) once again confirm the positive impact of income, population and mineral resource endowments on the sectors output. The positive effect of mineral rents is not surprising given the fact that the industrial sector of many African economies (e.g. South Africa, Ghana, Nigeria, Botswana, etc.) is dominated by the extractive sector with gold, crude oil, diamond, copper, manganese and bauxite as notable examples.

Surprisingly, we find the effect of the infrastructure index to be (negative) insignificant. This signals the inherent inefficiencies that still pertain in the utilities subsector of most African economies. Despite the appreciable gains in SSA in improving accessibility to electricity and telecommunications, the sector is marred with huge inefficiencies in their service delivery as frequent power outages have increased cost of production and in some cases resulted in the shutting down of some industrial plants due to an inadequate supply of energy. For instance, the World Bank Enterprise survey (2012) revealed that firms in most African countries surveyed including Benin, Burkina Faso, Tanzania, Kenya and Cameroun indicated electric power outages as the main constraint to their businesses with respective percentages of 69.25, 68.97, 60.24, 48.15 and 64.94. The telecoms sector is also fraught with challenges as call drops, low internet speed, and limited coverage are highly associated with service delivery in the region.

Another interesting outcome is the insignificance of educational attainment. This evidence provides credence to calls for reforms in the educational sector to improve science, mathematics and technology based education so as to train manpower equipped with relevant skills to resuscitate the ailing industrial sector of most African economies.

On the influence of trade reforms and openness, we find a positive impact on industrial output. This result on trade openness contradicts assertions that trade liberalization is the key factor responsible for the declining industrial sector in the region. The agriculture reform index also shows a positive impact. Again, signalling the presence of a positive spillover effect of agricultural reforms on the industrial sector, which corroborates the findings in Blunch and Verner (2006). Abdulai and Rieder (1996) have also reported evidence of strong interdependence between agricultural and non-agricultural sectors.

Manufacturing

As indicated earlier, owing to the important role of the manufacturing sector on economic transformation via value added and employment generation, we consider in this subsection the main drivers of manufacturing sector value added. Results are shown in Table 5. The result for the manufacturing value added is quite similar to the overall industrial sector value added with few notable exceptions. Here, mineral rents are shown to have negative effects on the manufacturing sector, thus suggesting some level of competition between the extractive and the manufacturing. This perhaps suggests the dominance of the industrial sector by the extractive industries, thus freeing up little resources and policy actions towards the mainstream manufacturing subsector. Further, the results suggest a positive impact of agricultural reforms on manufacturing sector output. This attests to the contributions of the agro-processing firms which process agricultural produce like fruits and vegetables mainly for exports.

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Table 4: Role of policy reforms: industry

Variables	(1) industry	(2) industry	(3) industry	(4) industry	(5) industry	(6) industry	(7) industry	(8) industry	(9) industry
Lagged dept. variable	0.96456***	0.94999***	0.98324***	1.01705***	0.97615***	0.94684***	0.98095***	0.96529***	0.96956***
	(0.025)	(0.021)	(0.011)	(0.027)	(0.019)	(0.023)	(0.019)	(0.018)	(0.017)
log of population	0.01933	−0.03131	−0.03085	−0.23575	0.07767	−0.03312	0.09896**	0.00206	−0.00550
	(0.028)	(0.024)	(0.036)	(0.282)	(0.053)	(0.030)	(0.039)	(0.024)	(0.025)
log of per capita income	−0.01720	0.06082*	0.00313	−0.01201	0.06179	0.11444**	0.00830	0.03194	0.03468
	(0.059)	(0.033)	(0.035)	(0.081)	(0.041)	(0.042)	(0.044)	(0.048)	(0.055)
age dependency, young (% of total)	0.00218	0.00660***	0.00510**	0.00399	0.00934**	0.00811**	0.00571	0.00803**	0.00795**
	(0.003)	(0.002)	(0.002)	(0.006)	(0.003)	(0.003)	(0.003)	(0.004)	(0.004)
Mineral rents (% of GDP)	0.01282**	0.00420	0.00991	0.02402	0.00475	0.00381	0.00975	0.00217	0.00142
	(0.004)	(0.005)	(0.007)	(0.028)	(0.009)	(0.004)	(0.006)	(0.003)	(0.002)
Arable land (% of land area)	0.00595**	0.00519**	−0.00017	−0.00588	0.00603	0.00522*	0.00597	0.00474	0.00492*
	(0.002)	(0.002)	(0.003)	(0.011)	(0.004)	(0.003)	(0.003)	(0.003)	(0.003)
educational attainment	0.00222	−0.01113	−0.00915	0.00776	−0.02431	−0.01889	−0.01762	−0.00108	−0.00252
	(0.022)	(0.017)	(0.019)	(0.054)	(0.027)	(0.013)	(0.027)	(0.015)	(0.014)
agric reform index		0.21538***	0.12679	0.16509	0.12476**	0.22390***	0.10173	0.17953**	0.15985**
		(0.068)	(0.086)	(0.168)	(0.052)	(0.064)	(0.073)	(0.064)	(0.059)
trade reform index		0.24698**	0.19000**	0.25850	0.33023*	0.26404***			
		(0.083)	(0.064)	(0.187)	(0.144)	(0.062)			
financial reform index			0.13351	0.29615					
			(0.095)	(0.271)					
infrastructure index				0.26303	0.03590		0.06763		
				(0.345)	(0.173)		(0.148)		
Domestic credit to private sector (% of GDP)					−0.00036	−0.00096	−0.00018	0.00083	0.00096
					(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
openness								0.00283*	0.00234
								(0.001)	(0.002)
FDI % of GDP									0.00684
									(0.006)
Observations	111	111	82	45	64	108	64	108	108
Hansen test	8.9[1]	0.8 [1]	0 [1]	0[1]	0 [1]	5.9[1]	0[1]	5.9[1]	0 [1]
AR(1)	−1.9[0.06]	−1.81[0.07]	−1.42[1.6]	−0.9[0.3]	−1.23[0.2]	−2.2[0.03]	−1.61[0.1]	−1.87[0.06]	−1.15[0.25]
AR(2)	−0.3[0.77]	−0.69[0.49]	−0.50[0.6]	−1.4[0.2]	−1.16[0.2]	1.48[0.14]	1.62[0.1]	−0.54[0.59]	−0.81[0.42]

Notes: Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Dependent variable is real value added of the industrial sector, expressed in logs.

Table 5: Role of policy reforms: manufacturing

Variables	(1) manufacturing	(2) manufacturing	(3) manufacturing	(4) manufacturing	(5) manufacturing	(6) manufacturing	(7) manufacturing	(8) manufacturing	(9) manufacturing
Lagged dependent. variable	1.00989***	1.01039***	1.01720***	1.00500***	0.98136***	0.98013***	0.98857***	0.98243***	0.98302***
	(0.035)	(0.036)	(0.036)	(0.042)	(0.019)	(0.021)	(0.020)	(0.019)	(0.018)
log of population	0.04898*	0.05502	0.07746*	−0.11931	0.04377	−0.01054	0.07683**	0.01688	0.01327
	(0.026)	(0.039)	(0.039)	(0.319)	(0.042)	(0.023)	(0.028)	(0.020)	(0.021)
log of per capita income	−0.12853	−0.10660	−0.10109	0.04799	0.16488**	0.09628*	0.08334	0.07209	0.07437
	(0.158)	(0.144)	(0.148)	(0.111)	(0.066)	(0.051)	(0.060)	(0.051)	(0.048)
age dependency, young	−0.00888	−0.00777	−0.00766	0.01040	0.01417***	0.00737*	0.00865*	0.00972**	0.00953**
(% of total)	(0.011)	(0.011)	(0.014)	(0.007)	(0.004)	(0.004)	(0.004)	(0.003)	(0.003)
Mineral rents (% of GDP)	−0.00154	−0.00093	−0.00188	0.02577	−0.00971	−0.00439	−0.00166	−0.00670*	−0.00720**
	(0.004)	(0.006)	(0.008)	(0.034)	(0.007)	(0.005)	(0.004)	(0.003)	(0.003)
Arable land	0.00156	0.00188	−0.00093	−0.01031	0.00244	0.00477*	0.00241	0.00464**	0.00470**
	(0.003)	(0.002)	(0.003)	(0.012)	(0.003)	(0.002)	(0.003)	(0.002)	(0.002)
educational attainment	0.03079	0.02132	0.00776	0.02685	−0.01862	0.00450	−0.00798	0.00767	0.00799
	(0.026)	(0.020)	(0.031)	(0.068)	(0.031)	(0.013)	(0.030)	(0.013)	(0.013)
agric reform index		−0.00736	−0.04569	0.29117	0.18750**	0.12625	0.15329	0.09246	0.08837
		(0.133)	(0.166)	(0.204)	(0.080)	(0.076)	(0.106)	(0.068)	(0.069)
trade reform index		−0.10348	−0.13704	0.25006	0.51893**	0.05370			
		(0.137)	(0.155)	(0.298)	(0.181)	(0.138)			
financial reform index			0.10431	0.17396					
			(0.100)	(0.243)					
infrastructure index				0.09951	−0.10876		−0.05759		
				(0.516)	(0.221)		(0.196)		
Domestic credit to private sector (% of GDP)					−0.00093	−0.00011	−0.00065	0.00071	0.00068
					(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
openness								0.00311**	0.00277*
								(0.001)	(0.001)
FDI % of GDP									0.00390
									(0.005)
Observations	111	111	82	45	64	108	64	108	108
Hansen test	10.9[1]	0 [1]	0 [1]	0[1]	0 [1]	3.03[1]	0[1]	0[1]	1.86 [1]
AR(1)	−0.8[0.4]	−0.8 [0.4]	−0.73[0.46]	−0.9[0.36]	−0.93[0.35]	−1.2[0.24]	−1.61[0.1]	−0.8[0.4]	−1.2[0.2]
AR(2)	−0.06[0.95]	−0.02[0.98]	−0.07[0.95]	−1.46[0.14]	−1.6[0.1]	−0.3[0.76]	1.62[0.1]	−0.8[0.4]	−0.4[0.68]

Notes: Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Dependent variable is real value added of the manufacturing sector, expressed in logs.

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Again, we see an insignificant effect of education on manufacturing sector value added, thus indicating that exogenous variations in educational attainment has not yielded any significant impact on manufacturing sector output in SSA. This can be attributed to the slump in vocational, science and technology education in the region largely due to the lack of adequate financing and teaching aid to the sector thereby resulting in a growing lack of interest among students to go into science and technology education. For instance, according to the African Economic Outlook (2008) 'while enrolment in technical and vocational programs is quite high in North Africa (averaging 22.95 per cent of total secondary school enrolment between 2001 and 2005), the vocational education sector generally occupies a much smaller — if not marginal — position in school systems in countries in SSA (5.2 per cent between 2001 to 2005 with a falling trend since 2003) compared to the OECD countries in the same period (18.6 per cent) and other developing regions, such as Latin America (11.6 per cent) and South East Asia (9.5 per cent)'. Again, consistent with the results of the industrial sector, trade reforms and degree of openness show a positive impact on manufacturing output while the effect of infrastructure index remains insignificant.

4.3 Role of Governance and Fiscal Reforms

The focus of this section is to highlight the role of governance and political stability, as well as fiscal reforms in spurring economic transformation in the sampled economies. Thus we use an index of democracy ranging between zero and one, with one being the most democratic country and zero the least democratic country. In terms of fiscal reforms two indices are used: current account index — which measures the extent to which a country's government is compliant to IMFs Article VIII that enjoins member countries to avoid restrictions regarding proceeds from international trade in goods and services; and capital account index — which measures the extent of government 'controls on external borrowing between residents and nonresidents, as well as the approval requirements for FDI' (Giuliano *et al.*, 2013). Results are shown in Table 6.

Table 6: Role of governance fiscal reforms

Variables	(1) Agric	(2) Service	(3) Industry	(4) Manufacturing
log of population	−0.01135	0.03490	−0.02622	0.07035**
	(0.020)	(0.032)	(0.022)	(0.024)
log of per capita income	0.01915	−0.00312	0.00367	0.06216
	(0.025)	(0.039)	(0.038)	(0.035)
age dependency, young (% of total)	0.00482*	0.00311	0.00613**	0.00939***
	(0.002)	(0.003)	(0.003)	(0.003)
Mineral rents (% of GDP)	0.00364	0.00022	0.01675**	−0.00026
	(0.005)	(0.006)	(0.006)	(0.006)
Arable land (% of land area)	0.00318*	0.00629**	0.00017	−0.00154
	(0.002)	(0.002)	(0.003)	(0.003)
capital account index	0.07542	0.11824**	0.21293*	0.17512
	(0.096)	(0.050)	(0.113)	(0.147)
current account index	−0.17802**	−0.04102	0.00167	−0.00666
	(0.070)	(0.066)	(0.128)	(0.128)
democracy index	−0.05895*	−0.03159	0.05329	−0.03804
	(0.027)	(0.053)	(0.084)	(0.109)
Lagged dependent variable	0.98772***	0.98002***	0.99419***	0.99255***
	(0.009)	(0.010)	(0.018)	(0.016)
Observations	77	77	77	77
Hansen test	0[1]	0 [1]	0 [1]	0[1]
AR(1)	−1.9[0.06]	−0.99[0.32]	−1.940.05]	−1.17 [0.2]
AR(2)	−0.5[0.64]	−1.91[0.06]	−1.17[0.24]	−1.18[0.24]

Notes: Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.
Time dummies included. Values in brackets are p-values for diagnostic tests. Dependent variables are real value added of the respective sectors and expressed in logs.

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The results reveal that these fiscal reform and governance indices have varying effects on output of the sectors. Specifically, we see a positive impact of capital account liberalization index on value added output of service and industrial sectors. On the other hand, we derive a negative effect of current account reform index on real value added of the agricultural sector. This may be due to the fact that current account liberalization encourages exports of raw agricultural products while at the same time encouraging importation of food products from Asia, Europe and North America. This development hinders value addition to agriculture value added in the region. Interestingly, the effect of the governance index on the output of the agricultural sector is negative. This suggest that the declining share of agriculture output can be attributed to the thriving democracies in the region which provides incentives for people to engage in highly productive economic activities other than being stuck to subsistence agriculture.

5. Conclusions

The aim of this paper is to answer the question 'what drives structural transformation in sub-Saharan Africa?' Findings from this paper reveal that country specific fundamentals such as natural resource and human capital endowments are important determinants of differences in the rate of economic transformation within the SSA region. Institutions and policy reforms such as education, trade openness, financial development, real and financial sector reforms are important in driving economic transformation. Finally, the paper shows that governance and fiscal reforms are important determinants of transformation in SSA. Thus, efforts aimed at promoting good governance and building institutions are key instruments in promoting structural transformation in the region. The historically poor score of most of the countries in the region in terms of governance and institutional quality measures partly explains the region's slow pace in structural transformation and consequently, the slow pace of economic growth and development.

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African Development Review, Vol. 28, No. 2, 2016, 170–191

Accounting for Gender Equality in Secondary School Enrollment in Africa

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***Abstract*:** In addition to analyzing the characteristics of gender equality in secondary education enrollment in Africa, this paper empirically studies the key drivers of gender equality in secondary education enrollment, using cross-sectional time series data from 1970 to 2010. Our results show that the coefficient associated with the level of real GDP per capita is positive and statistically significant in both the overall Africa sample and in the sub-Saharan and North African samples. But the quadratic term of real GDP per capita is negative in sign and significant in the overall Africa and sub-Saharan African estimates. These provide evidence of a hump-shaped relationship between real GDP per capita and gender equality in secondary education enrollment in Africa. Our results also suggest that higher share of female teachers in secondary schools, increased democracy (at a decreasing rate), higher female share of the labor force, Christian dominance in a country, higher domestic investment rate, and being an oil-exporting country increase gender equality in secondary education enrollment in the continent. However, higher population growth tends to lower it. The policy implications and lessons of these results are discussed.

1. Introduction

Given the importance of gender equality in education to economic development, this paper focuses on the key factors affecting the attainment of the Millennium Development Goal (MDG) of gender equality in secondary education enrollment in African countries. This MDG #3 is important in its own right and is salient to all the other MDG goals. Indeed, as Smee and Woodroffe (2013) note, the goal on gender equality and women's empowerment in the new post-2015 framework (Sustainable Development Goals — SDGs) is essential to complement mainstreaming gender equality in the indicators and targets of all sustainable development goals and to provide the leadership and visibility necessary for effective implementation. It is also the reason that gender equality is on the public policy agenda of almost every country of the world today.

The focus on gender equality in secondary education in Africa is important for at least two reasons. First, women's education is essential in the fight against poverty. This is not only because of the direct and interrelated contribution education and hence employment makes to household welfare, but also because of the personal power it provides women in shaping and making family decisions and in redirecting household spending on essential needs, especially in favor of children's education and healthcare. Second, from a rights-based perspective, gender equality in education should be enhanced simply from the standpoint that, as recognized internationally, everyone deserves the same opportunities.

In addition, Africa has the lowest gender parity index in secondary enrollment, whether measured in gross or net terms. A key question will be: why has Africa been lagging behind other regions in attaining gender equality in secondary education? Thus, understanding the key factors affecting gender inequality in secondary education enrollment and what can be done about them in African countries is critical for any notion of human justice and general gender equality in national development.

Consequently, there are three key objectives of the paper. The first is to examine the extent of the gender gap in secondary education enrollment in African countries. The second is to examine the key factors that are associated to and responsible for high gender inequality in secondary education enrollment in African countries, using cross-sectional time series data. And the third is to make recommendations based on the empirical results, which are also useful for policy review, advocacy, and action towards the attainment of the MDG3 and SDG5 targets.

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This paper is laid out as follows. While Section 1 sets out the introduction, Section 2 briefly examines the importance of gender (in)equality in education. Section 3 reviews the status of gender equality in secondary education enrollment by global regions and in Africa, and shows that while the situation is improving, gender inequality still persists in Africa. Section 4 reviews the literature documenting empirical evidence of the factors determining gender equality in secondary education enrollment. Section 5 presents the econometric methodology and the data. The estimation results are presented and discussed in Section 6. Section 7 provides some concluding remarks and the policy implications.

2. Importance and Characteristics of Gender (In)Equality in Education

As the United Nations Children's Emergency Fund (UNICEF) (2011) states, gender equality entails that women and men, and girls and boys, enjoy the same rights, resources, opportunities and protections. In addition, it means that girls and women have agency to use those rights, capabilities, resources and opportunities to make strategic choices and decisions about the course of their lives without the fear of coercion and violence. Therefore, equality between boys and girls as well as between women and men is both a human rights issue and a precondition for, and indicator of, sustainable, people-centered development.

It is, therefore, not surprising that gender equality and the empowerment of women is one of the main attributes of the United Nations Millennium Development Goals (MDGs) program (see also Baliamoune-Lutz and McGillivray, 2009). Gender disparities in terms of opportunities and women's access to education have become important issues for the developing world and for African countries in particular. This is partly because of the potential negative effects that can result from the exclusion of women in education on both sustainable growth and poverty reduction (see Figure 1).

Indeed, as the World Bank (2012a, b) has noted, gender equality, whether in education or other areas is both about economic empowerment, fairness, equity, increasing productivity, reduction of efficiency losses, and widening of the base of taxpayers and contributors to social protection systems. It is also about improving the opportunities and outcomes of the next generation; enhancing development decision-making; greater opportunities for businesses to expand, innovate and compete; economic/business freedom; and fostering of stronger, better, fairer, more sustainable and inclusive growth and development (see also Anyanwu and Augustine, 2013).

Investments in education determine women's ability to earn higher wages and to own and operate productive farms and firms. On average, differences in education explain a significant fraction of the variation in wages and incomes among adults. According to the World Bank (2012a), in both high- and low-income countries, gender differences in education have contributed significantly to the productivity and wage gap between men and women. It is also posited that education investments in women

Figure 1: Why does gender equality matter?

Source: Adapted from Smee and Woodroffe (2013).

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are also special in other ways. First, in their roles as mothers, educated women pass on the benefits of higher education to their children. Children born to more educated mothers are less likely to die in infancy and more likely to have higher birth weights and be immunized.

Second, high maternal mortality rates have implications for educational investments and the ability of women to participate in society. Women face particular risks during pregnancy and childbirth. For example, in Angola, one in every 29 pregnant women dies during childbirth compared with one of every 11,400 in Sweden. Therefore, as the risk of dying in childbirth declines, educational investments increase (and more so for girls) (see World Bank, 2012a).

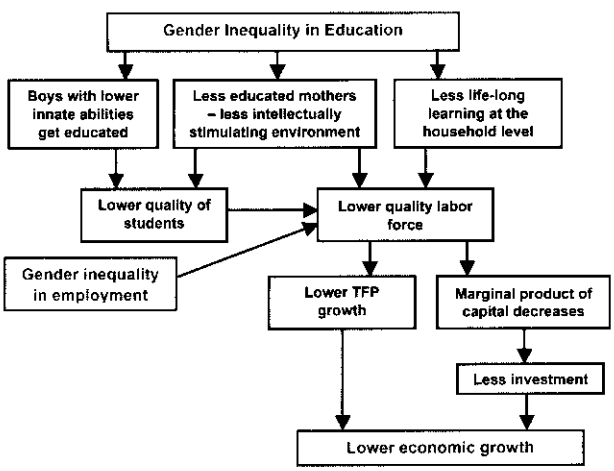
In addition, changes in education have also facilitated women's integration in the labor market. More educated women have traditionally exhibited higher participation rates than their less educated counterparts; so as education levels have increased around the world, more women have ventured into paid work (World Bank, 2012a). Evidence shows that women's access to education is associated with higher rates of participation in the labor market, better employment conditions and with higher access to decision-making positions (Darcy, 1987; Gaddie and Bullock, 1995). As Chen (2004) notes, having relatively less educated women tends to lower the intellectual environment at home, leading to a less productive workforce and lower economic growth (Figure 2). In the same vein, higher gender equality in terms of higher female education would indirectly lead to a transitory increase in economic growth via demographic effects (Figure 3).

3. Stylized Facts on the Status of Gender Equality in Secondary Education Enrollment

At the Millennium Summit in 2000, the 189 member states of the United Nations made a commitment in the Millennium Declaration to achieve eight goals, labeled the Millennium Development Goals (MDGs). The third goal on this list seeks to achieve gender equality and the empowerment of women. In setting this goal, the UN member states recognized the contributions that women make to economic development and the costs to societies of the multiple disadvantages that women face in nearly every country.

In 2000, 189 UN member states adopted the Millennium Declaration, which distils the key goals and targets agreed at the international conferences and world summits during the 1990s. Drawing on the Declaration, the UN system drew up eight Millennium Development Goals (MDGs) to provide a set of benchmarks to measure progress towards the eradication of global poverty. MDG 3, to promote gender equality and women's empowerment, includes one target on education and additional indicators on women's employment and political representation. Global agreement to include this goal was a very positive development and signaled a recognition by member states that gender inequality not only decreases the likelihood of achieving the other goals, but also that advancing gender equality and women's empowerment depends on progress made on each of the other goals. MDG 3, to promote gender equality and women's empowerment includes one target and three indicators. Target 3.A is to eliminate gender disparity in primary and secondary education preferably by 2005 and in all levels of education no later than

Figure 2: Gender inequality in education — selection-distortion and environment effects



Source: Adapted from Chen (2004).

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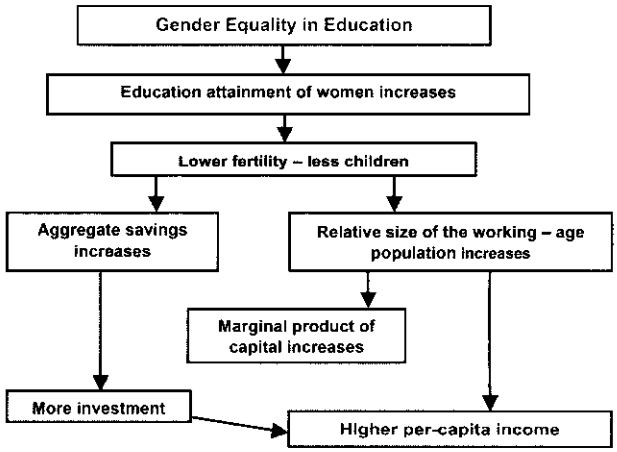
Figure 3: Gender equality in education — demographic transition effect



Source: Adapted from Chen (2004).

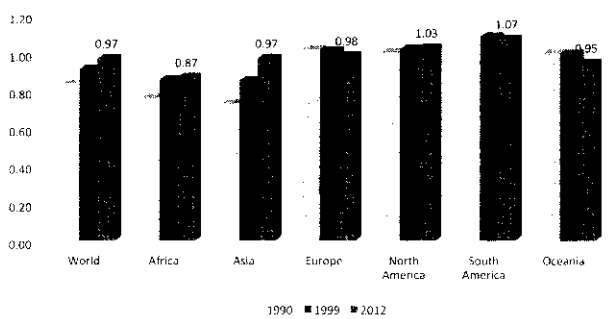
2015. Its related indicator (Indicator 3.1) is the ratio of girls to boys in primary, secondary and tertiary education. This is akin to goal 5 of the Sustainable Development Goals (SDGs) adopted in September 2015, which is that of achieving gender equality and empowering all women and girls. Specifically, target 5.c of SDG 5 is adopting and strengthening sound policies and enforceable legislation for the promotion of gender equality and the empowerment of all women and girls at all levels.

Gender parity in education is reached when the gender parity index (GPI), defined as girls' gross school enrollment ratio divided by the corresponding ratio for boys, is between 0.97 and 1.03. While there has been a general upward trend in the percentage of countries reaching gender parity in secondary education, the pattern has not been steady across the various regions. However, a closer look reveals significant gender disparities among regions. For example, GPI ranges from a high of 1.07 in South America (denoting an advantage for girls), to a low of 0.83 in sub-Saharan Africa.

As seen in Figure 4, South America is the top region, followed by North America, in terms of achieving parity at the secondary level. These are followed by Europe, Asia and Oceania where a majority of countries have done so. Africa has the lowest proportion of such countries. It also has the lowest GDI and still far from achieving equality in secondary enrollment. Indeed, in Africa, girls still face barriers to entering secondary school although substantial progress has been made over the past two decades. Africa had the lowest GPI of 0.87 in 2012 despite noticeable progress since 1990 (Figures 4 and 5). One of the most significant progress among developing regions was observed in Northern Africa, where the GPI increased from 0.77 to 0.98 (Figure 6).

Regional differences in GPI mask even greater differences among various countries. According to UNESCO (2012), GPI in the key African countries favoring male enrollment at the secondary school level include 0.41 for Chad, 0.46 for Somalia, 0.49 for Togo, 0.53 for Central African Republic, 0.56 for Democratic Republic of Congo (DRC), 0.59 for Guinea, 0.65 for Mali, 0.66 for Niger and Sierra Leone. These contrast with countries that favor females: 1.14 for Namibia, 1.15 for Libya and Cape Verde, and 1.28 for Lesotho.

Figure 4: Gross enrollment rate, secondary, gender parity index (GPI), 1990, 1999 and 2012



Source: Author, using data from UNESCO Institute of Statistics Online.

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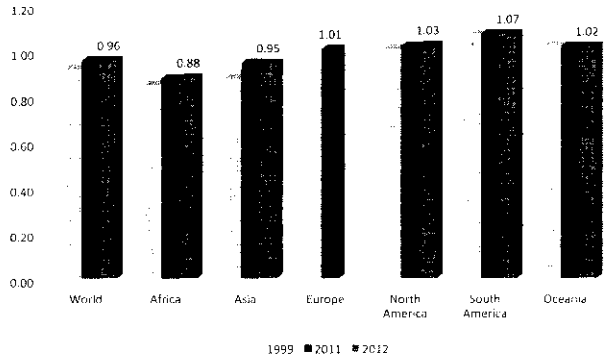
Figure 5: Net enrollment rate, secondary, gender parity index (GPI), 1990, 1999 and 2012



Source: Author, using data from UNESCO Institute of Statistics Online.

4. Brief Review of the Literature

From most studies, the various factors which hinder gender equality in education can be grouped broadly into two main categories: (a) on the demand side: socio-economic, familial and cultural factors which affect the behavior and the choices of parents and students; and (b) on the supply side: political, institutional/bureaucratic, infrastructural, contextual factors and factors linked to the school. The results have been limited access to schooling, low female enrollment, high school dropout rate (particularly at puberty age), low female participation in scientific/technical fields, high proportion of illiterate women, scarce or low scale employment opportunities, reduced contribution to national economic and social development, limited bargaining power, and absence from the political decision-making processes (UNESCO, 1997). Also, Subrahmanian (2002) summarizes key factors affecting gender equality in education to include macroeconomic context, household livelihoods and aspirations, prospects and capacities of individual children, and factors relating to schooling provision (see also Anyanwu, 1998). In the review that follows, we examine in depth recent key variables that have been found to be important in the literature.

4.1 Economic Development

Böserup (1970) argues that the initial stages of economic growth are characterized by a growing gender gap, which only begins to diminish once countries develop beyond a certain threshold. The explanation given is that productivity differentials are negligible prior to urbanization and they start growing with the emergence and development of an urban economy. Eventually, discriminatory practices diminish and women get greater access to education and training as well as greater bargaining power inside the household.

Figure 6: Gross enrollment rate, secondary, gender parity index (GPI), 1990–2012

Source: Author, using data from UNESCO Institute of Statistics Online.

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Recently, Eastin and Prakash (2013) find that economic development initially (i.e., below income levels of $4,000 per capita) enhances gender equality. The authors argue this improvement is due to increases in the following areas: female employment opportunities, women's intra-household bargaining power, female social networks, women's social status, and the cultural acceptance of female involvement in the formal labor market. However, as development progresses (i.e., between income levels of $4,000 and $8,000 per capita), the study finds a negative relationship between income and gender equality. The authors contend that at intermediate levels of development men begin to realize that although the size of the pie is growing, so to speak, their portion of it is getting smaller. The attendant backlash from entrenched patriarchal institutions, manifested in various ways such as occupational discrimination, acts to erode gender equality. Nonetheless, Eastin and Prakash find that the gender gap narrows beyond this point (i.e., above income levels of $8,000 per capita) as gender equitable social norms become more pervasive and as women develop the human capital necessary for advancement in the labor market.

While the work of Eastin and Prakash represents a valuable contribution to the literature, several shortcomings compromise the internal validity of this study. In addition to other variables such as Labor-Force Participation, and Female Parliamentary Participation, Eastin and Prakash use the Gender-related Development Index (GDI) and the Gender Empowerment Measure (GEM) as indicators of gender equality. However, according to the UNDP, 'the GDI is not a measure of gender inequality' (UNDP, 2009). As the GDI is the Human Development Index (HDI) adjusted downwards for gender inequality, the UNDP suggests using either the difference or the ratio of these two indicators to operationalize gender equality. Moreover, due to the nature of certain variables used to construct the index, a rich country cannot have a low GEM value and a poor country cannot have a high GEM value. Thus, as Dijkstra (2006) observes, the GEM reflects absolute welfare levels rather than the level of gender equality a nation has achieved. Therefore, Eastin and Prakash's study may not accurately measure gender inequality.

Dollar and Gatti (1999) study the impact of economic growth on the education gender gap and find strong evidence that increases in per capita income lead to reductions in gender inequality. However, the relationship seems to be nonlinear for secondary education: moving from being a very poor country to a lower or middle income one makes little difference in terms of gender gap. At higher stages of development, though, increases in income tend to reduce this gap. The authors claim that one possible explanation for this nonlinearity is that the market failures that hinder girls' education dissipate as countries become rich enough. Their results basically indicate that, as income increases up to a level of about $2,000 per capita (PPP adjusted), there is no tendency for female educational achievement to catch up with the superior male achievement. After that level of income, on the other hand, there is a strong tendency to catch up. This convex relationship comes through clearly when the data set is broken in half based on per capita income.

Easterly (1999) estimates the gender measure of female to male secondary school enrollment ratio with the only right-hand-side variable as per capita income. In a panel with fixed effects, he shows that there is a positive ('right' sign) relationship between income and gender equality. Easterly's work establishes that the correlation between income and gender equality in secondary education is not simply a cross-sectional association, but in fact is true for individual countries as they develop. Also, Easterly's (1999) fixed effects results show that female to male primary enrollment is significant with the 'wrong' (negative) sign with respect to income.

Employing OLS and IV panel regressions with country fixed-effects, Chen (2004) shows that while all of the estimated coefficients of the trend real GDP per capita variable are positive, none are statistically significant in affecting gender equality in primary and secondary education enrollment. In addition, the results show that increases in the level of ICT infrastructure and youth sex ratio tend to improve gender equality in education. Also, Chen's results show that education among the general population is important for improving gender equality.

4.2 Female Share of Secondary School Teachers

According to UNESCO (2012), one important factor that contributes to girls' success in school is the presence of female teachers who can serve as role models and send powerful messages to young girls. Female teachers can also make classrooms seem like safer and more inviting places for girls and young women and, in the process, encourage them to continue their education. The percentage of female teachers in primary schools roughly correlates with the gross enrollment ratios of girls' at the secondary level (UNESCO, 2012). For example, countries like Chad, Somalia and Central African Republic, are among the lowest both in their percentages of female primary school teachers and their proportions of females attending secondary school. By contrast, in all of the countries with female gross enrollment ratios of 100 percent, females make up at least two-thirds of the primary level teaching force. This correlation may partly reflect the impact that female role models have in making education more attractive to girls.

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4.3 Democracy

Cooray and Potrafke (2011) posit that democracy promotes gender equality, including, in particular, in education, since women can better express their views and interests in democracies. It is therefore argued that democracies promote gender equality through an educated middle class; democratic governments spend on educating girls; income redistribution and public good provision in democracies reduce pressure on sons to take care of their parents in old age and illness (when parents expect their sons to take care of them in old age, incentives of a family to invest in the education of a son rather than in the education of a daughter increase); and men in democracies have a self-interest in educating their daughters. Beer (2009) also argues that democracy facilitates gender equality through mobilization of women and electoral accountability: women can better organize to express their views and interests; they can obtain and disseminate information; and they may lobby for improving their status through education. Klasen and Wink (2003) note that women may also be empowered to positions of leadership since democracy increases women's bargaining power within the household, which can permit a mother to invest more in health and education of her children. In this sense, the improved bargaining position of a mother can improve the bargaining position of a daughter in relation to a son-in-law (Doepke and Tertilt, 2009).

On the other hand, it has been argued that political elites in autocratically ruled societies have incentives not to encourage education and investment in human capital because economic development will give rise to a middle class that will seek democratic institutions and accountability from government (Bourguignon and Verdier, 2000; Hillman, 2007; Welzman, 2010). Therefore, if education of girls is in particular conducive to economic development, self-preservation of political elites in non-democratic societies will be an explanation for gender bias against girls in education in government schools.

Empirical evidence on the influence of democracy on gender equality in education has produced mixed results. Using a sample of 105 high and low-income countries, Brown's (2004) results suggest that only an executive-recruitment sub-component of democracy has a positive influence on gender equality in education, measured as the average number of years women attended school divided by the average number of years men attended school in 1990. On the other hand, using a sample of 179 developed and low-income countries between 1960 and 2004, Beer (2009) finds that democracy may have negatively influenced gender equality in educational attainment measured as the difference between the average years of educational attainment of women and men. However, the results are sensitive to the inclusion of an illiteracy variable, the exclusion of which made the democracy variable positive. It is also argued that democratically elected governments have a greater incentive than authoritarian regimes to provide their citizens with primary schooling. Recent evidence from 12 African countries shows a clear link between democracy and greater provision of primary education (Stasavage, 2005, 2007).

Cooray and Potrafke (2011) investigate empirically whether political institutions or culture and religion underlie gender inequality in education. The dataset contains up to 157 countries over the 1991–2006 period. The results indicate that political institutions do not significantly influence education of girls: autocratic regimes do not discriminate against girls in denying educational opportunities and democracies do not discriminate by gender when providing educational opportunities. The primary influence on gender inequality in education is through culture and religion. Their results show that discrimination against girls is especially pronounced in Muslim dominated countries.

Dollar and Gatti (1999) have emphasized the role of legal rights, political freedom and religion affiliation; countries that invest poorly in women's education are characterized by social and cultural backwardness that limit their growth potential; moreover, they have found that more gender equality is associated with higher levels of family income. Noland (2005) concludes that the reason for the autocratic nature of nations with higher Muslim population is a reflection of being Arab rather than Islamic.

As indicated above, in the literature, religious practices and gender relations are examined by several studies and it is generally concluded that Islam as a reason of persistent gender inequality. For example, Fish (2002) analyzed the impact of Islam on literacy rate, sex ratio, women's political participation, and GEM by using cross-section data and concluded that, overall, the status of women in Muslim countries is inferior compared to non-Muslim countries. However, Fish explained that the only reason of this result is due to the democratic deficit in these countries.

4.4 Population Growth

To measure the effect of key demographic variables on gender equity in education, population growth is used. Increasing national population is expected to increase gender inequality in education. Rosaldo and Lamphere (1974) opine that freeing up large portions of women's lives and time from the basic reproductive roles is important for achieving gender equality because it allows

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them greater opportunities for participating in public spaces, becoming active agents in shaping culture, and thus changing it. Goldin and Katz (2000) argue that family planning and fertility decline mean that women could enter the labor force and avail themselves of the opportunity to get long- term education and pursue careers typically reserved for men. Amin and Lloyd (2002) argue that fertility declines appear to have empowered women by increasing their access to and control of resources, noting that increased school enrollment for girls, more access to credit, new ideas about reproductive control, and increased social networks as the key aspects of improved life options for women (see also Malhotra, 2012). Also, as Sajid (2014) had argued, population growth adversely affects gender equality in education. For example, as population increases, it expands the family size and the number of dependents, leading to low priority for women in education because female education is comparatively considered costlier than that of males since females would be married off in future, bringing little returns to the parents or siblings.

4.5 Culture/Religion

Cultural factors can exacerbate gender inequality as societal norms may inculcate reticence, value obedience and deference to males, and limit women's involvement in the public sphere, including school attendance. And Böserup (1970) acknowledges that cultural traditions, including the role of women in the traditional sector of market trade, seem to be a more important factor in determining the place of women in the modern trade sector than is the stage of general 'modernization' achieved by the country. In addition, patriarchal family structures, discriminatory labor practices, differential inheritance laws, and social mores shape the male-female power relationship and foster gender inequality. Some studies find that Muslim and Latin American countries are more likely to be characterized by entrenched patriarchal institutions (Böserup, 1970; Moghadam, 2004; Shukri, 1996). In a study of 143 countries and using an additive index of gender equality, Brym *et al.* (2005) investigate the relationship between gender parity and culture. They find a statistically significant negative relationship between Muslim nations and gender equality, explaining 10.6 percent of the variation in gender equality. Also, in their longitudinal study, Forsythe *et al.* (2000) find that gender inequalities are less likely to decline over time in countries with strong patriarchal institutional legacies.

As Seguino and Lovinsky (2009) argue, the nature of religions as organizational structures, which tend to be hierarchically structured and conservative rule-based institutions, is a strong explanation for their inculcation of gender inequitable norms. A further impetus towards hierarchy is related to the economic role organized religions play. To varying degrees, they have access to and control over material resources, and as such, exercise power to create and maintain social norms that perpetuate structures of power that preserve their control. Elite groups tend to capture power in institutions, and thus patriarchal dominance in the economic sphere is likely to be replicated in religious organizations.

Thus, as Norris and Inglehart (2004), Kardam (2005), and Sen (2007) argue, religious institutions may reflect patriarchal values in order to buttress the economic, social and political power of males to the disadvantage of women. If religious institutions inculcate gender norms and rules that disadvantage women, we might also expect they would hinder policy efforts aimed at closing gender gaps in important areas such as education.

Indeed, where patriarchal norms dominate the social landscape, the heterosexual family and the norm that women's primary role is to care for children and others, serving as unpaid homemaker, are emphasized. Also, sons tend to be more valued than daughters in patriarchal contexts.

Two transmission mechanisms exist on why religiosity might have an impact on education inequality. First, at the micro level, gender unequal attitudes act as a 'stealth' factor, shaping everyday decisions in labor markets, in household decision resource allocation, and through impacts on government spending and resource allocation. For example, families make decisions on which child to invest resources in. Thus, it is expected that insofar as religion affects norms and attitudes, there will be consequent and measurable effects at the country level on gender gaps in education. The second transmission mechanism is the effect of religious attitudes on government's distribution of resources (e.g., for education, health care) and regulation, such as enactment and enforcement of anti-discrimination legislation in education, among others. Therefore, in countries with dominant religions that are gender inequitable in their attitudes, it is possible that gender outcomes (such as access to education) are worsened through the government channel as well.

Empirical results from Seguino and Lovinsky (2009) indicate that the greater the degree of religiosity in a country, the more gender inequitable well-being outcomes (including access to education), even after controlling for level of GDP. According to these authors, the effect of religiosity is likely transmitted via a 'stealth' effect on everyday behavior in a variety of transactions and interactions, such as in labor markets, in household decision resource allocation, and through impacts on government spending and resource allocation.

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In a more recent paper, Seguino (2011) investigates the effect of religiosity on attitudes toward gender equality using World Values Survey data. Results indicate that religiosity is strongly correlated with gender inequitable attitudes across countries. In particular, OLS, TSLS, and 3SLS regression estimates reveal that gender inequitable attitudes are associated with negative effects on gender equality in education though no single religion stands out as more gender inequitable than others. Again, the conclusion is that the impact of religiosity is likely transmitted via 'stealth' effects on everyday behavior in economic transactions in labor markets, household resource allocation, and government spending.

According to Inglehart and Norris (2003), the reason for cultural conflict between Islamic countries and the West is not their political system (democracy), but gender equality. They find that Muslim societies are significantly less supportive on equal opportunities and rights for women. Rauch and Kostyshak (2009) analyze the gender gap in education and labor force participation in Muslim countries. They use the Muslim percentage of country's population as an explanatory variable and found that the gender gap in 100 percent of Muslim countries is 18.3 percent higher than a country with 0 percent Muslim population share. However, when they add a dummy variable for Arab countries, the Muslim ratio loses its significance. They conclude that the Arab effect explains the Islamic effect. According to their suggestion, if it is not the Islamic effect, there are two reasons to explain the results; social pressure on married Arab women due to the common belief of supporting them by husbands, and very strong beliefs and expectations about mothers to continue their careers as mothers at home. Abdelali-Martini (2011) also adds that staying at home, instead of working, is seen as a symbol of prestige for women in MENA region, which may explain these trends. Additionally, Donno and Russett (2004) concluded that the effect of Islam is much stronger and consistent in Arab countries.

However, studies analyzing gender equality in the 73 MENA region from the Islamic orientation point of view argue that Muslim countries still have some cultural and political drawbacks affecting equality within society (Fish, 2002; Inglehart and Norris, 2003). Dollar and Gatti (1999), Inglehart and Baker (2000) and Hillman and Jenkner (2004) indicate that religion and other aspects of culture including ethics and the absence of the rule of law can inhibit education of girls. Indeed, in the cases of radical Islam, education of girls may be punishable by death, for the girls and for their teachers, as recently evidenced in the case of Pakistani girls, whose faces Malala Yousafzai represents today. Therefore, Brotman *et al.* (2008) suggest understanding the role of political Islam (Law of Islam) in the Middle East and North Africa (MENA) region before understanding the policy or traditional culture in that region.

Using a sample of 97 high and low-income countries, Norton and Tomal (2009) find that the proportion of Hindu and Muslim adherents in a country has had a negative influence on female educational attainment, measured as the absolute differences between male and female percentages for four levels of educational attainment.

Cooray and Potrafke (2011), in a study of 157 countries, find that the primary influences on gender inequality in education are culture and religion. In particular, their results show a positive and significant effect of Christianity on girls-and-boys enrollment ratios at the primary and secondary level. By contrast, the results show that Islam and indigenous religion significantly and negatively affect gender equality in education at the primary and secondary levels. These results remain with or without the inclusion of Eastern European and high-income countries.

Also, Kucuk (2013) uses a cross-sectional data set for 209 countries to examine the relationship between gender inequality and its determinants, such as education in the MENA region. The aim is to test whether the regulation of social life by Islamic norms and values is related to gender inequality and whether the impacts differ for the MENA countries, as well as Arab and Muslim majority countries. The study finds that the impact on gender inequality differs for the MENA, Arab and Muslim majority countries only when control variables are excluded from the regressions. The apparently significant religious and oil impacts disappear once control variables, such as the institutional quality, education, and ICT, are incorporated into the regressions. Thus, the paper obtains empirical evidence against the belief that the religion and oil are culprits responsible for holding women back in the MENA, Arab, and Muslim majority countries.

Dollar and Gatti (1999) also find that high female primary attainment is associated with the Protestant religions and with good civil liberties, while low achievement is weakly associated with the Muslim and Hindu religions. The religious variables indicate the share of the population that follows a particular religion. There are also large positive coefficients on the Shinto variable (virtually an indicator for Japan).

4.6 Domestic Investment/Gross Capital Formation

One of the macroeconomic variables affecting gender equality in education is domestic investment. Domestic investment is a key source of employment, wealth creation and innovation. Increasing domestic investment levels is also fundamental to poverty

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reduction. Without it, countries are unable to spur the growth of their economies or to sustain the reduction of poverty over the long term. Where domestic investment is low, the productive capacity of the economy fails to increase. This results in lower rates of economic growth, fewer opportunities for the poor to improve their livelihoods, and lower rates of job creation. As Anyanwu (2013) had argued, the higher the value of investment rate, the more resources a government and the private sector ostensibly have at their disposal to spend on economic and social programs, including investments for education expansion and policies/programs for enhancing education equality. Domestic investment creates employment opportunities for females and increases economic growth which again enhances the states' ability to invest in social sector and women specifically. Domestic investment increases demand for inputs and consumption, resulting in increased skilled labor. This works as a motivation to invest in human capital expansion such as education. It also increases the productivity and efficiency of labor, resulting in increased employment level and lessening of the gender bias.

4.7 Share of Women in the Labor Force

Three key channels have been identified through which female participation in the labor force influences children's education. These are the income, greater bargaining power (empowerment), and substitution effects. First, an increase in mothers' labor supply could improve their children's outcomes purely due to an income effect. Second, mothers' say in household resource allocation decisions may rise due to their higher earned income as a result of her higher labor market participation, which, in turn has a positive effect on their children's schooling (see also Malhotra and Schuler, 2005). There is evidence that women in the labor force prefer to invest more in their children's health and education (see Blumberg, 1988; Thomas, 1990; Hoddinot and Haddad, 1995; Quisumbing and Maluccio, 2003) relative to fathers, thus improving children's education outcomes. Third, since women (including mothers) have more alternative uses of their time than men — market work, household chores and leisure — if mother's and children's time on household chores are not substitutes and child-care services in the market are either unavailable or unaffordable, then it is more likely that children are in school when mothers are at work. It must be noted, however, that if children's time in doing household chores substitutes for mother's time then an increase in labor force participation of mothers may lead to a decline in educational attainment of her children.

Those who find that increase in female wages decreases girls' time school include Skoufias (1993) and Grootaert and Patrinos (1999) while Ilahi (1999) does not find any impact on children's time use. Recently, Luke and Munshi (2011) for India and Qian (2008) for China show that increased female labor income has a positive effect on children's education. In addition, Qian (2008) finds that increased male labor income decreased educational attainment for girls but has no effect on boys' educational attainment. Also, Afridi *et al.* (2012) analyze the effect of the exogenous policy shock of the implementation of the National Rural Employment Guarantee Scheme (NREGS) on children's well-being, providing evidence which suggests that the mechanism through which children's educational outcomes improve is empowerment of mothers resulting from better labor market opportunities for females. They find that greater participation of women in NREGS works has a positive effect on her children's time in school. Moreover they find that this effect is largely on children in the poorest wealth group and for girls in the household.

4.8 ICT/Infrastructure

According to Chen (2004), there are several ways in which an established ICT infrastructure or a high level of ICT availability can lead to improvements in gender equality, including influencing public opinion on gender equality, increasing educational opportunities for females, and increasing economic opportunities for women. Since ICTs allow an increased flow of information and knowledge, their availability and use increased exposures to the customs, norms and practices of other cultures and societies. This in turn tends to increase awareness of issues surrounding gender inequality, which can positively change people's attitude, including women themselves, towards women by disseminating educational programs on gender equity. Also, increased pressure from an informed constituency that are sensitive to gender inequality issues can motivate, if not force, policy makers to include gender as an important component of their social and economic policies. In addition, ICTs can provide innovative ways for women to obtain and update their skills, for instance, through distance learning. It is recognized that ICTs that reduce time on family chores are likely to increase family members' ability to engage in educational opportunities. Further, it has been shown that new and emerging technologies, when accessible, can help people, by opening new education and economic (including employment) opportunities, breaking down information barriers, enabling people to take collective action, and helping those in isolated communities engage in educational activities and commerce. In this study, we use telephone and mobile phones (per 1,000 persons) to proxy infrastructure.

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4.9 Oil-producing and Exporting Countries

Another important issue is that most countries in the MENA region and Africa are oil-exporting countries, and in most studies, the oil sector is classified as the male dominated sector, which discourages women to enter the labor market (Moghadam, 2004; Ross, 2008) and hence promotes gender inequality. In such studies, this is analyzed as a 'cultural effect' in Muslim-dominated countries where female education, for example, is considered socially and culturally acceptable as long as it does not interfere with women's primary role as wives and mothers given the notion, belief and persistent stereotypes that motherhood and child care represent a 'woman's true vocation' (Blackburn, 2004; Stivens, 2006). However, in Africa, the pattern of gender equality in education in Africa partly reflects natural resource endowment structure, whereby gender equality in education is relatively higher in fossil fuel and mineral-rich economies. In addition, as the case of Tunisia demonstrates, legislation can codify social norms and 'gendered beliefs' into gender-equalizing education practices.

4.10 Sub-regional Effects

We include the five sub-regional dummies to capture sub-regional effects. In addition, to capture the effects of net oil exporters, we add two dummies representing net oil exporters and net oil importers.

Current research on gender (in)equality is subject to a number of key limitations. Firstly, as this section has demonstrated, the literature to date has primarily focused on the effect of economic growth on gender-based outcomes in lieu of other potential determinants of the gender gap. Given the increasing focus on reducing the role of government (including its consumption) in an era of fiscal constraints, an investigation of this relationship is merited. Moreover, given the role that oil production and exportation, culture, demographic factors, democracy, and the role that the number of primary teachers plays in promoting female school enrollment, and the impact of these factors on female empowerment, a comprehensive evaluation of these factors and their effect on gender equality is needed. In addition, in part due to data constraints, a large portion of the existing research is not disaggregated by major regions and does not compare North African to sub-Saharan African outcomes. This limits quantitative analysis and makes it difficult to uncover evidence of gender inequalities by sub-region.

Additionally, several studies use the household as the primary unit of analysis, dividing households into male- and female-headed households. While this distinction has been useful in demonstrating the extent of female poverty and the hardships experienced in female-headed households, it conceals the differential impact on women in male-headed households and obscures the complexities of intra-household gender relations. This data collection method erroneously assumes either perfect egalitarian sharing of resources within households or an asymmetric distribution across all households, with the former predominating (Razavi, 1997).

Finally, the overwhelming majority of the research to date is qualitative in nature, partially as a result of problems with data measurement and availability. Qualitative studies provide important insights into the nature of the gender gap in primary education enrollment in specific contexts and are able to uncover the mechanisms through which inequalities affect women's lives. However, unlike qualitative analysis, quantitative research is able to isolate the effects of certain factors on gender equality in education enrollment. Given the complex, often-interrelated nature of the determinants of gender (in)equality, a comprehensive quantitative study represents an important contribution to this burgeoning field of research.

5. The Model and Data

5.1 The Model and Estimation Techniques

Based on the above review and following the frameworks posited by Chen (2004), Tseloni *et al.* (2011), Eastin and Prakash (2013), and Anyanwu (2012, 2013), the relationship that we want to estimate can be written as:

$$logGESE_{it} = \alpha_0 + \beta_1 log(rgdppc_{it}) + \beta_2 log(rgdppc_{it}^2) + \beta_3(X_{it}) + \lambda_i + \delta_i + \varepsilon_{it}$$
$$(i = 1, ..., N; t = 1, ..., T) \quad (1)$$

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where $GESE_{it}$ is the measure of gender equality in secondary education enrollment (ratio of female to male secondary education enrollment) in country i at time t; α_0 is the constant term; β_1 is the elasticity of gender equality with respect to real per capita GDP in 2000, *rgdppc*; β_2 is the gender equality elasticity with respect to quadratic real per capita GDP; X is the control variables, including polity2 (democracy), female share of secondary school teachers, domestic investment rate, population growth rate, dominant religion (Christianity or Muslim), female share of the labor force, women's share in the labor force, information and communications technology (ICT) accessibility (fixed line and mobile phone subscribers per 1,000 persons), gross government final consumption expenditure (percentage of GDP). In addition, λ_i and δ_i denote country and oil fixed effects, respectively, while ε_{it} is an error term capturing all other omitted factors, with $E(\varepsilon_{it}) = 0$ for all i and t.

For robustness, our estimations are done with robust pooled OLS (OLS regression with robust standard errors) with regional and oil fixed effects and IV-2SLS with regional and oil fixed effects. In addition, one possible problem with Equation (1) is that it assumes that all of the right-hand side variables in the model — including per capita GDP — are exogenous to gender equality in primary school enrollment. However, it is possible that real per capita GDP may be endogenous to gender equality in primary school enrollment. Reverse causality may be taking place: real per capita GDP may be increasing gender equality in primary school enrollment, but gender equality in primary school enrollment may also be affecting the level of real per capita GDP. Without accounting for this reverse causality, the estimated coefficients in Table 2 may be biased. One way of accounting for possible endogenous regressors is to pursue an instrumental variables approach. Therefore, to deal with this problem, we also estimate the equation, instrumentalizing real per capita GDP variable with its two lagged levels, using a two-step (IV) estimation method.

5.2 The Data

Data (1970 to 2010) for the variables in Equation (1) are largely drawn from the World Bank's WDI Online database, except democracy from the Polity IV Project Online (2013) and religious dominance from the World FactBook. The descriptive statistics are presented in Table 1. It reports the sample mean and standard deviation of the variables used in the estimations. The data covers 53 African countries.

Figure 7 shows a non-linear (curvilinear) (inverted U-shaped) relationship between average gender equality in secondary education enrollment and per capita GDP over the period 1970 to 2010. The inflexion point (marking different phases in the evolution of gender equality in secondary education enrollment for the curvilinear relationship is around a per capita income of US$4,000.

6. Empirical Results and Analysis

Table 2 shows the results when Equation (1) is estimated using the robust pooled Ordinary Least Squares (OLS) with country and oil fixed effects. Table 3 presents the IV-2SLS results. The consistency of the IV-2SLS estimators depends on whether the

Table 1: Descriptive statistics of main regression variables (excluding dummies), 1970–2010

Variable	Observations	Mean	Standard Deviation
Gender equality in secondary school enrollment	1239	69.05	28.22
Real GDP per capita	1884	952.71	1385.10
Female share of secondary school teachers	727	27.64	14.04
Polity 2	1917	–2.47	5.83
Population growth rate	2173	2.53	1.24
Christian dominance	2173	0.66	0.47
Moslem dominance	2173	0.34	0.47
Domestic investment (%GDP)	1856	20.91	10.58
Female share in the labor force	1560	41.05	8.52
Phone subscription rate (per 1000 persons)	1854	2.10	4.16

Note: These are raw data before the log and other transformations.
Source: Authors' calculations.

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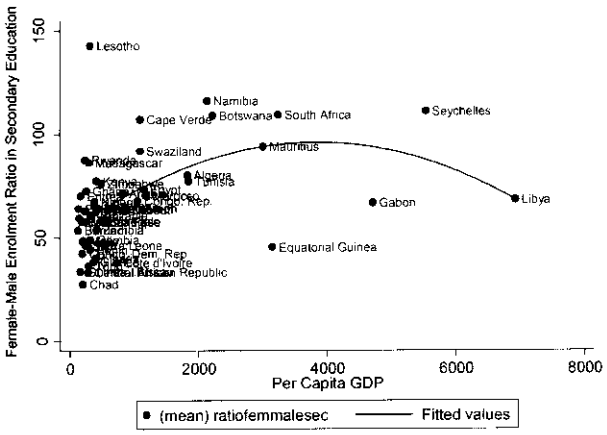
Figure 7: Africa: Humped-shaped correlation between gender equality in secondary education enrollment and GDP per capita, 1970–2010



Source: Author, using estimation data.

instruments are valid in the gender equality in education regression. We examine this issue by considering the tests of over-identifying restrictions. The no rejection of the null hypothesis implies that instrumental variables are not correlated with the residual and are satisfying the orthogonality conditions required. The IV-2SLS results pass the relevant tests. For example, the Sargan test of overidentifying restriction fails to reject that the instruments are valid, that is, not correlated with the error term at conventional significance levels in the reported regression (p-value of 0.4107 in Africa column, 0.4916 in the sub-Saharan Africa column, and 0.7055 in the North Africa column). All variables have basically the same behavior as in the robust pooled OLS estimates. Our discussion therefore focuses on the robust pooled OLS results.

The level of institutionalized democracy is found to have a statistically significant, positive impact on gender equality in secondary education in the overall Africa and sub-Saharan Africa estimates (but not in North Africa where it is significantly negative). This supports a number of existing literature that more open, democratic societies promote gender equality in education.

In our results, the coefficient associated with the level of real GDP per capita is found to be positive and statistically significant in both the overall Africa sample and in the sub-Saharan and North African samples. To test the hypothesis that real GDP per capita has a non-monotonic relationship with gender equality in secondary education enrollment, the squared real GDP per capita is included as an explanatory variable. The quadratic term is negative in sign and significant in both the overall Africa and sub-Saharan Africa (SSA) samples but not in the North African sample.

The results for Africa and SSA provide evidence of a humped-shaped relationship between real GDP per capita and gender equality in secondary education enrollment. Thus, this result suggests that although higher levels of real GDP per capita are positively associated with gender equality in secondary education enrollment in Africa as a whole and in SSA, the effect is not constant. Rather, for levels of real GDP per capita above a certain point (US$4,000), higher levels of real GDP per capita act to decrease gender equality in secondary education enrollment in Africa, holding other factors constant. This relationship suggests that the marginal effect of real GDP per capita exhibits decreasing returns for gender equality in secondary education enrollment in African countries. Thus, this finding supports Eastin and Prakash (2013) but refutes Böserup's (1970) assertion of a U-shaped relationship between economic development and gender equality.

Holding other factors constant, an increase in the female share of secondary school teachers employed in a country is found to be positively correlated with an increase in the ratio of girls to boys in secondary education. As seen in Tables 2 and 3, this result is statistically significant at the 1 percent level. Our estimates suggest that, on average, a 1 percent increase in the female share of secondary school teachers will lead to about a 0.12 percent increase in gender equality in secondary education in Africa as a whole and SSA but about 0.05 percent in North Africa. As seen in Table 2, democracy is positive in sign and significant at the 1 percent level. Thus, holding other variables constant, more democratic societies tend to experience greater levels of gender equality in education. This confirms earlier findings such as Anyanwu and Erhijakpor (2007).

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Table 2: Robust ordinary least squares estimates of the determinants of gender equality in secondary school education (with regional and oil fixed effects)

Variable	Africa	Sub-Saharan Africa	North Africa
Log of Real GDP per capita	28.03 (2.36**)	28.841 (2.28**)	21.398 (4.13***)
Log of Real GDP per capita^2	–2.118 (–2.30**)	–2.155 (–2.20**)	
Female share of secondary school teachers	1.168 (14.56***)	1.177 (13.85***)	0.522 (3.96***)
Polity2	1.020 (9.25***)	1.168 (9.47***)	–0.369 (–3.16***)
Polity2^2	–0.054 (–2.02**)	–0.065 (–2.12**)	
Population growth rate	–3.839 (–5.25***)	–3.918 (–5.19***)	–6.520 (–3.27***)
Christian dominance	3.639 (1.84*)	4.153 (2.08**)	
Moslem dominance			
Domestic investment (%GDP)	0.254 (3.07***)	0.282 (3.33***)	–0.352 (–2.34**)
Female share in the labor force	0.268 (2.21**)	0.202 (1.53)	0.861 (1.95*)
Phone (per 1000 persons)	–0.068 (–0.33)	–0.274 (–1.33)	0.847 (3.54***)
Net oil exporters	4.090 (2.49**)	3.498 (1.68*)	–0.884 (–0.47)
Net oil importers			
West Africa	–4.594 (–1.68*)	–9.020 (–3.10***)	
Central Africa	–0.500 (–0.13)	–4.936 (–1.60)	
East Africa	8.435 (2.74***)	4.147 (1.57)	
North Africa			
Southern Africa	5.388 (1.54)		
Constant	–54.809 (–1.40)	–50.935 (–1.25)	–98.241 (–2.33**)
R-squared	0.8009	0.8141	0.9427
F-statistic	116.90***	132.72***	142.24***
Prob > *F*	0.0000	0.0000	0.0000
N	419	345	74

Note: *t*-values are in parentheses; *** 1% significant level; ** 5% significant level; * 10% significant level.
Source: Author's estimations.

However, it contrasts with Huber *et al.* (1997) who maintain that democracy could reduce gender inequality by increasing expenditures on social programs just as Eastin and Prakash (2013) find little evidence that democracy is associated with gender equality. The quadratic term included to determine whether democracy has a nonlinear effect on gender equality in secondary education enrollment is also negative in sign and statistically significant in the overall African and sub-Saharan African results. This suggests that the marginal effect of institutionalized democracy, like real GDP per capita, exhibits decreasing returns for gender equality in secondary education enrollment in overall African and sub-Saharan African results.

Population growth rate has a negative and highly statistical significant effect on gender equality in education in all-Africa, SSA and North Africa samples. Thus, the higher the rate of population growth in a nation, the lesser the level of gender equality in education in that country. Our estimates suggest that, on average, a 1 percent increase in the overall population will lead to about 0.4 percent decrease in gender equality in secondary education in African countries.

One of the coefficients associated with culture — as proxied by countries with a majority Christian population — is found to be positive in sign and statistically significant at the 10 percent level for the overall Africa sample and 5 percent for the SSA results. Holding the other variables in the model constant, countries with a majority Christian population experience a lesser gender gap than countries with a majority Muslim population. These results confirm the findings of Forsythe *et al.* (2000), Spierings *et al.* (2008), and Inglehart and Norris (2003) that the Muslim-majority countries have more gender gap than less-Muslim majority ones. In spite of the statistically significant relationship we find in the paper, the result potentially masks large differences between Muslim countries. For instance, Muslim-majority nations vary widely in their geography, abundance of natural resources, per capita GDP, and their interpretation and application of Sharia law.

Domestic investment rate has positive and highly statistical significant effect on gender equality in education in all-Africa data and SSA samples. As seen in Table 2, domestic investment rate is positive in sign and significant at the 1 percent level. Our estimates suggest that, on average, a 1 percent increase in the share of domestic investment rate will lead to about a 0.03 percent

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Table 3: Robust IV-2SLS estimates of the determinants of gender equality in secondary school education (with regional and oil fixed effects)

Variable	Africa	Sub-Saharan Africa	North Africa
Log of Real GDP per capita	29.869 (2.49**)	30.605 (2.41**)	22.463 (4.43***)
Log of Real GDP per capita^2	-2.255 (2.42**)	2.284 (-2.32**)	
Female share of secondary school teachers	1.176 (14.77***)	1.185 (14.08***)	0.514 (4.21***)
Polity2	1.010 (9.29***)	1.155 (9.50***)	-0.369 (-3.40***)
Polity2^2	-0.054 (-2.05**)	-0.065 (-2.15**)	
Population growth rate	-3.576 (-4.75***)	-3.639 (-4.65***)	-6.460 (-3.56***)
Christian dominance	3.291 (1.68*)	3.829 (1.95*)	
Moslem dominance			
Domestic investment (%GDP)	0.259 (3.18***)	0.287 (3.46***)	-0.357 (-2.54**)
Female share in the labor force	0.274 (2.28**)	0.208 (1.60)	0.884 (2.21**)
Phone (per 1000 persons)	-0.049 (-0.24)	-0.260 (-1.27)	0.811 (3.30***)
Net oil exporters	3.993 (2.48**)	3.377 (1.65*)	-1.201 (-0.68)
Net oil importers			
West Africa	-10.054 (-3.62***)		
Central Africa	-5.677 (-1.99**)	-4.725 (-1.55)	
East Africa	3.179 (1.29)	4.322 (1.67*)	
North Africa	5.656 (1.64)		
Southern Africa			
Constant	-56.403 (-1.43)	-57.816 (-1.41)	-105.928 (-2.67***)
R-squared (overall)	0.8006	0.8139	0.9427
Wald chi^2	1798.89***	1916.18***	1306.03***
Prob > F	0.0000	0.0000	0.0000
N	416	342	74
Sargan test	1.780 ($p = 0.4107$)	1.42001 ($p = 0.4916$)	0.142781 ($p = 0.7055$)
Durbin test	0.134036 ($p = 0.9352$)	0.18531 ($p = 0.9115$)	0.338444 ($p = 0.5607$)
Wu-Hausman test	0.063324 ($p = 0.9386$)	0.089117 ($p = 0.9148$)	0.305613 ($p = 0.5823$)

Note: t-values are in parentheses; *** 1% significant level; ** 5% significant level; *10% significant level.
Source: Author's estimations.

increase in gender equality in secondary education in African countries. However, its effect is negative and significant in the North Africa estimation. The North African result could be attributed to wastages, inefficiency, and corruption associated with most investment projects in many African countries. Indeed, investment in white-elephant, unproductive activities, remains a development challenge in a number of African countries.

The share of females in a nation's labor force has positive and statistical significant effect on gender equality in education in all-Africa data and North Africa sample. Thus, the higher the proportion of women in a nation's labor force, the higher the level of gender equality in education in that country. Our estimates suggest that, on average, a 1 percent increase in the share of women in the labor force will lead to about a 0.03 percent increase in gender equality in secondary education in all African countries but about 0.09 percent in North African countries.

Our results show that the coefficient of the ICT infrastructure variable is positive and highly statistically significant only in the North Africa data. In this case, we can conclude that, in North Africa, increases in access to ICT infrastructure tend to lead to improvements in equality in education. This result is consistent with those of Chen (2004) who used five different indicators of ICT infrastructure (the number of computers per 1,000 persons, the number of Internet users per 1,000 persons, the number of telephones per 1,000 persons, ICT expenditure as a share of GDP and ICT expenditure per capita to estimate their effect on the ratio of the female to male enrollments in primary and secondary education. However, our ICT infrastructure proxy is negatively statistically insignificant in the all-Africa and SSA estimations.

Our results also show that net oil-exporting countries in Africa have more gender equality in education compared to net oil-importing countries in the overall Africa and SSA estimations — but negatively insignificant in the North African case. As both Tables 2 and 3 show, the dummy for net oil-exporting countries is positive in sign and significant at the 1 percent level. These

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results suggest that, holding other factors constant, net oil-exporting countries in Africa (except North Africa) experience higher levels of gender equality in education than net oil-importing countries. In this sense, our results fail to lend support to the hypothesis advanced by Inglehart (1997) and Ross (2008) that oil-exporting nations tend to increase gender inequality by excluding women from the formal economy.

The sub-regional fixed effects, which shift the intercepts, have varied performance, depending on the region. For example, in our basic overall estimation, East African countries have more gender equality in secondary school enrollment compared to West Africa.

7. Conclusion and Policy Implications

Our results show that the coefficient associated with the level of real GDP per capita is positive and statistically significant in both the overall Africa sample and in the sub-Saharan and North African samples. But the quadratic term of real GDP per capita is negative in sign and significant in these estimates. These provide evidence of a hump-shaped relationship between real GDP per capita and gender equality in secondary education enrollment in Africa. Our results also suggest that higher share of female teachers in secondary schools, increased democracy (at a decreasing rate), higher female share of the labor force, Christian dominance in a country, higher domestic investment rate, and being an oil-exporting country increase gender equality in secondary education enrollment in the continent. However, higher population growth tends to lower it.

What are the implications of these results for African countries? First, our results confirm that prosperity (higher economic development) promotes equality in education in African countries. In particular, increases in GDP per capita, a measure of standard of living, led to a large increase in gender equality in education in Africa, especially at their current initial levels of development. Therefore, African countries must take measures to increase their national incomes. To increase per capita income, African countries must deepen macroeconomic and structural reforms to increase their competitiveness, create more and higher quality jobs and hence increase participation in economic activity, dismantle existing structural bottlenecks to private and public investment, and scale up investments in hard and soft infrastructure to enhance local production and regional integration. Others are to structurally transform the economy for increased trade competitiveness in knowledge-intensive manufacturing, and increase productivity, especially in agriculture, through creating incentives and opportunities for the private sector and increasing government support to small farm holders in terms of finance, formalization of land ownership, and technical advice.

Second, our results indicate that the higher the percentage of female secondary school teachers, the greater the level of gender equality in education. More female teachers should be encouraged to take to teaching since UNESCO (2012) has shown that one important factor that contributes to girls' success in school is the presence of female teachers who can serve as role models and send powerful messages to young girls. Achieving higher government expenditure to hire more teachers, especially female ones at the primary school level must remain as an active goal of governments. A key challenge, therefore, for African countries is to mobilize increased resources for such high education expenditure. Successful generation of resources in Africa will require actions and measures at the national and regional levels. Apart from continuing to deepen the reforms (macroeconomic and institutional) that they have embarked on in the last decade, African countries need to increase efforts at the mobilization of higher domestic savings, including through the implementation of tax reforms, cost sharing in the provision of public goods and services and enhancing public expenditure productivity. Tax reforms should focus on broadening the tax base, emphasizing indirect taxes/value added tax (VAT) (and hence keeping marginal and average income tax rates low), raising tax elasticity with respect to economic growth, reducing exemptions, simplifying and improving tax administration, especially developing more efficient and effective tax collection systems.

Third, the promotion of effective democracy will help in the design of policies friendly to gender equality in education. This requires political will, commitment, good governance (including the control of corruption, transparency and accountability, the rule of law, government effectiveness, and political stability), inclusive development, collaborative spirit to formulate and faithfully implement the requisite policies, strategies, plans and collective action as well as the institutional changes needed for increased gender equality in education. Following their empirical results, Anyanwu and Erhijakpor (2014) advance critical measures to promote democracy in Africa, including promoting and maintaining effective rule of law, deepening macroeconomic and structural reforms and increasing investments to raise national income, and implementing greater economic and political inclusion, especially in North Africa. Democracy will thrive and be sustained and stable when there is the willingness to lose (contestation) and when there are capacities to challenge and enforce the rules of the game. Contestation means that parties are able to win but are willing to lose. In other words, opposition parties have to be able to compete effectively with incumbents, with the credible potential to hold incumbents accountable while voters and parties must be willing to lose

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elections. Also, laws must be effectively enforced. This means that a sturdy, thriving, durable and stable democracy requires a government with the capacity to enforce both the rules of the game and the policies produced through those rules against violation or nullification either by abusive agents of the government itself or by private actors, whether common criminals, would-be warlords or the military.

Fourth, given our finding that government consumption expenditure mostly reduces gender equality in education, achieving government expenditure effectiveness must remain an active goal of governments in Africa. Adoption of high level best practice principles to inform the development of these processes will help African governments achieve this. Those broad principles should include the following key elements: a nationally coordinated approach to the development of significant strategic projects and programs; and the promotion of competitive markets. Others relate to decision-making based on rigorous cost-benefit analysis to ensure the highest economic and social benefits to the nation over the long term; a commitment to transparency at all stages of the decision-making and project implementation processes; and a public sector financial management regime with clear accountabilities and responsibilities. At the same time, efforts to reform the fiscal system for consolidation by both the executive and legislative arms of government are imperative to reduce government consumption expenditure to avoid wastes, corruption and crowding out resources for public sector investment and gender equality. In addition, public spending on education (as well as on health and other human capacity), when targeted at women, especially the poor, can produce a double dividend, reducing gender inequality in education in the short run and increasing the chances for women to access formal jobs and thus break free from the poverty trap.

Fourth, given our finding that the domestic investment rate increases gender equality in education in most of Africa, achieving higher levels of investment as its effectiveness must remain an active goal of governments in Africa. A key challenge, for African countries, therefore, is to mobilize increased resources for high domestic investment. Successful promotion of investment in Africa will require actions and measures at the national and regional level as indicated earlier. Further efforts should also be made to improve the efficiency and effectiveness of public institutions, if these are to serve as genuine partners with the private sector. Sustainable domestic investment needs increased human capital investment to enhance the health and welfare of populations and generate the skills required in a competitive global environment.

Fifth, given that gender inequality in secondary education increases with population growth, there is urgent need to intensify family planning services efforts and activities in Africa so as to improve knowledge, acceptance and practice (KAP) of family planning. This will involve not only increased financial outlay but also research on fertility determinants as well as decentralized planning, delivery and supervision of family planning services (Anyanwu *et al.*, 1998a, 1998b). Governments at various levels need to address the problems of low access to contraceptives by married couples and high child mortality. A clear focus on healthcare and the structural issues, with free or subsidized contraceptives for married couples who lack access and scaled up public health education will go a long way in reducing population/family size and its poverty-related costs.

Sixth, policies to transform cultural/social norms and practices, especially in predominantly Muslim countries, are essential. In particular, the process of rapid urbanization in most African nations that is currently underway brings with it the possibility of newly defined roles for men and women, as traditional social norms and production relations become more relaxed and new parameters regarding appropriate forms of behavior are formed. The education system should also be used as an important means to change gender inequality and promote social norms from a young age. Indeed, the integration of gender equality principles into the school and professional curricula can tackle the value system of children early on and challenge discriminatory social norms. In addition, promoting women's voice and participation in public settings and increased information obtained from exposure to enlightened television programming also play a critical role in changing social norms.

Seventh, we have shown in this study that being a net oil exporting country increases gender equality in primary education across African countries. Thus, efficient management of oil and other natural resources in Africa requires actions throughout the value chain. In particular, a new natural resources management framework is needed for better governance, sectoral linkages, economic growth and human, capacity and infrastructure development — with strong parliamentary legislation, oversight, and representation throughout the resources value chain (Anyanwu, 2012). Given that oil, gas and mineral resources are non-renewable resources, it is vital to negotiate more beneficial and transparent contracts with oil/mining multinational corporations operating in Africa, and ensure that these companies do not evade taxes. For greater returns to African countries in terms of royalties, for example, the governments should engage in auctions for oil/mining rights. In this regard, international financial institutions like the African Development Bank have a critical role to play in helping these countries acquire the much-needed capacity not only to negotiate beneficial contracts but also for effective management of natural resource revenues. Other measures to promote efficient and effective allocation of public expenditure include promoting high levels of transparency, ensuring that the political system has a centralized system of financial authority and control, and the legislation of a 'fiscal

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constitution' that imposes ceilings (and perhaps also floors) on public spending from resource revenues (Anyanwu and Erhijakpor, 2014).

The range of strategies that we have proposed in this paper based on our empirical results to promote greater gender equality in education addresses key supply and demand constraints. In conclusion, it is important to note that the post-2015 MDG campaign offers an opportunity to attend to the unfinished business of development by fulfilling the promises made by world leaders to reduce poverty, end hunger, improve health and eliminate illiteracy. Gender inequality fuels many of these ubiquitous challenges and is exacerbated by them. Conversely, gender equality and the empowerment of women can secure the future of women themselves, their households, and the communities in which they live. Ensuring that girls/women do not continue to suffer the disadvantage of illiteracy and lack of education is critical for building women's capabilities, a first step in the empowerment process. It is also an essential ingredient for ensuring child health and welfare, reducing maternal mortality, and breaking the cycle of intergenerational poverty. Collectively and individually working towards equality between girls/women and boys/men in education is vital if girls and boys are to look ahead to a better future.

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African Development Review, Vol. 28, No. 2, 2016, 192–200

The Tiebout Hypothesis in Africa: Evidence from Angola*

Carlos P. Barros and Jelson Serafim**

***Abstract*:** This paper analyses the Tiebout hypothesis in Angola's provinces from 2004 to 2013, using a spatial panel data model. The Tiebout hypothesis, which states that a country's internal migration is dictated by regional public policy, is tested. Angola's internal inter-provincial migration is related to gross domestic product per capita, local public expenditure, unemployment, poverty, population density, the number of public employees in the region, and a NGO for civic education. The results reveal that spatial autocorrelation is a reality in the Angolan context, validating the adoption of a spatial model, and that regional migration is explained by the covariates. The general conclusion is that the Tiebout hypothesis is accepted in the Angolan regions, and that the most important cause of migration is regional poverty. Policy implications are derived and it is concluded that an efficient anti-poverty policy is needed in the Angolan context at regional level in order to decrease internal migration.

1. Introduction

The Tiebout hypothesis (1956) posits that regional migration is considered in regional public policy and that, as a result, residents vote with their feet, by migrating. According to this hypothesis, public goods are localized, which signifies that the consumption of public goods and locations are bundled together, and that residents move between distinct locations attracted by the best public goods on offer. This hypothesis has been tested in the USA (Cebula and Clark, 2013; Cebula, 1979) and Canada (Rubio, 2010), but not in Africa. This paper tests the Tiebout hypothesis in Angola at a regional level, using spatial models. The paper innovates in this context, as it focuses on Angolan provinces and it adopts a spatial econometric model. Research focusing spatial analysis in Africa includes Sassi (2015) and Wondemu (2015).

The motivation for this research is as follows: first, we noted the persistence of internal migration in Angola, which is well documented in statistical reports from the period 2004 to 2013. Migration in the 1990s was justified by the civil war, but subsequently it was found that this justification is no longer sustained by the regional public police, which explains the reason for this research. Secondly, there are no distinct municipal or provincial taxes in Angola, which signifies that migration is explained by other factors. Moreover, there is no public debt in the Angolan provinces. Public expenditure is consequently the main regional tax instrument. Thirdly, as the Tiebout hypothesis relates to a regional effect, this paper adopts a spatial analysis at a regional level, which is coherent with regional effects. Fourthly, the paper aims to uncover distinct causes for people to vote with their feet in the African context. As regional taxes are common in all provinces in Angola, migration is explained by other factors that are not under the control of the regional provinces, such as available jobs and the distinct wealth effect, as measured by GDP per capita. However, regional public expenditure could compensate for the distinct regional dispersal of natural resources among certain provinces. Finally, this paper focuses on internal migration, which is so prevalent in Angola and which has never previously been researched.

The paper is organized as follows: after the introduction, the contextual setting of the Angolan provinces is described, followed by the literature survey. Next, the methodology used in this paper, the theoretical background and the hypotheses are presented. The data and results are given in Section 6, followed by a robustness test, and Section 7 concludes.

*Research for this paper was undertaken with the support of the Calouste Gulbenkian Foundation.

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2. Contextual Setting

Angola is situated in West Africa, north of Namibia and south of the Congo. It is a vast country, with a population of around 20 million, located in 18 provinces. Governed by a parliament, the country's provinces are controlled by a governor, who is nominated by MPLA — Movimento Popular de Libertação de Angola. This political party was originally a Marxist guerrilla group emerging victorious from the civil war that affected Angola after the fight against the Portuguese colonial power. All the provinces levy the same taxes and none have any public debt. Regional competition between provinces is based on public expenditure and GDP per capita. Several provinces have natural oil resources, while others have diamonds. The northern part is located in the forest zone of central Africa, while the south is a desert area to the north of the Namibian desert, where agriculture is problematic. With their distinctive natural resources, the wealthier provinces attract young people searching for employment. The capital also attracts those who are searching for a better education and jobs. Regional competition is therefore based on endogenous factors that affect regional GDP, namely the number of available jobs and the poverty rate, both of which result in internal migration, with people voting with their feet (Tiebout, 1956). Table 1 presents some statistical characteristics regarding Angola's 18 provinces.

From the table it can be seen that GDP per capita varies among the provinces, that poverty also varies between the provinces, and that public expenditure does not compensate for the variety in natural resources. For example, Cabinda is characterized by oil extraction, and is responsible for the production of more than 80 per cent of Angola's onshore oil. Diamonds and gold mines exist in Lunda Norte and Lunda Sul, and diamonds also exist in Huila province.

3. Literature Survey

Research on the Tiebout hypothesis has been a well-established topic, ever since the publication of its seminal paper (Tiebout, 1956). Some papers focus on distinct income tax rates (Cebula, 1979; Carlson and Cebula, 1981; Lee and Zhee, 2001; Rhode and Strumpf, 2003), while others focus on health access (Cebula and Clark, 2013), demographic changes (Kim and Hewings, 2013) and minority migration (Cebula and Belton, 2004). More closely related to the present research is the research of Renas (1983), which focuses on the cost of living and labour market opportunities. Furthermore, Liu (1977) focuses on local government finance and employment growth, while Partridge and Rickman (2006) relate migration to labour markets. Therefore, there are

Table 1: Spatial characteristics of Angolan poverty in 2013

Unit	Province	Capital	Area km^2	Internal migration	Unemployment rate	Public expenditure in kwanzas
1	Bengo	Kaxito	31,371	0.407	0.204	3.33E+10
2	Benguela	Benguela	31,788	0.486	0.273	8.68E+10
3	Bié	Kuito	70,314	0.477	0.309	5.35E+10
4	Cabinda	Cabinda	7,270	0.485	0.171	4.87E+10
5	Cuando Cubango	Menongue	199,049	0.486	0.273	3.80E+10
6	Kwanza-Norte	Ndalatando	24,190	0.495	0.309	3.06E+10
7	Kwanza-Sul	Sumbe	55,660	0.520	0.309	4.20E+10
8	Cunene	Ondjiva	89,342	0.530	0.347	3.19E+10
9	Huambo	Huambo	34,274	0.540	0.347	7.19E+10
10	Huíla	Lubango	75,002	0.361	0.386	6.66E+10
11	Luanda	Luanda	2,418	0.521	0.386	2.37E+11
12	Lunda-Norte	Lucapa	102,783	0.530	0.386	4.02E+10
13	Lunda-Sul	Saurimo	45,649	0.513	0.386	2.66E+10
14	Malanje	Malanje	97,602	0.525	0.514	4.60E+10
15	Moxico	Luena	223,023	0.531	0.470	4.93E+10
16	Namibe	Namíbe	57,091	0.528	0.386	2.73E+10
17	Uíge	Uíge	56,698	0.386	0.427	5.80E+10
18	Zaire	Mbanza Kongo	40,130	0.397	0.347	2.78E+10

Source: Angolan Institute of Statistics.

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many reasons for internal migration. In fact, early papers focused on specific taxes as the cause of migration. However, in the case of internal migration, where all provinces have the same taxes by law, the reason for migration should be other factors, such as local amenities (Cebula and Alexandre, 2006). Consequently, the early theory that migration is based on state fiscal policy has been gradually abandoned (Conway and Houtenville, 2001). The majority of papers have tended to focus on the USA, with a small number studying Europe, but there have been none looking at the case of Africa. Therefore, this paper innovates in this context as it focuses on Africa, presenting evidence from the Angolan provinces and adopting a spatial model. Table 2 shows the variables and the models that have been used in the reviewed papers.

Table 2: Literature survey models and variables in Tiebout modelling

Paper	Country	Period	Model	Endogenous variable	Exogenous variables
Cebula (1979)	USA states	1970–1975	OLS	Migration	Median family income, unemployment rate, location in western state, location in area of warm weather, median education level of population aged over 25, average costs of living, percentage growth
Carlson and Cebula (1981)	USA states	1960–1970		Movements in Indian population	Aid to families with dependent children, per capita income, growth in per capita income, unemployment rate, location in western state, number of cold weather days in state
Conway and Houtenville (2001)	USA states	1990 USA census	OLS	Old migrators above 65 years	Distance, border, population, cost of living, household income, crime, sun, heating, cooling, education, hospital, public welfare, Medicaid, public spending, death taxes, property taxes, income taxes, income tax exemptions, marginal income tax, marginal income tax exemption, sales tax, sales tax exemption, other taxes.
Lee and Zhee (2001)	USA states	1979–1989	Binomial probit	African American Migration	Employment, poverty, gender, marriage, household head, child, household size, welfare income, age. Education, occupation, distance, mean employment, percentage of non-Hispanic blacks, average temperature
Partridge and Rickman (2006)	USA states	1968–1998	SVAR — Structural vector auto-regression	Migration	USA states
Cebula and Alexandre (2006)	USA states excluding Washington	2000–2004	OLS	Migration	Family income; cost of living; percentage of employment growth; normal daily maximum temperature; binary variable indicating that the state has a coast line; number of coastline miles; percentage of hazardous waste sites; toxic chemical releases in state, elementary and secondary education expenditures in state, per capita death and gift taxes paid to state, per capita state income tax burden, state income tax.
Cebula and Clark (2013)	USA states	2000–2008	2SLS regression	Migration	Median family income, cost of living in the state, growth rate of employment, average income rate in state; average property rate in state; primary and secondary education in state in 2000; Medicaid recipient in state in year 2000.

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From the table it can be seen that for the USA some authors use poverty (Cebula and Clark, 2013), some use minority groups such as Mexican and black people (Lee and Zhee, 2001) and some use public welfare (Conway and Houtenville, 2001), and all these references are equivalent to poverty. The idea that poverty dictates migration is because local owners cannot migrate since they will lose their assets, but poor people without assets can migrate.

4. Methodology

The spatial regression model displayed below relates to the migration variable, with covariates explaining internal migration, based on the literature survey and taking into account the spatial dependence between the observation locations (Anselin, 1988). In spatial models, the observations from one location tend to have similar values to those of nearby locations (LeSage, 2005). This paper adopts the panel data spatial autocorrelation model (SAC), which has the following specification:

$$Y_{it} = \lambda W y_{it} + x_{it}\beta + \rho M \mu_{it} + \varepsilon_{it} \tag{1}$$

The model used is a linear regression model, with Y being the endogenous variable for measuring migration in location I, in year t, and X is the vector of covariates that explains covariates. W and M are spatial-weighting matrices, which parameterize the distance between neighbourhood regions. W is the spatial lag of Y, and M is the spatial lag of u. u is the spatially correlated residual, and ε are independent and identically distributed disturbances. λ is the spatial autoregressive parameter for the spatially lagged error term, and ρ is the spatial autoregressive parameter for the spatial correlation of the errors (Barros *et al.*, 2012, 2016). Disasters such as Hurricane Katrina in the USA also attracted the attention of Landry *et al.* (2007).

The second spatial model adopted is the Generalized Spatial Errors model (GESPRE), which has the following specification:

$$\begin{aligned} Y_{it} &= x_{it}\beta + \mu_{it} + v_{it} \\ \mu_{it} &= \rho 1 W \mu_{it} + n \\ v_{it} &= \rho 2 M \mu_{it} + \varepsilon_{it} \end{aligned} \tag{2}$$

This model breaks down the error term into two parts. The first error term specifies the weight matrix for the spatial-autocorrelated random effects. The second specifies the weight matrix for the spatial-autocorrelated error term. The final model is the Arellano-Bond spatial model, which is a reference panel data that handles endogeneity. The use of all models serve as a robust test for the analysis.

5. Theoretical Background and Hypotheses

The theoretical background is based on the Tiebout hypothesis, which considers that regional residents vote with their feet by migrating to other locations in search of better welfare conditions.

Hypothesis 1: (Persistence). Migration is a persistent activity in developing countries (Tiebout, 1956).

Hypothesis 1 states that the migration's lagged effect is positive, which means that a positive autocorrelation exists when high values are correlated with high neighbouring values, based on the neighbour's spatial position, and over time.

Hypothesis 2: (Trend). Migration over time should increase in an economy with high inequality.

Hypothesis 2 states that the trend is for an increasing number of immigrants over the period.

Hypothesis 3: (Lagged migration). Migration increases over the period with a lagged auto-correlated effect.
Hypothesis 4: (Spatial effect). Migration generates positive spatial effects in Angola. These effects are derived from migration autocorrelation among Angolan provinces.

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Hypothesis 5: (Poverty). Poverty may affect migration in a dual economy (Bowden *et al.*, 2008; Anyanwu, 2005).

Hypothesis 5 states that poverty positively affects the incidence of migration in Angola.

Hypothesis 6: (Unemployment rate). The relationship between employment and migration is unclear (Cebula and Clark, 2013).

Hypothesis 6 states that the employment rate positively affects Angola's number of immigrants.

Hypothesis 7: (Tiebout). The Tiebout hypothesis is tested with regional public expenditure, meaning that government expenditure at a local level, in the form of wages, investment and other expenditure, affects the local economy's level of activity (Cebula and Clark, 2013).

Hypothesis 7 states that public expenditure negatively affects Angola's number of immigrants, as it generates more opportunities for the local population (Fosu, 2010).

Hypothesis 8: (Per capita income). Income per capita is measured by gross domestic product (GDP) per capita, which is an average measure of the resources available to the population (Ahluwalia *et al.*, 1979; Martins, 2007).

Hypothesis 8 states that per capita income negatively affects Angola's number of immigrants, since the higher the GDP per capita, the more developed the region is.

Hypothesis 9: (Density). Population density is defined as being the number of people in a given area.

Hypothesis 9 states that population density negatively affects Angola's number of immigrants, as more densely populated provinces have more amenities than remote zones.

Hypothesis 10 (Public employees). The number of public employees depends on government-generated local employment. The higher this employment is, the lower migration is, as public employment retains people in the province.
Hypothesis 11: (NGO). NGOs — Non-governmental organizations are common in developing countries. An NGO that supports civic education positively affects migration (Barros *et al.*, 2016). A common education enables local people to visit other localities.

6. Data and Results

The data were obtained from the Angolan Statistical Institute and were supplemented with data from Angolan public expenditure figures, which were obtained from the public budget of the Ministry of Finance. The migration data were obtained from the IBEP — Inquerito Integrado sobre o Bem Estar da População report (several years of the data set). The equation to be estimated is the following:

$$\log Immigration_{it} = Constant_{it} + \beta_1 Trend_{it} + \beta_3 \log Poverty_{it} + \beta_4 \log Unemployment_{it} + \beta_5 \log PublicExpenditure_{it} + \beta_6 \log GDPpercapita_{it} + \beta_7 \log Density_{it} + \beta_8 \log Density + \beta_9 Publicemployees_{it} + \beta_{10} NGO_{it} + \mu_{it}$$

Table 3 characterizes the variables used in the regressions.

The model is estimated in logs, in order for the parameters to be normalized and to be interpreted as elasticities. The results are presented in Table 4. Three spatial models are estimated. First, the SAC — Spatial Autocorrelation Fixed Effects Model, which corresponds to the specification displayed above in Section 4. Secondly, the GESPRE — Generalized Spatial Random Errors Model (Le Sage, 2005) and, finally, the Arellano–Bond Spatial Model, which is adopted as a robustness test as it takes

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Table 3: Characterization of the variables: 2004–2014

Variable	Description	Min[a]	Max[b]	Mean	Std Dev[c]
Migration	Number of people that migrate internally in Angola	1,951	4,349,959	245,680	607,989
Trend	Trend variable	1	10	5.500	2.880
Poverty	Number of people in poverty in the region	1,809	249,642	40,339	44,068
Unemployment	Number of people unemployed in the region	12,704	3,225,268	434,780	565,135
Public expenditure	Regional public expenditure in Kwanzas, 2010 = 100	5,527,890	2.37e+11	2.40e+10	2.92e+10
GDP per capita	Log of GDP per capita at 2010 = 100 prices	2.42e-07	0.0000277	3.24e-06	5.15e-06
Density	Population/area	0.703	3,452	153	587
Public employees	Number of public employees	3,285	48,386	17,585	11,659
NGO	NGO that supports civic education	1	46	9	9

[a]Min – Minimum; [b] Max – Maximum; [c] Std Dev – Standard Deviation.

Table 4: Estimation results of the spatial model (endogenous variable: Log migration)

	SAC fixed effects model	GESPRE random effects model	Arellano–Bond model
Constant	7.165	9.081	0.728
	(5.586)	(6.843)	(0.980)
Trend	0.146	0.691*	0.061**
	(0.230)	(0.304)	(0.0057)
Log*peasants*$_{t-1}$	—	0.397**	0.011**
		(0.117)	(0.040)
W1y_log*peasants*	—	—	0.0204**
			(0.0011)
Log*pobres*	5.077*	3.637*	0.0006*
	(2.294)	(1.842)	(0.0018)
Log*Unemployment*	–0.144	–0.062	–0.139*
	(0.058)*	(0.064)	(0.021)
Log*Publicexpenditure*	–0.416*	–2.903	–0.003*
	(0.091)	(2.244)	(0.0022)
Log *income per capita*	–0.413*	–0.309	–0.0029**
	(0.021)	(0.219)	(0.0012)
Log*density*	–0.009	–0.020	–0.205*
	(0.110)	(0.052)	(0.0309)*
Log*publicemployees*	–6.154	–7.037**	–0.008
	(1.918)**	(1.079)	(0.002)*
NGO	0.001	0.063**	0.0037**
	(0.0007)	(0.009)	(0.0005)
Number of observations	180	162	162
Overall R^2	0.574	0.649	0.449
Log-likelihood	–92.699	495.38	651.983
Spatial rho or lambda	22.272**	18.644**	0.0204
	(0.715)	(2.479)	(0.0000)*
Sargan test	—	—	231.954
			(0.0000)*
Variance Sigma_a	–1.146**	2.68e–10	—
	(0.247)	(8.06e–09)	

Note: Standard deviations below the parameters: ** statistically significant at 1%; *statistically significant at 5%.

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endogeneity into account. Endogeneity may be due to simultaneous reverse causation, biased omitted variables, or measurement errors. In this case, it may be best to omit variables not adopted in the model specification.

The results reveal that the three models interpret the data accurately, as measured by the overall R square. Furthermore, the variables have the same sign in all models, although the Arellano–Bond model is the best fit. Therefore, Angolan internal migration increases with the constant and the trend. Additionally, the lagged effect is also positive, and there is spatial autocorrelation in Angolan migration among provinces, which signifies that migration from one province generates migration in another nearby province. Poverty is the main cause of migration in Angola, which signifies that the regional poor emigrate in order to improve their living conditions. The NGO for civic education also increases migration, probably through the provision of a common social education, which gives a regional inhabitant the confidence to start the migration process. The other variables decrease migration, namely regional unemployment, regional public expenditure, income per capita, population density and regional public employees. Therefore, economic variables decrease migration, whereas unemployment does not cause migration. Regional migration goes to Luanda, yet there is no migration from Luanda to the provinces. Therefore it is the poor who are voting with their feet in Angola.

7. Conclusion and Discussion

This paper analyses the Tiebout effect in Angola, investigating the causes of regional migration. In a context where all provinces have the same taxes and no debt, it is public expenditure that mainly restricts regional migration. The main covariate that explains migration is poverty. Therefore, migration is explained by poverty, signifying that poor people migrate in order to improve their living conditions. This result is in line with the research in USA where public welfare is taken into account (Conway and Houtenville, 2001). Furthermore, all the economic variables that explain regional development decrease migration. From a theoretical perspective, public expenditure decreases poverty and it was the fact that it does not affect poverty that maintained the migration flow active and steadily increasing over the period under study. Angola has a public problem with poverty, presenting two statistical series of poverty: a lower one, as measured by the Angolan Statistical Institute, and a higher one, which was obtained in a questionnaire conducted by the NGO organization on several occasions during the period. These two statistical series are distinct, signifying that the poverty registered by the Statistical Institute is lower than the true one registered by the NGO. This is evidence of non-inclusive Human Development (Asongu *et al.*, 2015). Furthermore, a public policy to combat poverty was adopted by law in 2000, but without any tangible results (Duclos and Verdier-Chouchane, 2011).

Based on the present research, hypotheses 1, 2 and 3 are accepted and they all signify that Angolan local migration increased over the period. Hypothesis 4 is also accepted, signifying that a spatial effect of migration exists in all Angolan provinces. Hypothesis 5 is accepted, which signifies that poverty is the main cause of Angolan regional migration. Hypothesis 6 is rejected, as unemployment does not increase migration, but actually decreases it. Hypothesis 7 is rejected because public expenditure decreases migration. Hypothesis 8 is accepted, as GDP per capita decreases migration. Hypothesis 9 is accepted, as population density decreases migration, signifying that the more populated regions are those that have fewer migrants. Hypothesis 10 is accepted, as public employees reduce Angolan regional migration. Finally, Hypothesis 11 is accepted, as the NGO for civic education increases Angolan migration.

The policy implication of the present research is that Angola needs a regional anti-poverty policy that will counteract regional migration, Cebula (1974). With the regional economy being based on traditional agriculture, this signifies that regional public policy should adopt an anti-poverty policy. Traditional agriculture with bad roads signifies that peasants are unable to sell their products in main cities. Thus, improving the roads would be a way of increasing peasants' income. Furthermore the railway system is still the colonial one and new lines are needed to develop the regional provinces of Angola. Therefore it seems that public expenditure does not promote social inclusive growth (Owusu-Nantwi and Erickson, 2016). More research is needed to confirm these findings.

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African Development Review, Vol. 28, No. 2, 2016, 201–214

Does Entrepreneurship Promote Economic Growth in Africa?

Michael Adusei*

***Abstract*:** There seems to be a cloud of scepticism hanging over the value of entrepreneurship to the growth processes of developing economies. This haze of scepticism is fuelled by the reverberating mantra by a section of the extant literature that replicative entrepreneurship (entrepreneurship which is generally considered not to be growth-supporting) is pervasive in developing economies including Africa. We take motivation from this postulation to investigate whether entrepreneurship is of any relevance to the growth processes of 12 African countries. The results show that entrepreneurship positively explains the variations in the growth of the study countries. It is, thus, reasonable to contend that entrepreneurship in developing economies including Africa even if replicative is instrumental to economic growth.

1. Introduction

Entrepreneurship remains one of the most popular concepts in development economics. However, its exact meaning remains elusive. As a concept, entrepreneurship has attracted a lot of definitions. Bilic *et al.* (2011) and Kauffman (2008) posit that entrepreneurship should be construed as a transforming process which could be from an innovative idea to an enterprise or from an enterprise to creation of value. It is 'taking judgmental decisions about the coordination of scarce resources' (Casson, 2003, p. 20). Schumpeter (1912) considers it as initiation of innovative activity and the bringing of new products to market. Kirzner (1973) appears to share the view that entrepreneurship is a contest of ideas, positing that entrepreneurship encompasses the competitive behaviours that propel the market process. Dau and Cuervo-Cazurra (2014) take a legalistic view of entrepreneurship and define it 'as the creation of new businesses, i.e., a stable collection of individuals who coordinate their efforts to generate new value-added economic activity' (p. 670). Business has been defined by Brown and Clow (2007) as 'any commercial activity that seeks profit by providing goods and services to others in exchange for money' (p. 7). In sum, there are three elements of entrepreneurship: resource coordination, new enterprise creation, and innovation (Naudé, 2011).

Notwithstanding the avalanche of discordant voices that have characterized its definition, entrepreneurship has long been seen as a tool for stimulating economic growth even in excruciating times of economic depression. Baumol (2014) juxtaposes entrepreneurship against the hackneyed prescription of Keynesian theory that in times of economic downturn increased government spending should be the panacea. Baumol (2014) abundantly projects entrepreneurship as an alternative means of stimulating growth 'that may hold greater appeal for today's policy makers and world leaders' (p. 631).

Indeed, entrepreneurial activities are significant in many respects. New businesses create jobs (Folster, 2000); ensure economy's welfare, efficiency and productivity (Baumol, 1990), and serve as a major engine for promoting innovation, accomplishing business ideas, and transforming economic structures (Audretsch *et al.*, 2002; Fritsch, 2008). It is documented that entrepreneurship contributes to economic performance by introducing innovations, effecting change, fostering competition and improving competition (Wong *et al.*, 2005). The significance of entrepreneurship has found its endorsement in EU's enterprise policy which sees entrepreneurship as a core competence for growth, employment and personal fulfillment (EC, 2004).

Much empirical evidence exists that entrepreneurship positively impacts growth in industrial and transition countries (Carree and Thurik, 2008; Berkowitz and Dejong, 2005; Acs and Armington, 2004; Audretsch and Keilbach, 2004). From a Consumer Finances Survey, Cagetti and De Nardi (2006) find that entrepreneurs account for only 7.6 per cent of the US population but for approximately one-third of the total net worth. Mondragon-Velez (2009) reports that this entrepreneur group obtains over 20 per cent of income of the total population.

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A curious look at the extant literature reveals that the question of whether entrepreneurship stimulates economic growth seems to have been largely answered in developed economies but the same cannot be said about emerging and developing economies. The literature itself shares this position (Anokhin and Schulze, 2009). In the words of Bruton *et al.* (2008, p. 1) 'entrepreneurship research can still be critiqued as almost exclusively focused on North American and European sites'. The outcomes are, therefore, of little relevance to answering the question whether entrepreneurship has any significant impact on economic growth and development in emerging and developing countries (Naudé, 2011).

Does entrepreneurship matter for economic growth in Africa? The question stems from the fact that productive or opportunity entrepreneurship in Africa has been an issue of debate (Brixiova, 2010). This study attempts to answer this question. It has been observed that ascertaining the factors that could fuel long-term growth rates across Africa and targeting them is likely to culminate in a reduction in the continent's reliance on aid and stimulate utilization of local resource capacity to improve African economies (Popiel, 1994). The value of this paper is founded on the fact that it strikes a chord with the growth agenda of Africa.

Data from 12 African countries show that entrepreneurship has a strong positive impact on economic growth. This finding is important in the sense that it provides evidence that challenges the postulation of a section of the extant literature that entrepreneurship in developing economies lacks the force to promote economic growth. On the face of it, evidence in this paper suggests that even if replicative entrepreneurship is pervasive in developing economies, it is instrumental to the growth processes of developing economies.

2. Review of Literature

This section consists of two parts. The first part reviews the entrepreneurship-growth nexus and the second reviews the other determinants of economic growth.

2.1 Entrepreneurship-Growth Nexus

Audretsch *et al.* (2006) assert that the significant contribution of entrepreneurship to economic growth lies in its serving as a medium for the spillover of knowledge that might otherwise have stayed uncommercialized. However, empirical evidence on the relationship between entrepreneurship and economic growth is conflicting. Van Stel *et al.* (2005) report that whereas entrepreneurship has a positive relationship with per capita GDP growth in rich nations, its relationship with growth in poor nations is negative. Reynolds *et al.* (2003) find negative relationships between entrepreneurial activity and real per capita GDP among all nations they studied. Similar results have also been reported by Iyigun and Owen (1998), Yamada (1996) and Schultz (1990).

Jiang *et al.* (2010) find that an increase in the number of entrepreneurs generates a growth-improving variety effect and that diminished overall quality of entrepreneurial ability undermines economic growth. Evidence from West Germany indicates that entrepreneurship positively impacts growth. Audretsch *et al.* (2008) report from West Germany that innovation efforts have an indirect effect on economic performance through entrepreneurship and that knowledge-based entrepreneurship positively explains regional economic performance. Mueller (2006) tests the hypothesis that entrepreneurship and university–industry relations promoted economic growth in West German regions between 1992 and 2002 and reports that regions with a high level of entrepreneurship and university–industry relationships record greater productivity, and consequently, economic growth. In particular, both start-ups in innovative industries and university research in engineering science are found to advance economic growth. Mueller (2007) tests whether or not entrepreneurship is an important medium for knowledge flows and economic growth for the West German regions between 1990 and 2002 and finds that a rise in innovative start-up activity is more effective than an increase in general entrepreneurship in accelerating economic growth.

Stefanescu (2012) investigates the relationship between economic development and entrepreneurial activity in the European context. The categories of countries as defined by the Global Entrepreneurship Monitor used for the study are innovation-driven economies: Belgium, Denmark, Germany, Iceland, Ireland, Greece, Spain, France, Italy, Netherlands, Portugal, Slovenia, Finland, Sweden, United Kingdom, Norway and Switzerland; and efficiency-driven economies: Latvia, Hungary, Romania, Croatia and Turkey. The study finds that 'countries with different economic development level are distributed based on their entrepreneurial activity during the international crisis'. Wong *et al.* (2005) analyzed cross-sectional data from 37 countries that

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participated in GEM 2002 to explore the relationship between entrepreneurship firm formation and technological innovation as determinants of economic growth. They explore the relationship between different types of entrepreneurial activities using GEM Total Entrepreneurial Activity (TEA) rates: high growth potential TEA, necessity TEA, opportunity TEA and overall TEA. Their results show that only high growth potential entrepreneurship has a significant impact on economic growth.

Harbi *et al.* (2011) explore the causal relationship between entrepreneurship and economic growth with data (1996–2007) from 34 OECD countries and report that there is a unidirectional causality running from entrepreneurship to economic growth. The results also suggest that increases in self-employment promote economic growth over the short term but reduce economic growth in the long-term horizon.

Galindoa and Méndez (2014) investigate whether feedback effects exist among entrepreneurship, economic growth and innovation using data from 13 developed economies. They find evidence in support of feedback effects: economic activity supports entrepreneurship and innovation activities. They also find that innovation activities support economic activity.

It appears there is some cloud of scepticism surrounding the relevance of entrepreneurship to economic growth in developing economies. This is because in most developing countries where production takes place well within the technological frontier, economic growth is not 'innovation driven' and that replicative entrepreneurs are many. Such entrepreneurs are, however, of no relevance to economic growth (Naudé, 2011). Baumol *et al.* (2007) share this view but do not completely write replicative entrepreneurship off. Although they concede that it is the innovative entrepreneur who is needed for economic growth, they hardly write replicative entrepreneurship off, arguing that it is relevant in most economies insofar as it serves as a route out of poverty (Baumol *et al.*, 2007).

Pahn *et al.* (2008) seem to share the above position that entrepreneurs are not a binding constraint (binding constraints are 'circumstances or factors which, as long as they remain in place, would hinder growth, even if other possible constraints or determinants of growth are addressed', Naudé, 2011, p. 34) in poor economies. They rather identify government influence as the significant determinant of economic growth (Pahn *et al.*, 2008).

Notwithstanding the above position that entrepreneurship is an insignificant force in the growth process in developing economies, Li *et al.* (2012) examine the impact of entrepreneurship on economic growth with a panel data set from 29 provinces in China over 20 years and show from their results that entrepreneurship positively explains economic growth.

Despite the view that Africa is the richest continent in the world in terms of minerals and natural resources for which reason entrepreneurship should flourish on the continent, the continent's entrepreneurial performance has been abysmal (Kshetri, 2011). This abysmal performance, according to experts, should be blamed on factors such as lack of sensitivity of raw agricultural products to international prices, poor infrastructure, lack of human and financial capital; quality standards, inappropriate trade policies, poor management of human resources, and government policies that are hostile to entrepreneurship (Robson and Obeng, 2008; Alamine, 2006; Teal, 1998; Lall, 1995; Sender and Smith, 1989).

Elkan's (1988) study establishes that Africa can boast of many entrepreneurs who have the competence to spot business opportunities and to take advantage of them. However, African private entrepreneurs are deficient in financial and managerial ability to operate large and sophisticated businesses (Wilson, 1990). This raises the question as to whether entrepreneurship in Africa promotes economic growth. Answering this question is the focus of this study.

2.2 Other Determinants of Economic Growth

One determinant of economic growth that has galvanized a lot of empirical attention is financial development. Investigations into the relationship between finance and economic growth have reported conflicting outcomes. Whereas studies such as Jalil and Feridun (2011), Tran (2008), Waqabaca (2004), Levine *et al.* (2000), and King and Levine (1993a, 1993b) find a positive relationship between finance and growth, studies such as Adusei (2013a, 2013b), Hye and Islam (2013), Adusei (2012), Liang and Reichert (2012) and Ram (1999) report a negative relationship between the two. Few studies have reported an insignificant relationship between finance and growth (Guryay *et al.*, 2007; Lucas, 1988).

Human capital is one of the documented determinants of economic growth. Most studies that have investigated the relationship between human capital accumulation and economic growth have adopted two approaches: accounting framework (Samimi *et al.*, 2012; Barro and Lee, 1993; Barro, 1991) and endogenous model (Grossman and Helpman, 1991; Lucas, 1988). The growth accounting framework submits that education supports economic growth by increasing the human capital stock of individuals and improving their productivity. The endogenous growth model contends that the creation of new ideas is a direct function of human capital which finds its expression in the form of scientific knowledge. Thus, investment in human capital

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drives growth in physical capital and this, in turn, culminates in economic growth. Human capital accumulation might stimulate growth by catalyzing technology adaption (Foster and Rosenzweig, 1996) or human capital might be necessary for technology use (Easterly *et al.*, 1994).

There are four principal predictions in the literature relating to the impact of inflation on output and growth (Drukker *et al.*, 2005). The first prediction, credited to Sidrauski (1967), forecasts that inflation has no effect on growth (money is super-neutral). The second prediction, attributed to Tobin (1965), is that money is a substitute for capital, causing inflation to have a positive effect on long-run growth. The third prediction (cash-in-advance model) propounded by Stockman (1981), sees money as complementary to capital, predicting that inflation should have a negative impact on long-run growth. The fourth prediction is predicated on Huybens and Bruce's (1998) new class of models in which inflation is predicted to have a negative impact on long-run growth, but only if its level is above a threshold level. The models posit that financial market efficiency is influenced by various informational asymmetries. For instance, high rates of inflation typically exacerbate financial market frictions, obstruct the efficiency of the financial system and thus undermine economic growth. Indeed, inflation is identified as one of the most important determinants of growth (Ghosh and Phillips, 1998).

The literature emphasizes the value of openness to international trade, both as a means of affecting the transfer of technical progress and as an engine of growth (Saci *et al.*, 2009); Zang and Kim, 2007; Ghosh and Phillips, 1998; King and Levine, 1993a). Trade, either in the form of exports or imports represents growth-enhancing interactions (specialization, exchange of ideas through exports or acquiring foreign technology through quality imports) among countries acting as a channel for knowledge dissemination; thus more open economies should chalk higher growth rates (Apergis *et al.*, 2007). Anyanwu and Yameogo (2015) report that trade openness has a positive relationship with foreign direct investment (FDI) inflows in Central, North, Southern, and West Africa. This finding is refreshing because it has been observed that FDI can be instrumental to Africa's development efforts (Inekwe, 2013; Anyanwu, 2006).

The neoclassical growth theory posits that a rise in investment level increases the steady-state level of output per worker and, therefore, increases the growth rate of output. On the other hand, the endogenous growth theory uses economies of scale and spillover effects to support the way improved investment promotes growth (Apergis *et al.*, 2007). In short, the two theories predict a significant impact of investment level on economic growth.

Government spending is known to influence economic growth. It is on record that government's productive spending on education, infrastructure or some other productive capital positively drives growth. On the other hand, unproductive government spending could undermine growth (Barro and Sala-i-Martin, 1995).

3. Econometric Strategy

In this section we provide measures of entrepreneurship and economic growth, explain the model employed and describe the data used for the study.

3.1 Measures of Entrepreneurship and Economic Growth

Researchers are not unanimous regarding the measure of entrepreneurship. However, it appears self-employment ratio (defined as the proportion of the labour force who are self-employed or business owners) is widely used to measure entrepreneurship (Li *et al.*, 2012; Gleaser, 2007; Audretsch *et al.*, 2006; Carree *et al.*, 2002).

Another measure of entrepreneurship is private employment ratio — the proportion of the labour force that is employed by the private sector (Li *et al.*, 2012). Global Entrepreneurship Monitor (GM) uses total entrepreneurship activity to measure entrepreneurship. Total entrepreneurship activity is defined as the percentage of individuals in the nation — ages 18 to 64 — that are actively engaged in starting or managing a new business; entrepreneurs that are involved in both activities are counted only once (Bygrave *et al.*, 2003). Naudé (2011) identifies measures of entrepreneurship as rates of new business formation, self-employment, business ownership and innovation (Naudé, 2011).

From a legal point of view, Dau and Cuervo-Cazurra (2014) identify two types of entrepreneurship: formal entrepreneurship and informal entrepreneurship. They define formal entrepreneurship as 'the creation of new businesses that are legally registered in a given country'. Formal entrepreneurship refers to 'the activities of an individual or a group aimed at initiating economic activities in the formal sector under a legal form of business' (Klapper *et al.*, 2007, p. 131). On the other hand, informal

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entrepreneurship refers to the creation of new businesses that are not registered in law and are mainly unregulated but are legal in all other aspects (Dau and Cuervo-Cazurra, 2014; Nyström, 2008; ILO, 2002).

Due to data constraints, we focus on formal entrepreneurship (Klapper *et al.*, 2007) and use the number of new businesses registered in a fiscal year in each study country to represent entrepreneurship (Wong *et al.* 2005; Reynolds *et al.*, 1999).

Generally, economic growth is measured with gross domestic product (GDP) either in level or in rate. In a study by Galindoa and Méndez (2014), GDP in millions of US dollars is used to proxy economic growth. Per capita GDP growth is also used to measure economic growth in the literature (Van Stel *et al.*, 2005). However, this study uses the annual percentage growth rate of GDP to proxy economic growth.

3.2 Model

Following the extant literature (Van Stel *et al.*, 2005), the per capita GDP growth is used as the dependent variable in the chosen model. Entrepreneurship (*ENTRE*) is the independent variable in our model and as indicated above it is measured as the number of new businesses registered in a fiscal year in each study country (Wong *et al.*, 2005; Reynolds *et al.*, 1999). From the literature, the following control variables are selected: financial development (*FINDEV*) proxied by credit to the private sector as a share of GDP; inflation (*INFL*) proxied by GDP deflator; Human Capital (*HC*) proxied by gross primary education enrolment ratio; economic openness (*OPEN*) represented by imports plus exports as a share of GDP; private investment (*INVEST*) and government spending. The latter is usually included in growth models to measure macroeconomic stability (Apergis *et al.*, 2007). All variables are log-transformed to ensure standardization (Sarel, 1996).

The definitions of these variables have been given in Table 1. Our model is generally stated as:

$$y_{it} = \beta_1 + \beta_2 F_{it} + \mu_i + \varepsilon_{it} \tag{1}$$

Table 1: Definitions of variables

Variable	Definition	Expected sign	Source
Dependent variable			
Economic Growth (*GROWTH*)	Natural logarithm of annual per capita GDP growth		World Bank
Independent variable			
Entrepreneurship (*ENTRE*)	Natural logarithm of number of new businesses registered in a country in a fiscal year.	?	International Monetary Fund
Control variables			
Financial development (*FINDEV*)	Credit to private sector as a share of GDP	?	World Bank
Inflation (*INFL*)	The GDP implicit deflator is the ratio of GDP in current local currency to GDP in constant local currency. Inflation as measured by the annual growth rate of the GDP implicit deflator shows the rate of price change in the economy as a whole.	?	World Bank
Economic openness (*OPEN*)	Imports of goods and services plus exports of goods and services as a share of GDP	+	World Bank
Human Capital (*HC*)	Gross Primary Education Enrolment ratio	+	World Bank
Gross domestic investment (*INVEST*)	Gross capital formation (formerly gross domestic investment) consists of outlays on additions to the fixed assets of the economy plus net changes in the level of inventories.	+	World Bank
Government spending	General government final consumption expenditure as share of GDP	+	World Bank

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where y is the logarithm of per capita GDP growth; F represents the explanatory and control variables, $\mu_i + \varepsilon_{it}$ represent the unobserved country-level effects and the error term, respectively. The explanatory and the control variables are lagged with the logic that it takes time for entrepreneurship to have an effect on growth.

3.3 Model Suitability Check

We perform two tests to ascertain the suitability of the panel model used in this study. The first test is the Hausman specification test for the fixed effects estimator versus the random effects estimator. This test assesses the null hypothesis of an absence of correlation between the individual country effects and the explanatory variables. If the null hypothesis is rejected, then the fixed effects model is the appropriate estimator to use. On the other hand, if the test fails to reject the null hypothesis, the random effects model is the suitable estimator to use.

The second test is the Wald test. The Wald test assesses the null hypothesis that the explanatory variables do not jointly and significantly predict the variations in the dependent variable.

3.4 Data

We use eight-year data (2004–2011) from 12 African countries (Ghana, Algeria, Botswana, Egypt, Gabon, Lesotho, Mauritius, Senegal, South Africa, Togo, Zambia and Nigeria). Selection of countries is based on availability of the metrics required for the study. The restriction of the study to 2004–2011 has been dictated by the limited data on the number of new businesses registered in a fiscal year. The source of our data is the World Development Indicators (www.worldbank.org) of the World Bank and www.doingbusiness.org/data/exploretopics/entrepreneurship of the International Monetary Fund (IMF). The descriptive statistics of the data are presented in Table 2.

Table 2: Descriptive statistics

	GROWTH	*ENTRE*	*FINDEV*	*GS*	*INVEST*	*HC*	*OPEN*	*INFL*
Mean	2.58	10453.22	34.44	3.55	22.28	60.01	85.31	9.70
Median	2.94	5318.00	17.51	3.33	22.99	56.59	74.62	9.31
Maximum	7.8	65089.00	161.98	32.41	46.70	107.35	186.15	80.75
Minimum	−8.73	0.0000	6.43	−21.28	0.0000	0.0000	0.0000	−19.43
Std. Dev.	2.61	14932.81	39.33	7.76	9.166	15.58	32.46	10.48
Observations	85	85	85	85	85	85	85	85

Source: Author's calculation.

The average growth of the 12 countries is 2.58 per cent, meaning the study countries have grown at an average rate of 2.58 per cent. Compared to the average annual growth rate of LAC-7[1] countries during the same period, we can conclude that the annual growth rate of the 12 study countries has been low. Table 2 shows that the average number of new firms registered in a fiscal year in the study countries during the period under investigation is 10,453.22. Compared to the 361,264.5 average number of firms registered in the United Kingdom during the same period, it is not difficult to arrive at the conclusion that entrepreneurship is extremely low in Africa, which probably explains the seemingly unbridgeable development gap between the developed economies and the emerging and developing economies. Figure 1 shows the entrepreneurship performance of the study countries. Nigeria recorded the highest number of new firms during the study period followed by South Africa. Among the group, Togo recorded the lowest number of new firms.

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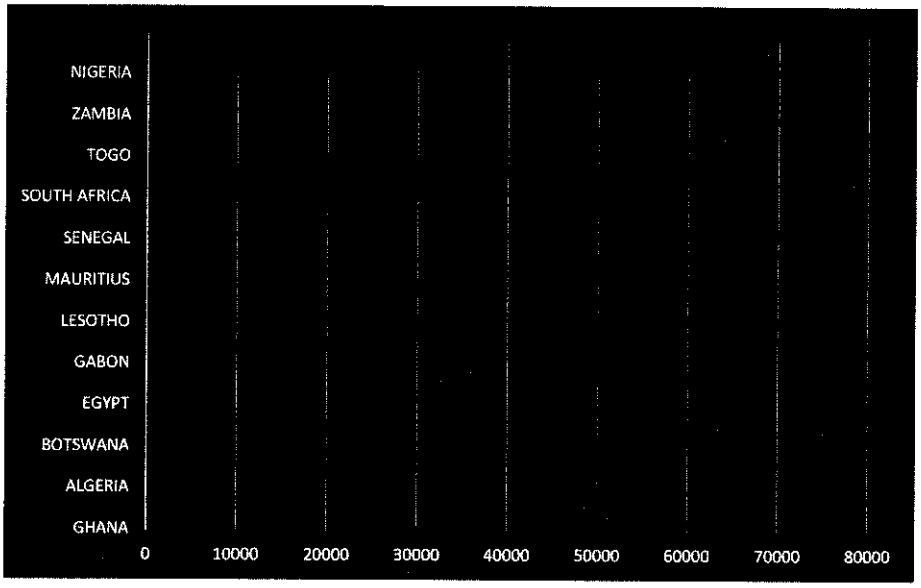
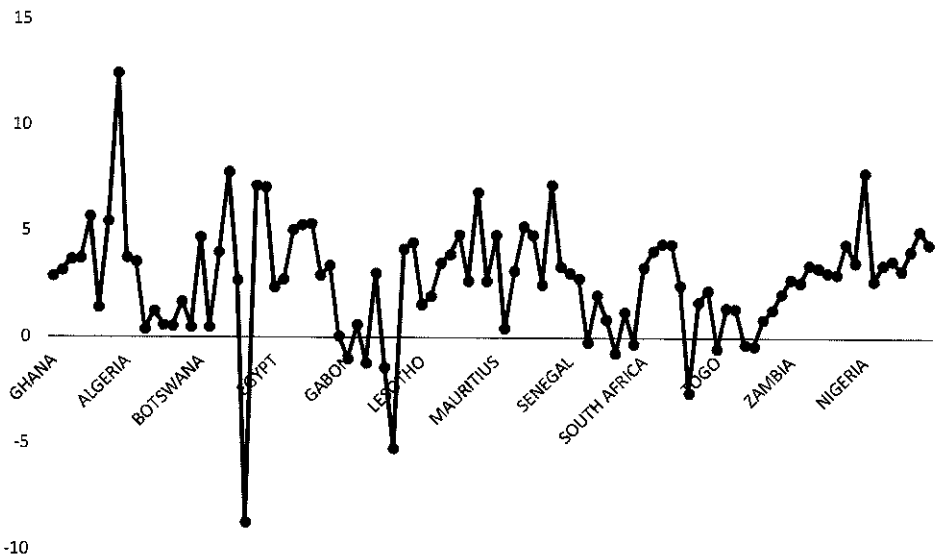
Figure 1: Trend of entrepreneurship performance in the study countries (2004–2011)



Source: Author's construction.

Figure 2 shows how the 12 countries have performed over the study period. It is obvious the performance of the countries has been undulating, suggesting that economic policies in the countries have not shown consistent effectiveness.

Figure 2: Trend of economic growth rate (%) of the study countries (2004–2011)



Source: Author's construction.

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4. Estimation Results

The correlations among the explanatory variables are reported in Table 3. As can be observed, the correlations are within tolerable limits, suggesting that there is no multicollinearity problem in our data (Bryman and Cramer, 1997).

Table 3: Correlation matrix

	ENTRE	*FINDEV*	*GS*	*OPEN*	*INFL*	*INVEST*	*HC*
ENTRE	1						
FINDEV	0.56	1					
GS	0.28	–0.02	1				
OPEN	–0.44	–0.29	–0.05	1			
INFL	0.28	–0.30	–0.17	–0.04	1		
INVEST	–0.091	–0.40	0.20	0.19	0.09	1	
HC	0.16	0.11	–0.08	–0.19	0.07	0.03	1

Source: Author's calculation.

Two models are estimated. Model 1 explores the effects of entrepreneurship on economic growth without including control variables. Model 2 tests the robustness of the outcome of Model 1 by including control variables. The results of the random effects regression estimations are reported in Table 4. As can be observed, the Hausman test indicates that the random effects model is the optimal estimation technique to use. This is because the test has yielded a value of 4.2884 ($p = 0.7460$) with 7 degrees of freedom. This result rejects the null hypothesis of an absence of correlation between the individual country effects and the explanatory variables. The R^2 is 43 per cent, the Durbin-Watson statistic is 2.07, the F-statistic is 4.1081 significant at the

Table 4: Random effects regression results. Dependent variable: Economic growth

Variable	Model 1	Model 2
Constant	–0.75(–0.96)[a]	2.18(0.69)
ENTRE (–1)	0.20(2.25)**	0.71(4.38)***
FINDEV(–1)	–	–0.68(–3.28)***
GS(–1)	–	–0.22(–2.35)**
OPEN(–1)	–	1.12(2.83)***
INFL(–1)	–	–0.39(1.88)*
INVEST(1)	–	2.55(–3.89)***
HC(1)	–	–0.2076(–0.46)
	$N = 70$	$N = 46$
	$R^2 = 0.05$	$R^2 = 0.43$
	Wald test: $\chi^2(1) = 55.78$***	F-statistic = 4.11***
		Wald test: $\chi^2(8) = 112.69$***
		Hausman test: χ^2 (7) = 4.29(0.75)[b]
		Durbin Watson statistic = 2.07

[a]Figures in parenthesis are t-values.
[b]The figure in brackets represents the p value.
***and ** represent 1% and 5% significance levels. *ENTRE*(–1) = lagged entrepreneurship, *FINDEV*(–1) = lagged financial development; GS(–1) = lagged government; *OPEN*(1) = lagged trade openness; *INFL*(–1) = lagged inflation; *INVEST*(–1) = lagged gross domestic investment; and *HC*(–1) = lagged human capital.
Source: Author's construction.

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1 per cent significance level and the Wald test Chi^2 value is also significant at the 1 per cent significance level. These diagnostic checks establish the reliability of our model.

The general position of the extant literature is that in most developing countries replicative entrepreneurs abound. Such entrepreneurs are, however, immaterial for economic growth (Naudé, 2011). Contrary to this postulation the results in Table 4 show that entrepreneurship has a strong positive effect on economic growth. This positive impact of entrepreneurship on economic growth strikes a chord with evidence from other parts of the world (Galindoa and Méndez, 2014; Stefanescu, 2012; Li *et al.*, 2012; Jiang *et al.*, 2010; Audretsch *et al.*, 2008; Mueller, 2006). As evident in Table 4, the coefficient of the lagged value of entrepreneurship (*ENTRE* (-1) is 0.7127, significant at the 1 per cent level, suggesting that the impact of entrepreneurship on growth is strong.

The literature emphasizes the importance of openness to international trade, both as a means of affecting the transfer of technical progress and as an engine of growth (King and Levine, 1993a; Ghosh and Phillips, 1998; Zang and Kim, 2007; Saci *et al.*, 2009). However, our data show that economic openness has a robust positive statistically significant relationship with economic growth, meaning that economic openness supports growth. It suggests to us that international trade between the study countries and the rest of the world is favourable.

The other control variables (financial development, government spending, inflation and human capital) have negative statistically significant coefficients except human capital, meaning they hurt economic growth in the study countries.

5. Discussion

Pahn *et al.* (2008) and Baumol *et al.* (2007) have observed that replicative entrepreneurship is pervasive in developing economics for which reason entrepreneurship may be immaterial to growth in such economies. Consequently, the motivation of this study has been to interrogate this observation. Our data show that, contrary to this contention, entrepreneurship has supported growth in the study countries. This suggests that the current model of entrepreneurship in the study countries, however replicative it may be, wields enough force to positively drive economic growth for which reason the needed impetus must be provided to deepen it.

Fortunately, Africa as the most resource-endowed continent has what it takes to succeed entrepreneurially. It has been estimated that Central Africa mines about two-thirds of the world's cobalt (Kshetri, 2011). Ivory Coast, Ghana, Nigeria and Cameroon are the four major West African cocoa producers. Ivory Coast alone produces about 43 per cent of the world's cocoa. Zimbabwe has the second largest reserves of platinum in the world and large quantities of other precious metals such as gold and copper (Mutasa, 2009). Unfortunately, African countries export agricultural products such as cocoa, coffee, tobacco and cotton, mainly in raw forms (Sáez and Gallagher, 2009). Maybe the time has come for African countries to aggressively pursue comprehensive entrepreneurship development programmes that will in the long run culminate in the effective and efficient utilization of these vast resources for economic growth and development.

6. Conclusion and Policy Implications

We have examined whether entrepreneurship promotes economic growth in 12 African countries. Our results show that entrepreneurship promotes economic growth. Consequently, we are inclined to contend that African economies could be entrepreneurship-driven. The results also reveal that economic openness supports the growth of the study countries.

According to experts, factors such as lack of sensitivity of raw agricultural products to international prices, poor infrastructure, lack of human and financial capital; quality standards, inappropriate trade policies, poor management of human resources, and government policies that are hostile to entrepreneurship in Africa. To the extent that the study has shown that entrepreneurship promotes growth, we strongly recommend that policy makers should give these factors the needed policy attention so as to promote economic growth.

How can policy makers promote entrepreneurship on the African continent? Communication and culture are important to elicit preferred actions (Kanter, 1983). At the national level, encouraging entrepreneurship among the population demands public communication and national culture. National communication of ideas about markets and technology may promote entrepreneurial ideas which may translate into growth in entrepreneurship. Creation of knowledge infrastructure — the

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aggregate number and diversity of channels by which ideas can travel, and also the level of access to the methods and media enjoyed by the majority of a nation's population (Kshetri, 2011) — can be of immense help in this regard. Education, internet access and ability to travel should not be restricted to the elite few so that the ability to discern entrepreneurial opportunities will be pervasive in Africa for the economies to grow.

Note

1. In Latin America LAC-7 refers to the seven largest Latin American countries, namely Argentina, Brazil, Chile, Colombia, Mexico, Peru and Venezuela, which together account for 93 per cent of the region's GDP.

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African Development Review, Vol. 28, No. 2, 2016, 215–228

The Comparative Economics of Catch-up in Output per Worker, Total Factor Productivity and Technological Gain in Sub-Saharan Africa*

John Ssozi and Simplice A. Asongu**

Abstract: Using the two-step system general method of moments panel data analysis we first investigate the effects of external financial flows on total factor productivity and technological gain, and then use the beta catch-up and sigma convergence to compare dispersions in output per worker, total factor productivity and technological gain in sub-Saharan Africa (SSA) for the years 1980–2010. The comparative evidence is articulated with income levels, years of schooling, and health factors. We find; first, a positive association between foreign direct investment, trade openness, foreign aid, remittances and total factor productivity. However, when foreign direct investment is interacted with schooling, its direct effect becomes negative on total factor productivity. Second, beta catch-up is between 19.22 percent and 19.70 percent per annum with corresponding time to full catch-up of 25.38 years and 26.01 years respectively. Third, we find sigma-convergence among low-income nations and upper-middle income nations separately, but not for the entire sample together. Fourth, schooling in SSA is not yet a significant source of technology, but it can make external financial inflows more effective. Policies to induce external financial flows are not enough for development if absorptive capacity is low.

1. Introduction

While productivity is arguably the most crucial aspiration of Africa, there is little consensus on how to achieve it. One of the intriguing debates has been between factor accumulation and total factor productivity. In a study of the East Asian economies, Young (1995) finds that factor accumulation played a major role, and he allocates a minor role to total factor productivity. The proponents of total factor productivity as the major differentiating factor between economies include: Abramovitz (1986), Romer (1986, 1993), Temple (1999), Nelson and Pack (1999), Klenow and Rodriguez-Clare (1997), and Easterly and Levine (2001), Durlauf *et al.* (2005). Devarajan *et al.* (2003) uphold that it is the low productivity rather than the level of investment that has been the main constraint to Africa's growth. They maintain that until the sources of low productivity in Africa are better understood, advocacy for more investment as a source of growth is premature. In his search for lessons to Africa from China's growth, Anyanwu (2014) points to both the higher domestic saving and investment, and to technological adaptation among other strategies. External financial flows remain the key channels of technological transfer and adoption.

There is vast literature about the determinants and effects of external financial flows on economic growth and convergence. However not much has been done on why despite the increase in the flows (see Figure 1), productivity and its convergence among African economies remains low. One strand of literature focuses on trade openness. Baliamoune (2009) studies 41 African countries from 1980 to 1999, and finds that greater openness to trade may enhance growth in countries with relatively high income but depress it in lower-income countries. She finds no support for conditional convergence. In a follow up, Baliamoune-Lutz (2011) finds that there is an inverted-U relationship between exports to the Organization for Economic Co-operation and Development countries and growth in Africa between 1995 and 2008. This suggests a threshold above which the effect of exports on growth would be negative. Elu and Price (2010) estimate firm-level production functions in five sub-Saharan African (SSA) countries from 1992 to 2004. They find no relationship between productivity-enhancing foreign direct investment and trade with China, and no effect of trade openness with China on the growth rate of total factor productivity. However, Miller and Upadhyay (2000) study 83 nations, of which 16 are from SSA, from 1960 to 1989. They find that opening

*The authors are highly indebted to the editors and referees for constructive comments.

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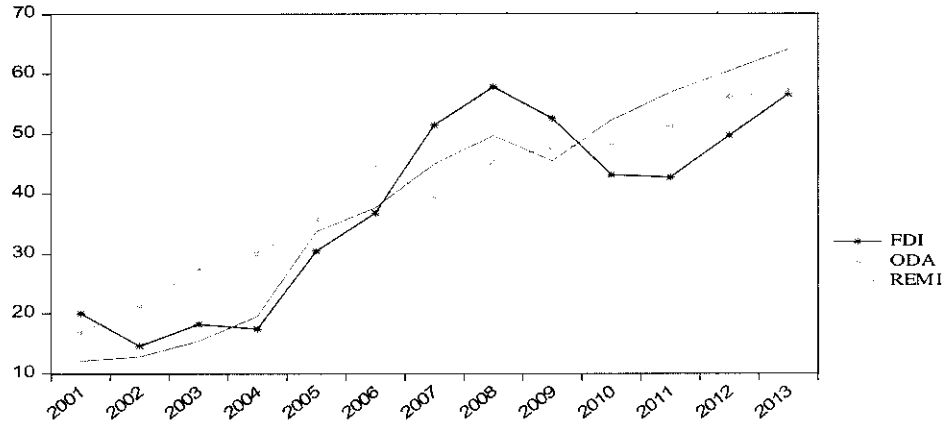
Figure 1: Total external financial flows to Africa (US$ billions, current)



Source: African Economic Outlook (2013), © OECD 2013.

an economy to trade generally benefits total factor productivity, and the effect of human capital on total factor productivity in low-income countries moves from negative to positive as the country moves from a low to a higher level of openness. In their follow up, Miller and Upadhyay (2002), using the same dataset, find that low- and middle-income countries benefit from the adoption of more advanced technology, and exhibit convergence in total factor productivity.

The second strand of literature focuses on economic integration as a potential source of convergence. Hammouda *et al.* (2009) study 42 African nations from 1981 to 2003, and find that despite the importance of regional economic integration in Africa there is very little income convergence. Hammouda *et al.* (2009) attribute the slow convergence, among other factors, to the slow accumulation of the factors production and low total factor productivity, and to the limited inflow of foreign direct investment into Africa which is shared by a few countries.

Asongu has investigated real and monetary policy convergences both existing (Asongu, 2013a) and potential (Asongu, 2014a) monetary zones in Africa. The findings from the African French Colonies (CFA) zones and the proposed monetary unions of East and West Africa suggest the need to reduce structural and institutional differences which inhibit convergence. Conversely, from an overall African perspective, there is substantial evidence of convergence in short-run finance or financial intermediary development dynamics of depth, activity, efficiency and size (Asongu, 2014b); a tendency that is scantily apparent in long-term finance or stock market performance dynamics (Asongu, 2013b). Asongu (2014c) has also investigated convergence in real per capital income and human development (adjusted for inequality) in 38 African countries for the period 1981–2009 to conclude that the income component of the Human Development Index (HDI) is moving slower than others in the process of convergence and thus requires more policy attention.

The third strand of literature focuses on human capital. Cole and Neumayer (2006) study 52 nations of which 8 are from SSA for the period 1965-1995. While controlling for international trade, inflation and agricultural share of GDP, they find that poor health is negatively associated with total factor productivity. Other authors who find an adverse effect between poor health and economic growth are: Gallup and Sachs (2000), McCarthy *et al.* (2000), Arcand (2001), and Bhargava *et al.* (2001). Sala-i-Martin (2005) uses the theory of growth with poverty traps to illustrate that health has a direct effect on productivity. He explains that while the aggregate productivity of the economy depends on the business activities that citizens decide to undertake, sometimes the choice of activities is affected by the health conditions of the region in which they live, such as malaria and sleeping sickness.

The fourth strand of literature focuses on technology. Jerzmanowski (2007) finds that the bulk of income differences are caused by the fact that many countries operate below the technology frontier, whereby 43 percent of the variation in output per worker is explained by inefficiency. Jerzmanowski argues that many developing countries would gain access to better technologies if they could accumulate physical capital faster than human capital, that is, their k/h ratios are low relative to those suited to the most productive technologies. Caselli (2005) who uses a development accounting approach to give a bird's-eye view of differences in income per worker across countries, maintains that efficiency is as important as capital in explaining income differences.

The above strands of literature leave room for improvement in at least four key areas which this paper addresses. First, the channels of technology transfer and their effects on total factor productivity and relative real gross domestic product per capita

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which is a proxy for the technological gap (Wan, 2004). Notwithstanding the fact that external financial flows into SSA have quadrupled since 2000 (African Economic Outlook, 2013), productivity and relative incomes have not been boosted due to lack of the requisite absorptive capacity. We therefore investigate the role of human capital, that is, schooling and health, in enabling external financial flows to increase productivity and technological change.

Second, we search for evidence of catch-up and convergence in 'output per worker', total factor productivity (TFP) and technological gain. This contribution builds on the need for more economic integration and policy harmonization discussed in Africa (Akpan, 2014; Kayizzi-Mugerwa *et al.*, 2014; Njifen, 2014). Others include: Charaf-Eddine and Strauss (2014); Baricako and Ndongo (2014); Nshimbi and Fioramonti (2014); Ebaidalla and Yahia (2014); Ofa and Karingi (2014); Shuaibu (2015) and Tumwebaze and Ijjo (2015). This inquiry is based on two theories: (1) countries with lower levels of the underlying factors (per worker output, TFP and technological gain) are more likely to catch up their counterparts of higher levels. (2) According to Martin and Sunley (1998) and Temple (1999), if technology is a public good and can cross national borders, over time SSA countries should be able to adapt and adopt modern technology, and in the long run the rate of technological progress would be similar among SSA. However, if there are variations in the opportunities and/or abilities to emulate the existing modern technology we may not observe any convergence.

Third, in order to avail room for more policy options, we disaggregate the dataset into some fundamental panels, based on income levels. The choice of income levels is in line with African literature on TFP (Miller and Upadhyay, 2002). Moreover, theoretical and empirical convergence literature is consistent on the position that it is unlikely to find convergence within a heterogeneous set of countries (Islam, 1995; Narayan *et al.*, 2011, p. 2773; Asongu, 2013a, p. 46).

Fourth, building on the narrative of the third strand, we further improve space for policy implications by conditioning the convergence analysis on health-oriented factors, notably: HIV prevalence, malaria reported cases and life expectancy. The intuition for this fourth component is that low human capital may constrain the opportunity and ability to gain efficiency, and account for the convergence or the lack of.

The rest of the study is organized as follows. Section 2 engages the data and methodology. The empirical results and discussions are covered in Section 3 while Section 4 concludes.

2. Model, Data and Estimation Methodology

2.1 Data and Estimation Methodology

The dataset is made up of 31 selected SSA countries over the time period 1980–2010, taken from the World Bank Database. Countries are included on the basis of data availability especially for the average years of schooling. We have three categories of variables: (1) Production function variables: output per worker, physical capital per worker, labor force, and average years of schooling. Real gross domestic product (GDP) per worker is derived from GDP per capita and physical capital per worker, which in turn is generated from the gross capital formation as a percentage of GDP using the perpetual inventory method. Labor force is the percentage of the total population between 15 and 64 years, we use the Barro–Lee average years of schooling per person 15 years and older. (2) External financial flows: foreign direct investment, foreign aid, remittances, and trade openness. (3) Human capital: schooling, prevalence of human immunodeficiency virus (HIV), malaria cases reported, and life expectancy. Prevalence of HIV refers to the percentage of people aged 15–49 who are infected with HIV, while malaria cases reported refers to the sum of confirmed cases of malaria by slide examination or rapid diagnostic test and probable cases of malaria. Life expectancy at birth indicates the number of years a newborn infant would live if prevailing patterns of mortality at the time of its birth were to stay the same throughout its life. In accordance with the Barro–Lee five-year averaging of the years of schooling, all data are averaged over 5-year periods: 1980, 1985, 1990, 1995, 2000, 2005, and 2010. For lack of space, the descriptive statistics are available upon request.

Panel data methods of fixed effects and general method of moments (GMM) are used. The two-step system GMM method (Arellano and Bond, 1991; Arellano and Bover, 1995; Blundell and Bond, 1998) in accordance with Roodman (2009a, 2009b) is preferred for four reasons: first, it allows us to control omitted variables that are persistent over time. Second, several lags of the regressors can be used as instruments where required, thus alleviating measurement error and endogeneity biases. If the measurement errors are not persistent, the standard fixed effects within-transformation may worsen the problem of measurement errors. Third, the Arellano-Bond estimator was designed for small T and larger N panels. Fourth, it allows us to control for cross-sectional dependence. The general GMM equation is specified as follows:

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$$\ln(Z)_{it} = \sum_{f=1}^{h} \beta_1 \ln(Z)_{it-f} + \gamma_l \ln(X)_{it-l} + \delta_i + \varepsilon_{it}$$

$$\mathrm{E}[\delta_i] = E[\varepsilon_{it}] = E[\delta_i \varepsilon_{it}] = 0 \tag{1}$$

where Z is a vector of the dependent variables, X is vector of the independent variables key of which are external financial flows and measures of human capital; δ_i are the unobserved time-invariant country-specific effects while ε_{it} are the observation error terms.

The specifications are two-step with forward orthogonal deviations as opposed to differencing. The procedure is preferred for two reasons: first, the two-step procedure is robust since it is heteroscedasticity-consistent while the one-step assumes homoscedasticity. Second, unlike first differencing, the forward orthogonal deviations accounts for cross-sectional dependence that may bias estimated coefficients (Baltagi, 2008). Consistent with Love and Zicchino (2006), the specific effects from the cross-sections are eliminated with the use of forward orthogonal deviations. With this approach, lags of one period in the regressors are valid instruments because they are uncorrelated with the error term that has been transformed. The findings satisfy post-estimation diagnostics, notably: the difference-in-Hansen test for exogeneity of instruments, the Hansen test of over-identification (OIR) and the Arellano and Bond (1991) test for serial correlation of second order (AR (2)).The instruments matrix is also collapsed to avoid the proliferation of instruments.

2.2 Total Factor Productivity

We estimate total factor productivity (TFP) from a production function specified as follows:

$$Y = AK^{\alpha}\left[e^{\varphi(E)}L\right]^{\beta} \quad \text{where } 0 < \alpha < 1, \text{ and } 0 < \beta < 1 \tag{2}$$

Y denotes real GDP, A is total factor productivity, K is total physical capital, E represents schooling, ϕ is the rate of growth of education, and L denotes the total labor force. We do not restrict that $(\alpha + \beta)$ equal to one. Hence we allow for the possibility of the increasing returns to scale. Dividing by L we transform Equation (2) into per worker terms.

$$y = Ak^{\alpha} e^{\beta\varphi(E)} L^{\alpha+\beta-1} \tag{3}$$

Taking the natural logarithms of Equation (3) provides us with Equation (4).

$$\ln(y) = \ln(A) + \alpha \ln(k) + \beta\varphi E + (\alpha + \beta - 1)\ln(L) \tag{4}$$

Let A_0 be the initial endowment of technology, we model technological progress to increase exponentially at the rate of θ as: $A_t = A_0 e^{\theta t}$. In the $\lim_{t \to \infty} A_0(1+\theta)^t = A_0 e^{\theta t}$. Hence $\ln(A) = \ln(A_0) + \theta t$. Since A_0 does not reflect just technology alone, but also factors such as resource endowments, climate, institution, and so on (Mankiw *et al.*, 1992), it can be rewritten as $\ln(A_0) = \delta + \varepsilon$. Where δ is a constant and ε is a country-specific shock. Thus Equation (4) becomes:

$$\ln(y_{it}) = \delta_i + \alpha \ln(k_{it}) + \beta\varphi E_{it} + (\alpha + \beta - 1)\ln(L_{it}) + \varepsilon_{it} \tag{5}$$

The subscripts i and t represent country and year, respectively. Equation (5) is estimated for 31 SSA nations for the time period 1980–2010, at five-year average intervals, to obtain the TFP as a residual.

2.3 Technological Gain

The second variable of interest is the relative real gross domestic product per capita which is a proxy for technological gap. This variable is based on the Wan (2004) theory of catching up. Let $v_{it} = x_{it}/z_{it}$, where x is the real GDP per capita in country i while z

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is the real GDP per capita of the leading hypothetical economy. Taking achievability into perspective, z is set to an initial value of \$40,000 in 1980, but allowed to grow at a moderate annual compound rate of 2 percent. The 2 percent which is implicit rate of innovation in the advanced leading economy is also the average long-run growth rate of advanced economies established in literature for Europe and the USA (Armstrong, 1995) and for Australia (Cashin, 1995). According to Todaro and Smith (2012), \$40,000 is the same figure used as the goalpost by the United Nations Development Programme in the computation of the Human Development Index (HDI) for developing countries. It therefore follows that $0 < v \leq 1$. If $v=1$, then the developing SSA has attained its short-term goal. All of the 31 nations in our sample have real GDP per capita income of less than \$40,000.

Following Wan (2004), the growth rate of x_{it} depends on the value of v_{it}, such that the lower the v_{it} the faster the growth rate of x_{it}. According to Lucas (1988) there would be an accelerating trend until x^0, beyond which a developing economy would experience a decelerating trend in the growth rate. At the same time x^0 can vary over time. For a developing country to catch up with the leading economy, it is expected to initially grow faster than 2 percent. Since we assume that there is no or minimal innovation in the developing countries, the technological gain is attained through contact with, and emulation of, the advanced economies. At the same time technological spillovers, that is, effective emulation, need a proper environment, namely, human capital and policy regimes or institutions as specified in Equation (6).

$$\ln(v_{it}) = \delta_i + \mu \ln(contact_{it}) + \rho \ln(schooling_{it}) + \tau \ln(health_{it}) + \gamma polity2_{it} + \varepsilon_{it} \quad (6)$$

2.4 Convergence Tests

Finally, we test for the conditional β-convergence and σ-convergence of output per worker, total factor productivity, and technological gain among the SSA nations. Our goal here is to test whether technology is becoming more evenly distributed in SSA. We compute the conditional β-convergence using the two-step system GMM with autocorrelation tests and controls for cross-sectional dependence. The conditional β-convergence tests whether economies converge, not to a common steady state (equalization of incomes) but to their own long-term steady-state. To test for conditional convergence we introduce additional X variables to the growth regression using panel cross-sectional data specified as follows:

Table 1: Production function estimates of Equation (5)

Dependent variable: income per worker ln(y): entire sample 31 nations				
	Fixed effects		Two-step system GMM	
	(1)	(2)	(3)	(4)
Lagged ln(y)				0.398***
				(0.001)
ln(k)	0.329***	0.347***	0.357***	0.257***
	(0.000)	(0.000)	(0.000)	(0.000)
ln(L)		0.306	0.139	–0.141**
		(0.223)	(0.573)	(0.034)
Schooling			0.109***	0.084***
			(0.000)	(0.000)
Constant	4.56***	–0.179	1.68	4.05***
	(0.000)	(0.963)	(0.667)	(0.006)
R-squared (within)	0.278	0.284	0.335	
Observations	207	207	207	178
AR(1)				(0.872)
AR(2)				(0.147)
Hansen test (p-value)				0.143
Implied estimated β		0.959	0.782	0.602

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Table 2: Effects of FDI, openness, schooling, and health on total factor productivity

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Lagged dependent variable	1.01***	0.901***	1.01***	0.969***	0.866***	0.939***	0.897***	0.961***	0.986***	1.06***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
ln(*fdi*)	–0.012	0.041*	0.061**	0.031**	–0.054**	–0.004	–0.051**	–0.012	–0.014	0.013
	(0.448)	(0.062)	(0.011)	(0.013)	(0.042)	(0.898)	(0.012)	(0.341)	(0.439)	(0.398)
ln(*open*)	0.279***	–0.108	–0.063	0.077*	0.191**	–0.016	0.187**	–0.151	0.180**	0.117
	(0.001)	(0.278)	(0.258)	(0.065)	(0.033)	(0.785)	(0.016)	(0.122)	(0.037)	(0.488)
ln(*aid*)	0.066**	–0.004	0.116**	0.045**	0.003	0.073**	0.007	0.024	0.032*	0.065**
	(0.045)	(0.894)	(0.011)	(0.012)	(0.903)	(0.013)	(0.778)	(0.278)	(0.065)	(0.043)
ln(remi)	0.030	0.035**	0.048**	0.025***	0.003	0.012	0.006	0.054***	0.059***	0.009
	(0.146)	(0.035)	(0.018)	(0.001)	(0.849)	(0.520)	(0.650)	(0.001)	(0.004)	(0.640)
Schooling		0.075***	0.017	–0.033	0.047***	0.045***	0.023*	–0.062	0.116**	0.058
		(0.009)	(0.262)	(0.193)	(0.002)	(0.004)	(0.078)	(0.305)	(0.043)	(0.636)
ln(*HIV*)		–0.131***			–0.034***			–0.026		
		(0.000)			(0.004)			(0.209)		
ln(*malaria*)			–0.025**			–0.018*			0.007	
			(0.015)			(0.072)			(0.162)	
ln(*lifeexp*)				0.554***			0.354***			0.436***
				(0.000)			(0.000)			(0.000)
Avpol2		0.007	–0.004	0.001	–0.001	0.000	0.002	0.002	–0.001	0.004*
		(0.210)	(0.183)	(0.924)	(0.937)	(0.993)	(0.149)	(0.386)	(0.767)	(0.081)
ln(*fdi*)* *Schooling*					0.010***	0.002	0.010***			
					(0.007)	(0.652)	(0.004)			
ln(*open*)**Schooling*								0.027*	–0.018	–0.012
								(0.090)	(0.167)	(0.668)
Constant	–1.44***	0.959	0.144	–2.29***	–0.015	0.359	–1.56***	0.638	–0.937**	–2.83***
	(0.001)	(0.157)	(0.794)	(0.000)	(0.932)	(0.135)	(0.000)	(0.241)	(0.015)	(0.000)
Observations	116	116	101	116	116	101	116	116	101	116
Countries	31	31	30	31	31	30	31	31	30	23
Instruments	15	19	19	27	25	25	25	23	23	23
AR(1)	0.374	0.113	0.301	0.167	0.840	0.357	0.248	0.559	0.996	0.031
AR(2)	0.139	0.869	0.443	0.199	0.214	0.126	0.168	0.346	0.345	0.115
Hansen test (*p*-value)	0.231	0.711	0.392	0.359	0.232	0.318	0.217	0.115	0.143	0.518

Notes: *p*-values in parentheses. AR(1) and AR(2) are presented in *p*-values.
Fdi: foreign direct investment; *open*: trade openness. Aid: foreign aid. Remi: remittances; *lifeexp*: life expectancy; *Avpol2*: Average Polity2.

$$\left(\frac{1}{T}\right)\ln\left(\frac{y_{it}}{y_{i,t\ -1}}\right) = \alpha + \beta ln\left(y_{i,t-1}\right) + \delta X_{i,t} + \varepsilon_{i,t} \tag{7}$$

where $X_{i,t}$ is a vector of variables that hold constant the steady state of economy i, and those we include are foreign direct investment, trade openness, foreign aid, remittances, polity2, schooling, prevalence of HIV, malaria cases reported, and life expectancy. The left-hand term is the annualized growth rate of each of the three measures productivity: either output per worker or total factor productivity or relative income per capita. We compute the left-hand term as a logarithmic difference between output per worker (or total factor productivity or relative income per capita) between 1976–1980 and 1981–1985,... and between 2001–2005 and 2006–2010, each divided by 5. Following Barro (1991), Mankiw *et al.* (1992), and Barro and Sala-i-Martin (1995), having introduced the $X_{i,t}$ variables in Equation (6), we infer conditional convergence if β is negative.

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Concerning σ-convergence we follow Sala-i-Martin (1996), that a group of countries are said to be converging in the sense of σ if the dispersion of their levels of output per worker or total factor productivity or relative income per capita tends to decrease over time. That is, if $\sigma_{t+1} < \sigma_t$, where σ_t is the time t standard deviation of $\ln(y_{i,t})$ across i.

3. Estimation Results

We use fixed effects and two-step system GMM techniques to estimate a Cobb–Douglas production function specified in Equation (5) to obtain the total factor productivity. The results are reported in Table 1. Total factor productivity is obtained as the residual of column (4), in an estimation that includes the years of schooling. This specification is adopted from Mankiw *et al.* (1992), who maintain that leaving out human capital affects the coefficients on physical capital investments and labor. The capital per worker elasticity of output is 0.257 while the implied labor elasticity is 0.602. The schooling coefficient $\beta\phi$ is

Table 3: Effects of FDI, openness, schooling, and health on technological gain

	Relative real GDP per capita: entire sample of 31 nations									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Lagged dependent variable	0.873***	1.16***	0.819***	0.965***	1.03***	0.836***	0.908***	0.865***	0.875***	0.904***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
ln(*fdi*)	0.030***	0.076***	0.043*	0.026*	0.087***	0.018	–0.007	0.051***	0.087***	0.048***
	(0.003)	(0.004)	(0.080)	(0.099)	(0.000)	(0.513)	(0.592)	(0.000)	(0.000)	(0.002)
ln(*open*)	0.287***	0.127	0.180*	0.231**	0.110*	0.193**	0.137**	–0.30	0.180**	–0.168
	(0.000)	(0.236)	(0.087)	(0.013)	(0.059)	(0.021)	(0.031)	(0.736)	(0.043)	(0.290)
ln(*aid*)	–0.043*	–0.009	–0.097**	–0.059**	0.054**	–0.092**	–0.063*	–0.088***	–0.28	–0.047
	(0.055)	(0.819)	(0.030)	(0.042)	(0.031)	(0.022)	(0.073)	(0.001)	(0.337)	(0.103)
ln(*remi*)	0.007	0.032**	0.018	–0.036	0.011	0.003	–0.018	0.005	0.001	0.005
	(0.515)	(0.034)	(0.445)	(0.134)	(0.439)	(0.856)	(0.256)	(0.957)	(0.926)	(0.629)
Schooling		–0.035	0.011	–0.022	0.017	0.008	0.003	–0.112	0.072	–0.089
		(0.313)	(0.254)	(0.192)	(0.259)	(0.602)	(0.981)	(0.121)	(0.253)	(0.425)
ln(*HIV*)		0.104***			0.001			-0.050**		
		(0.001)			(0.999)			(0.016)		
ln(*malaria*)			0.011			0.009			–0.011*	
			(0.251)			(0.239)			(0.082)	
ln(*lifeexp*)				0.369***			0.615***			0.936***
				(0.002)			(0.000)			(0.000)
Avpol2		0.011**	–0.011**	0.001	–0.003	–0.013***	–0.007	–0.006	–0.005**	–0.003
		(0.023)	(0.031)	(0.666)	(0.229)	(0.000)	(0.851)	(0.810)	(0.038)	(0.468)
ln(*fdi*)* *Schooling*					–0.004	0.009**	0.006**			
					(0.148)	(0.047)	(0.019)			
ln(*open*)* *Schooling*								0.029*	–0.018	0.022
								(0.065)	(0.226)	(0.383)
Constant	–1.65***	0.507	-1.48**	–2.31***	–0.549*	1.46***	–3.23***	–0.274	–1.06***	–3.31***
	(0.000)	(0.266)	(0.031)	(0.000)	(0.064)	(0.004)	(0.000)	(0.521)	(0.005)	(0.004)
Observations	138	118	121	138	118	121	138	118	121	138
Countries	31	31	30	31	31	31	31	31	30	31
Instruments	16	21	22	22	27	24	24	23	26	24
AR(1)	0.161	0.171	0.062	0.100	0.042	0.036	0.058	0.103	0.089	0.034
AR(2)	0.669	0.928	0.742	0.474	0.372	0.599	0.338	0.665	0.346	0.741
Hansen test (*p*-value)	0.362	0.907	0.195	0.416	0.572	0.320	0.505	0.214	0.657	0.271

Notes: *p*-values in parentheses. AR(1) and AR(2) are presented in *p*-values.
Fdi: foreign direct investment; *open*: trade openness. Aid: foreign aid. Remi: remittances; *lifeexp*: life expectancy; *Avpol2*: Average Polity2.

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composite: the implied ϕ is 0.139, which is the growth rate of schooling. Hence $\varphi(E_i)$ measures the effect of the average years of schooling on output per worker.

We then examine the effects of external financial flows on total factor productivity, controlling for human capital and polity2. The results are reported in Table 2. The lagged total factor productivity variable is positive and close to unity elasticity. This suggests that technological emulation in SSA is more or less at a constant rate. We find that foreign direct investment (FDI), trade openness, foreign aid, remittances, schooling, and life expectancy directly increase total factor productivity, which is in line with Islam (1995) and Benhabib and Spiegel (1994). Using interactive terms, we also find that schooling makes FDI and openness to more effectively increase total factor productivity (Borensztein *et al.*, 1998); Miller and Upadhyay, 2000). While FDI has a positive direct effect on total factor productivity, when interacted with schooling, the direct effect is either insignificant or negative. This mixed effect of FDI on total factor productivity could be due to the type of FDI generally received by the SSA countries which is more resource- and market-seeking than efficiency-seeking (Gui-Diby and Renard, 2015).

The results in Table 2 also show that the prevalence of HIV and malaria reduce total factor productivity. On the other hand, increase in life expectancy is positively associated with total factor productivity. Our results are in line with Engel (2003) and Cole and Neumayer (2006). Table 3 presents the estimation results of the effects of external financial flows and human capital on technological gain for human capital and polity2. Again, the lagged relative income variable is positive and close to unity elasticity implying a constant rate of catching up. Again we find that poor health in terms of increased prevalence of HIV and malaria reduces relative income, the proxy of technological gain. The poor spend all their income and savings to save lives (Sala-i-Martin, 2005).

Having established that contact with the advanced economies increases total factor productivity and technological gain, and that better human capital increases the effectiveness of the external financial flows, we use the β-convergence and σ-convergence to investigate whether a combination of these dynamics would result in faster convergence among the SSA nations. We test for

Table 4: Conditional β-convergence

	Includes HIV prevalence		Includes malaria cases reported		Includes life expectance	
	All countries (31)	Low income countries (25)	All countries (30)	Low income countries (24)	All countries (31)	Low income countries (25)
β-income per capita	–0.036***	–0.026***	–0.015***	–0.021**	–0.031***	–0.034***
[observations]	(0.000) [116]	(0.010) [80]	(0.009) [101]	(0.043) [70]	(0.000) [116]	(0.000) [80]
Catch-up	Yes	Yes	Yes	Yes	Yes	Yes
Catch-up rate (% pa)	19.28	19.48	19.70	19.58	19.38	19.32
Time to full catch-up (years)	25.93	25.66	25.38	25.53	25.79	25.87
β-total factor productivity	–0.019***	–0.039***	–0.019***	–0.034***	–0.022**	–0.026***
[observations]	(0.003) [96]	(0.000) [67]	(0.000) [84]	(0.000) [59]	(0.022) [96]	(0.001) [67]
Catch-up	Yes	Yes	No	Yes	Yes	Yes
Catch-up rate (% pa)	19.62	19.22	NA	19.32	19.56	19.48
Time to full catch-up (years)	25.48	26.01	NA	25.87	25.56	25.66
β-relative income per capita	–0.033***	–0.026**	–0.026***	0.015**	–0.032***	–0.033***
[observations]	(0.000) [117]	(0.036) [81]	(0.000) [102]	(0.043) [71]	(0.000) [117]	(0.000) [81]
Catch-up	Yes	Yes	Yes	No	Yes	Yes
Catch-up rate (% pa)	19.34	19.48	19.48	NA	19.36	19.34
Time to full catch-up (years)	25.85	25.66	25.66	NA	25.82	25.85

Notes: All regressions include schooling, foreign direct investment, openness, foreign aid, remittances, polity2, and time effects (years).

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Table 5: σ-Convergence

	All countries	Low income countries	Lower middle income	Upper middle income
σ-output per worker				
1976–1980	0.943	0.550	0.500	0.791
1981–1985	0.961	0.444	0.371	0.685
1986–1990	0.969	0.531	0.399	0.440
1991–1995	1.055	0.636	0.132	0.396
1996–2000	1.060	0.623	0.147	0.337
2001–2005	1.047	0.517	0.320	0.204
2006–2010	1.045	0.457	0.607	0.119
σ-total factor productivity				
1976–1980				
1981–1985	0.910	0.500	0.336	0.509
1986–1990	0.917	0.578	0.476	0.461
1991–1995	0.916	0.567	0.091	0.370
1996–2000	0.955	0.591	0.002	0.396
2001–2005	0.961	0.512	0.234	0.385
2006–2010	0.936	0.436	0.622	0.344
σ-relative output per capita				
1976–1980	0.897	0.418	0.471	0.783
1981–1985	0.949	0.444	0.423	0.668
1986–1990	0.961	0.510	0.531	0.400
1991–1995	1.030	0.569	0.385	0.320
1996–2000	1.051	0.573	0.238	0.200
2001–2005	1.055	0.499	0.366	0.114
2006–2010	1.060	0.473	0.666	0.109

convergence in the output per worker, total factor productivity, and relative income per capita, controlling for the external financial flows, schooling, and the health variables. Table 4 reports the conditional β-convergence results for the entire sample and for the low income countries. We do not have enough data for regressions on the middle income. We find evidence of conditional β-convergence among the SSA in this sample.

For comparative purposes, we also compute the catch-up rate and time required for full catch-up. For instance, with a beta value of −0.036, the catch-up rate is 19.28 percent per annum (pa) [(−0.036+1)/5] and the corresponding time to full catch-up is 25.93 years [500 percent/19.28 percent]. Five years and 500 percent are employed in the computation because tau is 5, since we have employed 5-year intervals to mitigate short-term or business cycle disturbances (Asongu and Nwachukwu, 2015). Comparatively, we observe the following. First, the catch-up rate is between 19.22 percent and 19.70 percent per annum. Second, the corresponding time to full catch-up is between 25.38 years and 26.01 years.

Table 5 presents the σ-convergence results which consider the degree of dispersion in the steady-states to which output per worker, total factor productivity, and relative income per capita converge over time. We find σ-convergence among the low-income and the upper-middle income countries, but not for the entire sample and for the lower middle income nations. This result supports the notion of the club convergence among the SSA countries. A possible reason for higher sigma catch-up in low income countries (compared to their lower middle-income counterparts) could be a more homogenous relationship between income and productivity among low income countries.

4. Conclusion

The results show that foreign direct investment (FDI), trade openness, foreign aid, and remittances increase total factor productivity and relative income in SSA, with the strongest positive relationship coming from trade. We control for some indicators of health, and find that while an increase in life expectancy is directly related to total factor productivity, an increase in

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the prevalence of HIV and malaria are inversely related to it. Poor health not only reduces labor supply and its productivity, it also absorbs savings that would have been invested. Using interactive terms, we find that schooling makes FDI and openness to more effectively increase total factor productivity and technological gain, but schooling has a statistically insignificant direct effect on technological gain. Schooling in SSA is not yet a significant source of technology, but it can make external financial flows more effective.

We have tested for both conditional β-convergence and σ-convergence in output per worker, total factor productivity, and relative per capita income. We find evidence of conditional β-convergence for both the entire sample all together and the low-income sub-sample, but find evidence of σ-convergence only among the low income and upper middle income nations separately. We do not find σ-convergence for the entire sample or for the lower middle income group of nations. Our results support the view that while technology eventually becomes a public good, and external financial flows involve transfer of technology and can facilitate the convergence of efficiency, SSA nations do not have the same opportunity and ability to absorb modern technology.

We have found the beta catch-up to be between 19.22 percent and 19.70 percent per annum with corresponding time to full catch-up of respectively 25.38 years and 26.01 years. The presence of catch-up implies that policies designed to boost underlying factors (output per worker, TFP and technological gain) are feasible if absorptive capacity is enhanced in the SSA nations, paying attention to the country-specific needs. Hence while SSA countries continue to seek attracting higher external financial flows, they should also ensure that the flows heighten productivity. As a policy implication, SSA needs to work towards deepening absorptive capacity in order for the external flows to boost productivity and accelerate the rate of catching up.

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Appendix: List of Countries in the Sample

Benin
Botswana
Burundi
Cameroon
Central African Rep.
Congo, Dem. Rep.
Congo, Rep.
Côte d'Ivoire
Gabon
Gambia, The
Ghana
Kenya
Lesotho
Liberia
Malawi
Mali
Mauritius
Mozambique
Namibia
Niger
Rwanda
Senegal
Sierra Leone
South Africa
Sudan
Swaziland
Tanzania
Togo
Uganda
Zambia
Zimbabwe

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African Development Review, Vol. 28, No. 2, 2016, 229–240

Determinants of Bribery: Theory and Evidence from Sub-Saharan Africa

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Abstract: The paper investigates the determinants of bribery in sub-Saharan Africa by using probit models and data from the World Bank's Enterprise Survey of 10,457 firms in 30 countries in sub-Saharan Africa from 2009 to 2013. By doing so we find that securing a government contract is the most significant motivation for bribery and that overall, the propensity to bribe depends on the size of the firm as well as the predictability of the regulatory environment. Our findings have similarities and differences compared to Asian firms. The paper also highlights that the incidence and the determinants of bribery vary across the four sub-regions. On the basis of this evidence we suggest that when it comes to anti-corruption strategies, one size does not fit all and that country-specific and region-specific strategies should be adopted to address context-specific needs and conditions.

1. Introduction

Much is known about the causes and consequences of corruption. Corruption, the literature argued, is more likely to occur in poor and ethnically fragmented societies (Shleifer and Vishny, 1993); in countries where the political system is poorly institutionalized (Evans, 1989), civil servants are badly paid (Kraay and Van Rijckeghem, 1995) and mechanisms of inter-institutional accountability are either absent or ineffective (Pelizzo and Stapenhurst, 2012); and in countries where the government intervention in the economy, in the form of trade restrictions, subsidies, licensing and price controls, creates rent-seeking opportunities and where public officials have wide discretion in enforcing regulations (Klitgaard, 1988).

Corruption in Africa has also been the subject of extensive investigations (Collier, 2000; Kodila-Tedika and Bolito-Losembe, 2014). African politics anti-corruption specialists have repeatedly noted that corruption is a staple feature in nearly all African states and have identified the causes of African corruption in a wide range of conditions such as modernization (Huntington, 1968; Alam, 1989), class formation (Diamond, 1987), capital accumulation (Harsch, 1993), power relations (Sklar, 1979), the lack of professionalism of state employees (Gould and Mukendi, 1989), and the rent-seeking behavior of public officials (Mbaku, 1992). While culture, greed, state softness, rent-seeking behavior, and the need for capital accumulation were often regarded as the determinants of corruption; class formation, capital accumulation, and slow economic growth were regarded as the consequences of corruption in the African continent. The literature paid considerable attention to defining corruption, its causes and its consequences (Atangana Ondoa, 2013; Odedokun and Round, 2004) thus greatly contributing to advancing the understanding of corruption.

Yet, while much is known about corruption in general, much less is empirically known about the determinants of specific forms or manifestations of corruption. The case of bribery is, in this respect emblematic.

The literature on bribes has developed and empirically tested theoretical propositions and hypotheses as to why public officials elicit and/or accept bribes (Sanyal, 2005). Yet, much less attention has been paid to why firms accept to or sometimes are happy to bribe public officials. Rose-Ackerman (1998), for instance, suggested that there is a wide range of reasons why firms may wish to pay bribes. In her analysis, Rose-Ackerman (1998) suggested that bribes may be paid to buy judicial decisions, to obtain government contracts, to lower costs, as a form of incentive for bureaucrats, or to enjoy benefits

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to which one is (and sometimes is not) entitled to. These analyses have laid the foundations for the study of bribery and its determinants and have provided policy makers with guidance as to what should be done to curb and possibly eliminate bribery. And for this reason, they must be commended. But by developing grand theories, sweeping generalizations, and law-like statements as to why firms pay bribes, these important studies have neglected that bribery, like other forms of corruption, is to a large extent the product of the environment in which it occurs. It is always the product of a specific context and specific contextual conditions.

The purpose of the present paper is, more modestly, to investigate bribery as it occurs in sub-Saharan Africa. We perform this analysis to see whether and to what extent the determinants of bribery in Africa are the same that one could identify in other continents. Moreover, by performing our analyses at the sub-regional level (Central, Eastern, Southern and Western Africa), we explore whether and to what extent bribery is the product of specific contextual conditions or whether the determinants of bribery that one can identify for Africa as a whole are also responsible for bribery in each of the four sub-regions. By exploring whether bribery has common roots or reflects instead specific contextual conditions, we can provide policy makers with the information they need to design more effective anti-corruption strategies.

Building on this literature, Wu (2009)—using data from Asian firms—found that indeed the size of the firm, its growth rate and corporate governance are significant determinants of bribery. Likewise, he found that the operating context—the extent of market competition, corruption in the court system, high taxes, inefficient government service delivery, non-transparent interpretation of the law and convoluted licensing requirements—are also significant determinants of bribery.

In this paper, we build on the findings from the bribery literature and test the hypothesis that bribery is a function of the characteristics of the firm as well as its operating context, particularly regulatory uncertainty. We test our hypothesis using probit models and data from the World Bank's Enterprise Survey of 10,457 firms in 30 countries in sub-Saharan Africa from 2009 to 2013. This region is an interesting case study because of the variations we observe in terms of levels of bribery and variations in the operating context of businesses. Countries in sub-Saharan Africa also vary significantly in terms of the operating context of businesses, that is, political stability, level of violence, rule of law, credible commitment and control of corruption.

The next part of the paper outlines the various hypotheses to be tested, the econometric model to be used and a description of our data. This is followed by a discussion of the descriptive statistics and econometric results. We conclude with the theoretical and policy implications of our paper.

2. Determinants of Bribery: Theories and Hypotheses

While much is known about corruption using cross-country data, little is empirically known about the determinants of bribery at the level of firms. The literature suggests by and large that bribery depends on the attributes of the firm and its operating context. For instance, Hellman *et al.* (2000) suggest that the probability of paying bribes is higher when firms are small, newly established and with poor access to public officials; when they receive public services, are engaged in trade and pay more types of taxes (Svensson, 2003); and when they face a thick web of regulations (Johnson *et al.*, 2000).

Henderson and Kuncoro (2011), using data from local governments in Indonesia where corruption is rampant, provided a model of bribes as a form of compensation for local government officials. Others suggest that bribery is determined by the type of auction regimes used in public procurement, where most bribes occur, while Mbaku (1996), in his overview of bureaucratic corruption in Africa, reported that bribes are paid not only to get licenses and permits, to avoid/minimize the tax burden, to cope with the problematic enforcement of state regulations, as the literature has generally emphasized, but also to avoid violent threats.

Scholarly attention to the determinants of bribery has increased noticeably during the last decade with the development of appropriate survey techniques. This section summarizes main findings of empirical literature on bribery activities at the firm level.

The effect of firm size on propensity to bribe has been studied extensively in the literature. Small firms have higher propensity to bribe than larger firms as the latter have more abilities to withstand bribe extortions from public officials. Arvis and Berenbeim (2003) report that the lack of robust internal procedures for dealing with various business frauds such as bribery may increase bribery activities at the firm level, and small firms are less likely to have appropriate internal protocols in place compared to larger firms. Last, small firms may be easy targets because they lack power to resist predatory officials' demands for bribe payments and they do not ordinarily attract much attention from government disciplinary agencies and law enforcement authorities (Svensson, 2003; Herrera and Rodriguez, 2003).

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The difference in corporate governance, such as ownership structure and accounting standards, may contribute to the difference in the level of bribery at the firm level. Good corporate governance also imposes more constraints on corrupt officials by increasing the risks of being caught in illicit activities. Family-run firms are often more vulnerable to bribery pressures because they may be perceived by corrupt officials as ideal 'trading' partners. Family firms are more likely to return past favors because of a longer continuity of management (Wu, 2005). Being involved with a few families instead of a large number of firms also could reduce the chances of being exposed, as corrupt officials would only need to deal with a few individuals.

Foreign ownership has generally been regarded as one of the factors that affect the incidence of bribery. In fact, an increasing number of studies has shown in recent years that companies that are wholly or partially owned by foreign investors tend to be less involved in bribery activities due to the higher bargaining power of the enterprise with authorities, since foreign stakeholders have alternative investment options, and in many cases governments aim to create a positive image to attract foreign capital (Svensson, 2003). Lee *et al.* (2010) find that companies with foreign capital have a lower incidence of bribe payments than locally owned counterparts. Hellman *et al.* (2000) also provides evidence that multinational companies are less willing to give bribes due to the lack of knowledge of the environment, 'zero-tolerance' policies on corruption, and strong accounting practices. Additionally, Herrera and Rodriguez (2003) conclude after examining multi-country firm-level data that foreign firms pay less bribes in total, but do so more frequently to various authorities.

Poor accounting practices may pose another significant barrier to efforts to reduce bribery (Wu, 2005). Meticulous accounting practices are essential to detecting and preventing bribery. Because bribery often involves financial payment in one form or another, it almost inevitably leaves a paper trail. Accounting is an information system that reports financial transactions and auditing serves as a monitoring and internal control mechanism; together they form a critical line of defense against corrupt practices.

The legal system provides a potential safety valve for controlling the spread of bribery practices: it imposes risks on both sides, to corrupt officials and to firms that pay bribes (Treisman, 2000). However, the legal system itself is a part of government structure and thus subject to the same afflictions. Firms operating within a corrupt legal environment may be more prone to bribery, for two reasons. First, predatory officials have less to fear when backed by a corrupt legal system. And, second, firms can bribe their way out of trouble when dealing with law enforcement agencies, even if their bribery activities become exposed.

Judiciary efficiency and a strong legal framework are among essential elements to promote long-term growth and economic development of a country. Many researchers argue that provision of fair and impartial judgment in disputes, as well as setting a transparent regulatory framework to mitigate corruption practices and limit opportunities to extort bribes from firms is necessary (Ali and Isse, 2002; Herrera and Rodriguez, 2003).

Regulation is an important policy instrument that governments can use, but regulation can provide a fertile breeding ground for bribery in countries with weak governance, where officials charged with regulatory responsibility are often given discretionary power (Wei, 2000). Governments not only impose regulations but also levy taxes and enforce criminal laws. As they carry out these functions, officials can delay and harass firms that they deal with, and they can impose costs selectively in a way that affects firms' competitive position (Rose-Ackerman, 1996). The greater an official's discretionary power becomes, the more opportunities arise for extracting bribery payments. Moreover, according to the endogenous harassment theory, predatory officials may create unnecessary regulations and rules expressly in order to maximize opportunities for reaping payments.

Tax evasion is a common form of financial fraud among firms that are confronted with high taxes (Palda, 2001). Opportunities for tax evasion provide firms with an incentive to bribe tax collectors to overlook the fraud or to minimize the sanction, which is why one would expect that firms facing high taxes would have greater propensity to bribe.

Batra *et al.* (2003) show that access to finance for firms in a global sample is a second constraint for business operations and growth followed by political instability. Aterido and Hallward-Driemeier (2007) and Beck *et al.* (2005) also support that limited access to finance together with poor business regulatory framework and extensive corruption significantly reduce firms' growth, especially for small enterprises.

Corruption and political instability are intertwined. Ene *et al.* (2013) argue that corruption is one of the causes of political instability in African countries, while Collier and Vicente (2012) present evidence of how political instability may enhance incentives for corruption.

Crime and corruption are among the top obstacles for the firms to do business in many developing regions in the world. There are reasons to believe that in the low security environment firms carry extra operational costs either on safety measures or bribe payments for protection. According to Goldberg *et al.* (2014), firms identify crime among major obstacles of doing business with costs (including spending on security measures, paying bribes, losing value to theft and fraud) reaching up to 10 percent of an economy in cases of some developing countries in Latin America.

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Gaviria (2002) in his work on the influence of crime and corruption on firms' performance finds that both variables have negative effects on its competitiveness and limit economic prospects for Latin American enterprises.

Based on what we know from the literature, we propose to test the effects of two sets of variables: (1) characteristics of the firm; and (2) the firm's operating context. The characteristics of the firm that we will examine includes its size, growth, governance structure, ownership and access to finance. On the other hand, the regulatory context we will examine includes the effects of audits, courts, licensing, taxation, political instability and crime.

3. Model and Data

Building on the relevant literature, we decided to test for the following hypotheses: whether small firms are more likely to bribe than larger ones (H1), whether faster growing firms are more likely to bribe (H2), whether family or individually owned firms are more likely to bribe than firms with more complex forms of governance structures (H3), whether firms are less likely to bribe if they are foreign-owned (H4), whether firms are more likely to bribe if their financial statements are not checked (H5), whether firms are more likely to bribe if the court system is corrupt (H6), whether they are more likely to pay a bribe if the licensing procedures are problematic (H7), whether they are more likely to bribe as a response to the degree to which taxes are seen as problematic (H8), whether foreign owned firms are less likely to pay bribes (H9), whether firms are more likely to pay bribes in response to the perceived severity of political instability (H10), crime (H11), and of accessing finance.

3.1 Data

These hypotheses will be tested by analyzing the data from the World Bank's Enterprise Surveys (ES), which use standardized sampling methodology and set of survey instruments to collect information on firms' responses with regard to investment climate, impediments to business growth and performance (including corruption and bribery), and business-government environment.

The ES data for African countries were collected for several years with different countries in each year, and our data includes four waves during the period 2009–2013, with the exception of 2012, when the survey was not carried out. Data were collected through interviews with managerial personnel, and our analysis is based on the responses from 10,457 firms in 30 African states. During the period from 2009–2013 the surveys for Democratic Republic of Congo and Madagascar were carried out twice, but only the latest survey data is used for our analysis.

The ES questionnaire includes representative and extensive sections on firms' attitude toward corruption and bribery activities in different business operations. For example, a manager is asked whether it is required to make 'informal payments to public officials to "get things done" with regard to customs, taxes, licenses, regulations, services, etc.',[1] and what is the annual total amount of such payments or as a percentage of firm's sales. Other examples of questions that directly related to corrupt practices include respondent's answers on expectations of informal gifts and payments in cases when a firm applies for (1) an operating license; (2) electricity connection; (3) construction-related permits; (4) compulsory certificates.

The ES provides substantial information on firms' characteristics, financial statistics, past applications for services, as well as opinions on issues to business operations. From the hypotheses on determinants of bribery stated in the previous part, independent variables were defined to measure its impact on corruption levels and incidences of bribery. The description of the variables is presented in the Table 1.

3.2 Econometric Models

In the data analysis we will use a probit regression model to estimate firms' decision to engage in bribery activities, which is treated as a binary outcome. The probit model estimates the relationship between firm's payment of a bribe (Y_i^*) and a set of determinants of bribery activities (independent variables).

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Table 1: Variable descriptions

Variable	Description
Firm's size (SMALL)	Dummy variable. 1 = small firm size (less than 100 employees); 0 = all others
Ownership (INDIV)	Dummy variable. 1 = firm is established as a sole proprietorship or a partnership or a limited partnership; 0 = all others
Foreign capital (FOREIGN)	Dummy variable. 1 = shares of a firm is owned by private foreign individuals, companies or organizations; 0 = all others
Audit (AUDIT)	Dummy variable. 1 = last year financial statements were checked and certified by an external auditor; 0 = all others
Sales dynamics (SALES_DYN)	Percentage of change (increase or decrease) of a firm's sales over the last three years
Court fairness (COURT)	The extent to which a firm agrees that the court system is fair, impartial and uncorrupted. Scale from 1 to 4 (1 = strongly disagree, 2 = tend to disagree, 3 = tend to agree, 4 = strongly agree)
License (OB_LIC)	The extent to which business licensing and permits is an obstacle to the current operations. Scale from 1 to 4 (1 = no obstacle; 2 = minor obstacle; 3 = moderate obstacle; 4 = major obstacle or very severe obstacle)
Tax rate (OB_TAXRATE)	The extent to which tax rates is an obstacle to the current operations. Scale from 1 to 4 (1 = no obstacle; 2 = minor obstacle; 3 = moderate obstacle; 4 = major obstacle or very severe obstacle)
Political stability (OB_POLSTAB)	The extent to which political stability is an obstacle to the current operations. Scale from 1 to 4 (1 = no obstacle; 2 = minor obstacle; 3 = moderate obstacle; 4 = major obstacle or very severe obstacle)
Crime (OB_CRIME)	The extent to which crime is an obstacle to the current operations. Scale from 1 to 4 (1 = no obstacle; 2 = minor obstacle; 3 = moderate obstacle; 4 = major obstacle or very severe obstacle)
Access to finance (OB_FIN)	The extent to which access to finance is an obstacle to the current operations. Scale from 1 to 4 (1 = no obstacle; 2 = minor obstacle; 3 = moderate obstacle; 4 = major obstacle or very severe obstacle)

$$Y_i^* = \varphi_i^T \beta + u_i = \beta_0 + \varphi_1 \beta_{i1} + \varphi_2 \beta_{i2} + \ldots + \varphi_w \beta_{iw} + u_i \tag{1}$$

where Y_i^* is a latent real-valued variable for observation i; φ_i^T represents independent variables values for observation i, and β defines variables' coefficients. The underlying latent probit model is observed by a dichotomized variable Y_i defined by the following equation:

$$Y_i = \begin{cases} 1. \text{if } Y_i^* > 0; \\ 0. \text{if } Y_i^* \leq 0. \end{cases} \tag{2}$$

The dependent variable Y_i is a dummy variable, that if equal to 1 means a firm is engaged in bribery practices, and if $Y_i = 0$ means no bribes were given for a previous period. The parameters of the probit model are obtained by maximization of the log likelihood function that is expressed as follows:

$$Pr(Y_i = 1) = \Phi(\beta_0 + \varphi_1 \beta_{i1} + \varphi_2 \beta_{i2} + \ldots + \varphi_w \beta_{iw}) \tag{3}$$

where Φ represents the cumulative normal distribution of independent error terms u_i.

In the course of our analysis we run two probit models. One model includes only the variables that had already been used by Wu (2009) and for which information was collected by the Enterprise Surveys. The second model includes an additional four variables. Three concern respectively the extent to which firms believe political stability, crime and access to finance represent an obstacle to their operations, while the fourth variable concerns foreign ownership. While the first model allows us to perform a cross-regional comparison of the determinants of bribery, the second model is believed to shed additional light on the contextual and firm-related characteristics which may influence firms' decision to pay bribes.

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Table 2: Corruption in Africa and the incidence of bribery by country

Country	Corruption Perceptions Index 2013[c]	% of firms that were involved in bribery activities	Control of corruption[d]
Angola	23	35	−1.32
Benin	36	48	−0.67
Botswana	64	6	1.00
Burkina Faso	38	5	0.38
Cameroon	25	44	−0.92
Cape Verde	58	2	0.77
CAR[a]	25	39	−0.84
Chad	19	36	−1.36
Congo	22	48	−1.18
DRC[b]	22	38	−1.30
Djibouti	36	4	−0.44
Eritrea	20	0	−0.43
Ethiopia	33	3	−0.68
Gabon	34	24	−0.94
Ghana	46	19	−0.07
Kenya	27	25	−1.06
Lesotho	49	13	0.16
Liberia	38	53	−0.56
Madagascar	28	19	−0.69
Malawi	37	9	−0.38
Mali	28	10	−0.65
Mauritius	52	3	0.63
Niger	34	33	−0.61
Rwanda	53	4	0.43
Sierra Leone	30	19	−0.94
Tanzania	33	12	−0.82
Togo	29	16	−1.03
Uganda	26	20	−1.05
Zambia	38	6	−0.39
Zimbabwe	21	5	−1.39

[a]Central African Republic.
[b]Democratic Republic of Congo.
[c]The Corruption Perceptions Index is published by Transparency International.
[d]Control of corruption is a part of the Worldwide Governance Indicators project and it ranges between −2.5 and +2.5.

4. Findings and Discussion

4.1 Bribery practices in Sub-Saharan Africa

Table 2 shows that in one-third of our sample, more than 25 per cent of the firms reported to pay bribes. But the data presented in Table 2 also reveal that there is considerable cross-country variation in the incidence of bribery. In fact, the percentage of bribe-paying firms varies from 0 percent in Eritrea to 53 percent in Liberia. The incidence of bribery varies not only across countries but also across regions.

If we divide sub-Saharan Africa into Western, Central, Eastern and Southern Africa (see Table 3), we find that while only 7.85 percent of the firms operating in Southern Africa reported to pay bribes while the percentage of self-reported bribe-paying firms is 9.79 percent in Eastern Africa, 17.81 percent in Western Africa and 37.87 pe cent in Central Africa (see Table 4).

The evidence at our disposal sustains the claim that firms are asked to pay bribes for a variety of purposes — obtaining licenses and permits, dealing with tax inspections, getting the access to utilities (water, electricity, telephone), and securing government

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4.2 Regression Results

The survey instrument employed to collect data from sub-Saharan African firms presented some differences from the survey instrument used by the World Bank to conduct the World Business Environment Survey (WBES). Two such differences affect and constrain our ability to replicate the analyses performed by Wu (2009). First, some of the questions asked in the WBES questionnaire were not included in the ES questionnaire. Second, some of the questions were not consistently worded in the questionnaire used for those two surveys. As a result, we can only use seven of the eleven variables used by Wu (2009) to estimate the determinants of bribery in Asian firms.

Wu (2009) found that eight of the eleven independent variables included in the statistical models had a significant impact on bribery activities. Small, individually owned firms, unhappy with the licensing process and procedures, facing strong competition and heavily taxed were more likely to engage in bribery than bigger firms, with a different corporate arrangement, less resentful over licensing regulations and facing less competition.

Furthermore, Wu (2009) reported that the probability that firms engage in bribery is affected not only by the firms' size (small), firms' ownership (individual or family), the cumbersomeness of the licensing procedures (licensing), the strength of the competition, and the nature of taxation but also by the honesty of the court system, government efficiency and the transparency in the interpretation of the law.

By replicating Wu's analysis (2009), we find that Africa's data provides a slightly different picture. There are similarities, differences in degree and differences in kind as we are about to discuss. There are four similarities between the African and the Asian results.

First, the analysis of African data reveals that the size of the firm affects bribery similarly as it does in Asia: smaller firms are more prone to pay bribes. Second, the analysis of African data reveals that the propensity to bribe is not affected whether firms' accounts were subjected to auditing — a finding that is consistent with what Wu (2009) reported for Asia. The regression coefficient for Audit is weak, negative and statistically insignificant both in Africa and Asia. Third, the firms' rate of growth, measured on the basis of increases in sales, is also an insignificant predictor of bribery both in Africa and in Asia. Finally, the fairness of the court system has a negative effect on the incidence of bribery in Africa just as it does in Asia.

In addition to these similarities, there are also differences in degree and differences in kind between the results reported by Wu (2009) and the estimates of our analyses. Specifically, there are two differences in degree between the results presented by Wu (2009) and the results presented here. First, the extent to which taxation is viewed as an obstacle by the firm affects the probability that a firm engages in bribery.

In Africa and in Asia the heavier the taxes, the greater the likelihood of bribery, but the coefficient is much stronger for Asia than it is for Africa. Second, the extent to which the licensing process and procedures are viewed as an obstacle have the same effect on the probability that firms pay a bribe, but, even in this regard, the coefficient is considerably stronger for Asian firms than it is for African ones.

There are also differences in kind between the Asian and the African case. For example, while individual ownership increases in a statistically significant way the probability of bribery for Asian firms, the analysis of Africa data reveals that individual ownership has a weak, negative and statistically insignificant impact on the African firms' propensity to pay bribes.

While the data presented in Table 6 sustain the claim that the incidence, or rather the frequency, of bribery in Africa is higher for smaller firms confronted with problems to get licenses, burdened by a heavy tax rate and confronted with a corrupt/non transparent court system, the data presented in Table 6 show that the impact of each of these independent variables varies considerably across the four regions of sub-Saharan Africa.

First of all, there is considerable variation in the number of independent variables that exercise a statistically significant influence on bribery across the four regions of sub-Saharan Africa. Only one variable (court fairness) has a statistically significant impact on bribery in West Africa, two variables (court fairness, licensing) have a significant impact on bribery in Southern Africa, three variables (firm's size, court fairness, licensing) significantly affect bribery in East Africa, while four variables (firm's size, court fairness, licensing, tax rate) do so in Central Africa.

Second, there is some variation in the impact that each independent variable plays in each of the four regions. The extent to which obtaining a license is considered to be problematic increases the probability of bribery in three regions (Central, East, South), but not in West Africa where bribery does not seem to be affected by the difficulties of the licensing process. The small size of a firm increases the probability that firms pay bribes in East and Central Africa, but not in West or in Southern Africa where the regression coefficient is insignificant. Tax rate is a significant determinant of bribery only in Central Africa.

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Table 6: Results of probit regression models for sub-Saharan Africa and its sub-regions

	Probit model					Extended Probit model				
Independent variables	Sub-Saharan Africa	Eastern Africa	Western Africa	Central Africa	Southern Africa	Sub-Saharan Africa	Eastern Africa	Western Africa	Central Africa	Southern Africa
SMALL	0.190***	0.173*	0.234	0.335**	–0.511	0.180**	0.182*	0.141	0.262*	–0.469
INDIV	–0.080	–0.003	–0.081	–0.140	0.231	–0.079	–0.002	–0.034	–0.184*	0.219
AUDIT	–0.059	0.039	–0.110	0.110	0.312	–0.037	0.035	–0.136	0.157*	0.324
SALES_DYN	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
COURT	–0.263***	–0.222	–0.186***	–0.165***	–0.419***	–0.235***	–0.207***	–0.161***	–0.144***	–0.358**
OB_LIC	0.135***	0.156***	–0.008	0.089**	0.194*	0.104***	0.123***	–0.006	0.077*	0.165
OB_TAXRATE	0.099***	0.036***	0.070	0.171***	0.035	0.080***	0.023	0.074	0.174***	0.007
FOREIGN						–0.122*	–0.196*	–0.092	–0.348***	–0.222
OB_POLSTAB						0.085***	0.115***	0.097**	–0.019	0.056
OB_CRIME						0.068**	0.043	–0.020	0.075*	0.123
OB_FIN						–0.008	–0.055*	–0.087*	0.039	0.110
No of observations	4245	2192	934	902	217	4105	2136	907	848	214
Pseudo R^2	0.06	0.05	0.02	0.04	0.13	0.07	0.06	0.03	0.06	0.15
Pearson χ^2 p-value	0.15′	0.14	0.36	0.29	0.66′	0.13	0.11	0.41	0.22	0.16′
Rate of correct classification (%)	79.2	86.3	78.9	63.3	89.9	73.0	86.1	79.2	63.9	90.2

Notes: $^{*}P < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$; ′ denotes p-value of the Hosme–Lemeshow goodness-of-fit.

This evidence suggests that not only the incidence but also the determinants of bribery vary across the four regions of sub-Saharan Africa and the efforts to reduce corruption and bribery in each of these regions should be region-specific and should address region-specific needs and conditions.

By running our second probit model (see Table 6) we develop a more nuanced understanding of the determinants of bribery in African firms. In our complete model there are eleven independent variables, five of which pertain to the firm (firm's size, ownership, audit, foreign capital, sales dynamics) while six pertain to the context in which the firms operate (court fairness, license, tax rate, political stability, crime, access to finance).

By running this second model for sub-Saharan Africa we find that bribery is strongly and significantly affected by two of the variables pertaining to the characteristics or the corporate governance of the firm. In fact small firms are likely to engage in bribery, whereas the fact that a firm's ownership structure contains foreign capital reduces the probability that a firm pays bribes.

Bribery is also significantly affected by the firm's regulatory context. Firms are more likely to engage in bribery if they believe the court system to be corrupt. Furthermore the probability that firms pay bribes increases the more they perceive crime, political instability and the licensing process to be problematic to their operations. Overall, bribery seems to be more sensitive to contextual factors than to firms' characteristics.

But the data presented in Table 6 suggest that the relative importance of contextual factors varies considerably across the four regions of sub-Saharan Africa. The estimates of probit models presented in Table 6 reveal that eight (firm's size, ownership, audit, foreign capital, court fairness, license, tax rate, crime) of the eleven independent variables included in the model have a significant impact on bribery in Central Africa, six have a statistical impact in Eastern Africa (firm's size, foreign capital, court fairness, license, political stability, access to finance), three have a statistically significant impact in West Africa (court fairness, political stability, access to finance), while in Southern Africa only the fairness/unfairness of the court system is a significant determinant of bribery.

The fairness of the court system is a significant determinant of bribery in all four regions. Political instability, the problems to get access to finance, the problems in the licensing process, the small size of firms, and the ownership with foreign capital are significant determinants of bribery in two of the four regions of sub-Saharan Africa. Individual ownership, audit, crimes and heavy taxation are significant determinants of bribery in only one of the four regions (Central Africa).

Bribery is the product of a more complex set of causes in some regions (Central Africa) than in others (Southern Africa). In each of the four regions bribery is affected by contextual factors and conditions, but while in West and Southern Africa bribery is exclusively affected by contextual factors, in Central and Eastern Africa it is also affected by firms' characteristics.

5. Conclusions and Implications

The analyses performed in this paper allow one to draw conclusions and to formulate some practical recommendations. There are three basic conclusions that could be drawn from the present study. First, bribery in sub-Saharan Africa is the product of a complex set of factors. The evidence presented in Table 6 supports our hypothesis that bribery depends on the characteristics of the firm and the contextual conditions under which a firm operates. We find that there is considerable variation in the incidence of bribery across the four sub-regions of sub-Saharan Africa.

Second, there are similarities and differences in the determinants of bribery in Asia and sub-Saharan Africa. Firm's characteristics — particularly the size of the firm — is a significant determinant of bribery in both regions. Contextual factors such as fairness of the courts, taxation, licensing — all have the same effects on the propensity to bribe among firms in Asia and sub-Saharan Africa.

Third and finally, bribery by African firms is more sensitive to contextual factors than to the firm's characteristics. This conclusion offers some interesting theoretical implications that deserves further empirical testing. The contextual factors that we have studied in this paper — corrupt courts, onerous licensing, arbitrary inspections, criminality and political instability — have the same effects on the firm in the sense that they all create *uncertainty and risk*.

A rational firm would try to reduce these risks associated with uncertainties. Bribery is one mechanism to reduce this risk. Firms would deliberately bribe officials to win procurement contracts, reduce taxes and transaction costs, reduce risks in policy decisions, maintain an ongoing relationship, facilitate licenses and services or simply because paying bribes is just part of doing business. Firms pay bribes to syndicates or the police as protection money. In this sense, bribery is supply driven. This conclusion supports the view that bribe paying firms are not always innocent victims of corruption, but are in fact active and willing participants in the bribery process. While it is obvious that bribery is also demand-driven the data at our disposal do not allow us to assess whether and to what extent bribery in African firms is driven more by demand or supply.

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There are also some policy recommendations that could be formulated on the basis of the evidence presented here. The most important of which is that, if the incidence and the determinants of bribery vary across regions and within regions, anti-corruption strategies should be tailored to address context-specific conditions. Failure to do may prevent policy makers from eradicating one of the main obstacles for socio-economic development in sub-Saharan Africa.

Note

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African Development Review, Vol. 28, No. 2, 2016, 241–243

Book Review: Stephen Meintjes and Michael Jacques, *Our Land, Our Rent, Our Jobs: Uncovering the Explosive Potential for Growth via Resource Rentals* (Shepheard-Walwyn (Publishers) Ltd, London, UK, 2015)

Brian Hodgkinson*

Our Land, Our Rent, Our Jobs is an excellent demonstration of how to apply principles of economics to precise circumstances of place and time — in this case of South Africa today. The main principles concerned are the law of rent, the incidence of taxation and the role of credit, all of which are included in the authors' understanding of natural law. What characterizes the book, and distinguishes it from others that have dealt with these same principles, is the use of the concept of resource rentals as a broader alternative to land value taxation. In support of their argument the authors quote from the preamble to the South African Constitution: 'South Africa belongs to all who live in it.' With great care and perception they draw out the implications of this statement.

Firstly, there is an examination of what the founders of modern economics, Adam Smith and David Ricardo, wrote about taxation, followed by the more explicit advocacy of taxing land values by Henry George. The aim is 'to carry forward both Henry George's and Adam Smith's thinking into a modern economy where monopoly rents arise not only from the ownership of land, but from ownership of other natural resources that belong in the public domain' (p. 19). This is a clear reference to the concept of resource rentals, which in no way excludes land values as such. Two cited facts, amongst many, show this: on the one hand, 96 per cent of total value added in South Africa arises on less than 7 per cent of the land; and on the other hand, the government introduced 'tax harmonization' in 1994 with no recognition of locational advantage. Clearly land values are given crucial importance in the analysis that follows.

The law of rent is explained with the use of several diagrams showing a range of value added on a variety of sites. The division of value added between wages and rent is explicit, with wages set on the marginal site. With all land in unconditional ownership, wages are shown to fall as unemployment leads to an excess demand for jobs. This diagrammatic exposition is a major contribution to the understanding of the law of rent and its effects. Just two comments may be made at this point. Firstly, only the extensive margin is considered, with no reference to the intensive margin, which even firms on superior sites experience as a limit to their employment of workers, as Ricardo explained. Secondly, the term 'capital' is used to include both real capital, which is an input and does not add directly to value added, and also claims on wealth such as shares and loans that attract dividends and interest paid out of rent. These omissions, however, in no way invalidate the main thesis of the book.

'Tax harmonization' in 1994 ensured that the margin of production would be inflicted with a whole range of taxes, like VAT, income tax and excise duties, which bear down on every form of production by closing marginal sites. No less than 70 per cent of the area of South Africa and 40 per cent of the population are marginal in this sense. This alone explains why the country has a vast number of rural poor, with shanty towns in the cities where those who were on sub-marginal land have fled. Justifiably this dreadful economic situation is a major concern of the authors. Examples abound, such as 'even for one dry hectare in the Karoo battling to create wealth of R50 per annum, the government still takes R10 (or 20%)' (p. 143). At the other end of the scale, prime residential land on the Atlantic seaboard of Cape Town can fetch up to R400 million per hectare. Yet it bears taxes in no way related to this enormous value.

The remedy for this dire situation follows the principles previously explained. Resource rentals would provide the government with income from every type of natural resource including, especially, land, in accordance with its annual net value

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added, that is, its economic rent. Besides providing adequate public income, other substantial benefits would flow from such a fundamental reform. The authors list them:

(1) Inefficient resource owners would sell out.
(2) Optimal use of land would be encouraged.
(3) Rural areas would become 'hives of prosperity'.
(4) Land and resources would be kept in good condition.
(5) Land speculation would be minimized.
(6) The tax system would be greatly simplified.

Difficulties are not ignored, in particular, the 'racially skewed distribution of landownership'. Existing programmes to correct this need to be continued, with the vital proviso that new farmers would be capable of paying a resource rental when they are not on marginal land.

Considerable attention is given to special cases of resources rentals. The increasing importance of the electro-magnetic spectrum is fully recognized. Unlike the present South African system, which almost gives away spectrum allocations to a few giant companies, like Telkom or Vodacom, the authors recommend auctioning licences for an initial payment, plus an annual escalating rental for a limited number of years. Successful bidders would recompense previous owners of plant and infrastructure.

Fishing rights would become property rights subject to an annual resource rental. Seaports could likewise be put out to tender with an up-front payment and an annual rental. The same principle would be applied to South Africa's nine airports, in effect treating their land occupancy as a national resource. Landing slots could be incorporated in this, perhaps with a shorter time span. Both seaports and airports would be operated by private firms, which the authors regard as usually more efficient than public operators. Some major roads in the country are toll roads. These, too, could be auctioned to the highest bidder. It is noted that resource revenues generally are raised by a good road system, so that greater public revenue could be equitably invested in this. Similar treatment could be applied to the railways. The conclusion on all such public infrastructure projects is 'act the landlord; don't bother with running them, just rent them out!' (p. 96).

Mineral resources are given a thorough analysis in view of their significance for the South African economy. Resource rental is more difficult to calculate in this case, mainly because unimproved site value cannot be easily distinguished from the current value of improvements. But here the authors find a solution to hand. South Africa, uniquely, uses a profit to revenue tax formula (GMF) for the gold mining industry. It exempts marginal mines from tax and charges other mines at an escalating rate. This system 'provides enormous flexibility for the industry as well as the ability to cope with the endless volatility inherent in commodity prices' (p. 98). Once again release from the crippling burden of other taxes, such as PAYE, would enhance production, especially at the margin. The GMF principle could be applied to other mining sectors. Reduction of tax on fuel would greatly benefit rural economies, where fuel prices at present can be up to 40 percent higher than in urban areas.

Further proposals deal with banks, the steel industry, telecom and luxury goods. All of these are labelled legacy rentiers in that barriers to entry have enabled monopoly profits to become embedded. Here the recommendation is the continuation of company tax for a limited period in addition to the general resource rentals. This dual programme would gradually reduce the banks' dependence on land values as collateral security for loans, and push them in the direction of lending to productive enterprises, an outcome which is clearly relevant to the banking industry elsewhere. ArcelorMittal, part of Mittal's global steel empire, would likewise be subject to legacy rentier treatment, as would the large telecom operators, and luxury goods providers, including tobacco and alcohol firms.

Agriculture gets special attention with regard to the racial issue of black farmers recovering land. 'Deep-seated cultural ties to land persist in the minds of what is nowadays the urban majority, a fair proportion of whom still maintain links with their rural origins' (p. 149). Farm land prices vary from the Kuruman district with a price of R500 per hectare to the Umfolozi Flats (with irrigation rights) of R90,000 per hectare. Improvements such as farmsteads, dams and so on, would be subtracted to give unimproved land values. Resource rentals based on such values would revive rural areas, including small towns, by increasing employment, attracting greater investment and raising productivity, especially where subsistence agriculture has meant rural poverty, and encourage public infrastructure.

The impact of a switch to resource rentals upon urban areas is discussed from three main aspects. One is the relief given to grossly overcrowded towns by rural development, which should reverse the huge inflow from impoverished farms. Another is

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the public collection of rent, which would deny private landlords the ability to rent 'shoebox' houses and excessive tenancies of flats in townships. Thirdly, manufacturing, like clothing and other light industries, would migrate to areas where resource rentals would be very low or zero. Freedom from VAT, PAYE and fuel taxes would greatly assist the growth of manufacturing in both urban and rural areas.

The book concludes with a chapter entitled 'Why South Africa?'. A quote from Pliny the Elder, 'Ex Africa aliquid semper novi' ('Out of Africa always something new') sums up the value of applying Georgist principles to the post-apartheid Republic. South Africa already recognizes the communal ownership of minerals and water, for example, and is in a 'better position than almost any other country in the world to explore a different and empowering fiscal system' (p. 207). Success would set a precedent for others, especially the BRIC group (Brazil, Russia, India and China), even for the faltering economies of Europe and the USA. The authors deserve great applause for their devoted application of principle and empirical research to their native economy.

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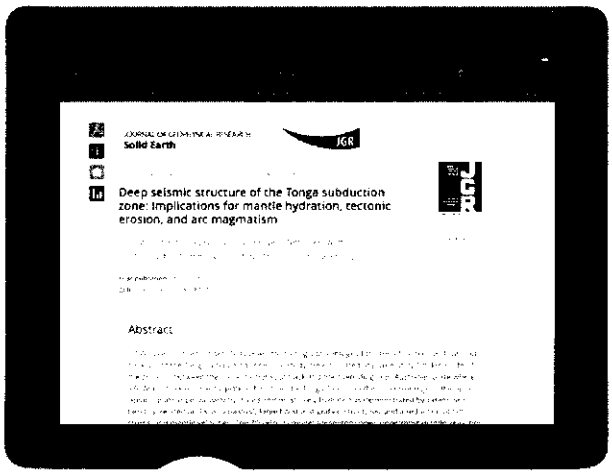

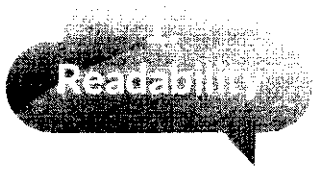

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African Development Review

AIMS, SCOPE AND AUTHOR GUIDELINES

Aims and Scope

African Development Review is a professional journal devoted to the study and analysis of development policy in Africa. Published four times a year for the African Development Bank, the *Review* emphasizes policy relevance of research findings, rather than purely theoretical and quantitative issues.

The African Development Bank is a regional multilateral development finance institution, the members of which are all of the 53 countries in Africa and 25 countries from Asia, Europe, North and South America. The purpose of the Bank is to further the economic development and social progress of African countries, individually and collectively. To this end, the Bank promotes the investment of public and private capital for development, primarily by providing loans and grants for projects and programs that contribute to poverty reduction and broadly based development in Africa.

The review contains:

- High quality articles analyzing recent critical issues relating to Africa's economic and social development;
- Empirical analyses and case studies either of single countries, or of comparative nature, which shed light on development policy choices; and
- Book reviews, conference reports and comments on *Review* articles.

It covers, amongst others, the following subjects:

- Macroeconomic Policies (Fiscal, Monetary and Exchange Rate Policy);
- Economic and Structural Reforms including Issues of Financial Sector Reforms;
- Sectoral Issues on Agriculture, Energy, Mining and Industry;
- Issues of Building Infrastructure and Human Resource Capacity;
- Private Sector Development;
- Regional and International Concerns such as Debt, Trade, Capital Flows, Regional Integration, South-South Cooperation and Globalization; and
- Socioeconomic Issues, including Income Distribution and Poverty Alleviation.

Author Guidelines

Information for Contributors

The *African Development Review* is interested in publishing papers, research notes and book reviews on development issues in Africa. The journal focuses on quality policy-oriented papers. Articles submitted should not be under consideration elsewhere. Manuscripts will be sent anonymously to at least two referees.

Preparation and submission of manuscripts

1. African Development Review has now adopted ScholarOne Manuscripts, for online manuscript submission and peer review. The new system brings with it a whole host of benefits including:
   - Quick and easy submission
   - Administration centralized and reduced
   - Significant decrease in peer review times

   Manuscripts should be submitted, double spaced throughout and typed clearly on one side of the paper only at http://mc.manuscriptcentral.com/adrev. Authors will be able to track the status of their papers online. Full instructions and support are available on the site and a user ID and password can be obtained on the first visit. If you require assistance then click the Get Help Now link which appears at the top right of every ScholarOne Manuscripts page.
2. Papers should be no more than 7,000 words. There are no submission fees.
3. The paper must be preceded by an abstract of no more than 200 words which should be submitted in English or French, and should state, in condensed form, the contribution made by the paper.
4. No more than 3 levels of headings should be used. Footnotes are to be avoided and should take the form of endnotes listed prior to the references. The Harvard style of referencing is used (author's name and date of publication bracketed in the text) and all works cited should be listed alphabetically by the author after the main body of the text, style as follows:

Bosrup, E. (1981), "*Populations and Technological Change*", University of Chicago Press, Chicago, USA.

Cohen, J. (1980), "Land Tenure and Rural Development in Africa", in *Agricultural Development in Africa*, R. Bates and M. Lofchie (eds), Praeger, New York, USA.

Nissanke, M. and Thorbecke, E. (2008), "Introduction: Globalization-Poverty Channels and Case Studies from Sub-Saharan Africa", *African Development Review*, Vol. 20, No.1, April, 1–19.

Venables, A. J. (2009), "Rethinking Growth in a Globalizing World: an Economic Geography Lens", *African Development Review*, Vol. 21, No.2, September, 331–351.

5. All editorial correspondence, outside manuscript submission and status of papers, should be sent to: the Editor, African Development Review, African Development Bank, CCIA Building, Avenue Jean-Paul II, 01 BP 1387, Abidjan 01, Côte d'Ivoire; E-mail address: j.anyanwu@afdb.org or Tel.: +225 2026 2225.

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Revue Africaine de développement
OBJECTIFS, PORTÉE ET DIRECTIVES AUX AUTEURS

Objectifs et Portée

La Revue Africaine de développement est une revue professionnelle consacrée à l'étude et à l'analyse des politiques de développement en Afrique. Publiée quatre fois par an pour la Banque africaine de développement, la *Revue* met l'accent sur la pertinence des résultats de la recherche, plutôt que sur des questions purement théoriques et quantitatives.

La Banque africaine de développement est une institution régionale multilatérale de financement du développement qui compte les 53 pays africains comme membres ainsi que 25 pays d'Asie, Europe et d'Amérique du Nord et du Sud. La Banque a pour vocation de contribuer au développement économique et au progrès social des pays africains, individuellement et collectivement. À cette fin, la Banque encourage l'investissement de capitaux publics et privés dans des opérations en faveur du développement, essentiellement par l'octroi de prêts et de dons à des projets et programmes qui contribuent à la réduction de la pauvreté et à un développement à base élargie en Afrique.

La revue contient :

- Des articles de qualité qui analysent les grandes questions récentes relatives au développement économique et social de l'Afrique ;
- Des analyses empiriques et des études de cas, soit de pays individuels, soit à caractère comparatif, qui apportent des éclaircissements sur des choix de politiques de développement ; et
- Des critiques de livres, des rapports de conférences et des commentaires sur des articles parus dans la *Revue*.

Elle couvre, notamment, les thèmes suivants :

- Les politiques macroéconomiques (Politiques budgétaire, monétaire et de change) ;
- Les réformes économiques et structurelles, y compris les questions touchant les réformes du secteur financier ;
- Les questions sectorielles sur l'agriculture, l'énergie, les mines et l'industrie ;
- Les questions relatives au renforcement de l'infrastructure et des compétences des ressources humaines ;
- Le développement du secteur privé ;
- Les questions régionales et internationales comme la dette, le commerce, les flux de capitaux, l'intégration régionale, la coopération Sud-Sud et la mondialisation ; et
- Les questions socioéconomiques, notamment, la répartition des revenus et la lutte contre la pauvreté.

Directives aux auteurs

Information aux collaborateurs

La *Revue Africaine de développement* s'intéresse à la publication d'articles, de notes de recherche et de critiques de livres sur les questions de développement en Afrique. La revue privilégie les articles de qualité axés sur la politique. Les articles soumis ne doivent pas être présentés dans d'autres revues. Les manuscrits seront envoyés de manière anonyme à au moins deux lecteurs.

Préparation et présentation des manuscrits

1. La Revue africaine de développement a à présent adopté le Manuscript central de ScholarOne, pour la présentation de manuscrit en ligne et l'évaluation par les pairs. Le nouveau système présente de nombreux avantages, notamment :

   • Une présentation rapide et facile
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2. Les articles ne doivent pas excéder 7 000 mots. Il n'est pas perçu de droits de présentation.
3. Chaque article doit être précédé d'un résumé de 200 mots au plus, rédigé en anglais ou en français, et doit présenter, sous une forme très résumée, la contribution apportée par l'article.
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Boserup, E. (1981), *Populations and Technological Change*, University of Chicago Press, Chicago, USA.

Cohen, J. (1980), 'Land Tenure and Rural Développement in Afrique', in R. Bates and M. Lofchie (eds.), *Agricultural Développement in Afrique*, Praeger, New York, USA.

Nissanke, M. and E. Thorbecke (2008), 'Introduction: Globalization-Poverty Channels and Case Studies from Sub-Saharan Afrique', *Revue Africaine de développement*, Vol. 20, N°1, Avril, pp. 1-19.

Venables, A. J. (2009), 'Rethinking Growth in a Globalizing World: An Economic Geography Lens', *Revue Africaine de développement*, Vol. 21, N°2, septembre, pp. 331-51.

5. Hormis les présentations de manuscrits et la situation des articles, toutes les correspondances relatives à l'édition doivent être envoyées à : Éditeurs, Banque africaine de développement, Immeuble du Centre de commerce International d'Abidjan CCIA, Avenue Jean-Paul II, 01 BP 1387, Abidjan 01, Côte d'Ivoire; Adresse électronique : j.anyanwu@afdb.org ou Tél. : +225 2026 2225.

Tableaux et maquettes

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The African Development Bank

The African Development Bank is a regional multilateral development finance institution the members of which are all of the 54 countries in Africa and 25 countries from Asia, Europe, North and South America. The purpose of the Bank is to further the economic development and social progress of African countries, individually and collectively. To this end, the Bank promotes the investment of public and private capital for development, primarily by providing loans and grants for projects that contribute to poverty reduction and broadly based development in Africa.

La Banque africaine de développement

La Banque africaine de développement est une institution régionale multilatérale de financement du développement. Elle compte 54 pays membres africains et 25 pays membres non africains situés en Asie, en Europe et en Amérique du nord et du sud. L'objectif de la Banque est de promouvoir le développement économique et le progrès social des pays africains, pris individuellement et collectivement. A cet effet, elle encourage l'investissement de capitaux publics et privés en faveur du développement, surtout à travers l'octroi de prêts et de dons à des projets et programmes qui contribuent à la réduction de la pauvreté et au développement économique du continent.

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