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Diery Seck *Editor*

Investment and Competitiveness in Africa

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Political Economy
CREPOL - Center for Research on Political Economy
Dakar, Senegal

ISSN 2198-7262 ISSN 2198-7270 (electronic)
Advances in African Economic, Social and Political Development
ISBN 978-3-319-44786-5 ISBN 978-3-319-44787-2 (eBook)
DOI 10.1007/978-3-319-44787-2

Library of Congress Control Number: 2016958511

Printed on acid-free paper

This Springer imprint is published by Springer Nature
The registered company is Springer International Publishing AG
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

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Introduction

Africa's recent economic history has been marked by a paradox. Sub-Saharan Africa (SSA) recorded an average growth rate of 6.8 % between 2004 and 2008 and 5.05 % between 2009 and 2014.[1] However, this high growth episode that compared favorably with all other regions except East Asia and South Asia was accompanied by a modest rate of investment and poor global ranking and limited progress in its Global Competitiveness Index. With respect to investment, in 2000, SSA had a ratio of Gross Capital Formation as a percentage of its Gross Domestic Product (GDP) that was equal to 16 %; in 2014, it was 22 %. These figures appear to be low because for the two main emerging countries of the period, the ratios were 24 % in 2000 and 32 % in 2014, for India, and 35 % in 2000 and 46 % in 2014, for China. Overall, the group of low-income countries scored 17 % and 28 %, respectively, while the middle-income countries had 25 and 31 %. The importance of the modest investment record of SSA cannot be overstated and needs to be understood in the context of the region's high growth episode.

Growth during the 10-year period, 2004–2014, could partly be explained by the high global demand for Africa's commodity exports before the onset of the Global Economic and Financial Crisis—2007 to 2009—coupled with favorable export prices, both of which declined but moderately after 2010. Growth-inducing macroeconomic reforms and enhanced political stability are also seen as contributing factors. In other words, these developments helped sustain SSA's economic growth, at least as long as their impact lasted, despite moderate levels of investment.

For the IMF, the empirical evidence shows that " ... competitiveness has a strong and significant impact on the duration of growth spells at the global level."[2] Competitiveness can also be considered useful in weathering adverse shocks. Therefore, policies that aim to improve or sustain competitiveness are crucial in

[1] See IMF, Regional Economic Outlook, Sub-Saharan Africa; Dealing with the Gathering Clouds, October 2015, Table SA1, page 81.

[2] See reference above, page 45.

achieving medium- to long-term growth. According to the World Economic Forum's Africa Competitiveness Report, 2015, of the 144 countries that are ranked according to their Global Competitiveness Index 2014–2015, only Mauritius, South Africa, Rwanda, and Morocco rank in the top half. All other 34 African countries rank below the median. More specifically, of all 38 African countries in the ranking only four score above the global median on the competitiveness pillar of Infrastructure, seven on the pillar of Business Sophistication, and seven on the pillar of Goods Market Efficiency.[3]

Using its own measures of competitiveness, the IMF reports that, for a sample of 11 African countries, apart from South Africa and two oil exporting countries, Nigeria and Angola, the change from 1995 to 2014 of Domestic Exports as a share of Total Global Exports is not significantly different from zero and is even negative for some countries. Furthermore, out of a sample of 41 African countries only two, Mauritius and Senegal, have Manufacturing's share of Total Gross Exports that exceed the world average.

As is seen above, growth is related to investment and competitiveness in the medium to long term. But what is the relationship between investment and competitiveness that can justify their joint analysis? While the definition and measurement of investment are arguably relatively unambiguous, the concept of competitiveness is approached differently by different institutions. The IMF proposes four different indicators of competitiveness.[4] These indicators include Price Index-Based Indicators: (1) the Standard Real Effective Exchange Rate (REER) and (2) the Global Value Chain REER (GVC); Price Level-Based Indicators: (3) Balassa–Samuelson Adjusted Relative Price Level and (4) Import and Export Basket. They are mainly focused on the external sector and relate to trade.

The World Economic Forum proposes the Global Competitiveness Index that is based on 12 pillars: Institutions, Infrastructure, Macro environment, Health and primary education, Higher education and training, Goods-market efficiency, Labor-market efficiency, Financial development, Technological readiness, Market size, Business sophistication, and Innovation. The Global Competitiveness Index encompasses a wide array of dimensions including markets, institutions, infrastructure, and technology and therefore proposes dimensions that complement the indicators suggested by the IMF.

Are investment and competitiveness mutually reinforcing and what is the direction of causality between the two, if any? First, it should be noted that the impact of both on growth is best felt in the medium- to long-term unlike short-term growth spurts caused by sudden variations in the price or volume of export commodities. The relationship between the pillars proposed by the World Economic Forum and Investment is multifaceted. Investment can contribute to improvement in the pillars Infrastructure, Technological readiness, and Innovation which would help increase

[3]See World Economic Forum, Africa Competitiveness Report, 2015.

[4]See IMF, Regional Economic Outlook, Sub-Saharan Africa; Dealing with the Gathering Clouds, October 2015, Table 2.1, page 33.

a country's Global Competitiveness Index. Conversely, progress recorded in the pillars Macro environment, Higher education and training, Market size, as well as Efficiency in the Goods and Labor markets would make the country more attractive for investment.

A similar analysis can be conducted between Investment and IMF's indicators of competitiveness. The standard REER and GVC-REER give an indication of a country's trade competitiveness relative to its trading partners and therefore an incentive or disincentive for investment. If a country's Balassa–Samuelson indicator improves—its prices relative to the USA are lower than the level predicted by its income level—it increases its international competitiveness and becomes more attractive for investment. Investment can have a positive effect on competitiveness if, through price competition and efficiency, it helps lower the level of prices thus of some IMF-based indicators of competitiveness.

The purpose of this book is to examine various aspects of the relationship between growth and two of its key medium-term determinants, investment and competitiveness. The 11 chapters focus on various aspects of investment (financial, physical, private, public, foreign direct investment, structural and institutional determinants) and of competitiveness (trade, value chains, regional integration, and regional disparities). The findings of the chapters are as follows.

Part I includes six chapters related to financial and physical investment. In chapter "The Performance of African Stock Markets Before and After the Global Financial Crisis", Seck examines the performance of African stock markets before and after the Global Financial Crisis of 2007–2009, in comparison to the performance of Industrialized, Asian, and Latin American countries. The empirical evidence shows that African stock markets recorded the best performance in a mean-variance space before the crisis, January 2000 to December 2007, with the highest average monthly returns and levels of total risk (standard deviation of returns) that equaled the score of industrialized countries and were significantly lower than those for Asian and Latin American stock markets. Their average systematic risk (Beta relative to the S&P 500) was the lowest among world regions. However, during the crisis, January 2008 to February 2015, they recorded the sharpest declines in their average returns and an increase in their total and systematic risk. Their average Sharpe and Treynor ratios and their Jensen's Alpha also suffered significant deterioration of their performance between the pre-crisis and the crisis period and ranked them from the best investment destination to the poorest one for a US-based investor. Weak recovery of African stock markets is documented by the inability of most of them to return to their pre-crisis index levels and the lower average returns that they have recorded since the peak of the global financial crisis.

In chapter "Structural and Institutional Determinants of Investment Activity in Africa", Chuku et al. use several econometric techniques—generalized method of moments, panel data estimation, and kernel regression to test if structural and institutional variables have a causal relationship with investment in Africa. They find that financial openness and institutional quality partly determine investment, the former having its highest impact if it reaches a threshold. However, they report a

negative interaction between financial openness and institutional quality although it is mitigated for countries with high institutional quality. In chapter "Public Investment and Competitiveness in ECOWAS: An Empirical Investigation", Ekpo performs panel data and vector error estimations to measure the effect of various determinants on economic growth in the economies of ECOWAS and finds that public investment, government consumption, and democracy have a positive impact on growth, while openness, private investment, and inflation show a negative relationship under fixed effects of the panel data analysis. The vector error correction estimates indicate various speeds of adjustments from short- to long-run equilibrium condition.

Folawewo et al. investigate the determinants of the income of nine subgroups of African countries and report that, for six of them, physical investment has a significant positive impact on income, but health investment has mixed causal links with income. Furthermore, they report evidence of conditional convergence in income among African economies. In chapter "Do Market Size and Remittances Explain Foreign Direct Investment Flows to Sub-Saharan Africa?", Amponsah and Garcia-Fuentes reveal that for 40 Sub-Saharan African countries per capita GDP and Remittances have a significant positive effect on Foreign Direct Investment (FDI) flows. The two effects are complementary although it is not known at which level of recipient countries' per capita income remittances explain increase in FDI inflows. Their results are consistent with the view that market size can be a strong determinant of FDI which underscores the need to enhance policies of regional integration, increased trade openness, and continued buildup of physical capital and other business assets to further attract FDI. Onyekwena et al. in chapter "Trade and Foreign Direct Investment nexus in West Africa: Does Export Category Matter?" use a commodity-proximity model to uncover that inward FDI that exports to European Union countries stimulates export of different goods depending on the sector. The results of their augmented gravity model show that multinational presence in ECOWAS region is associated with an increase of exports of primary goods, a decrease of exports in intermediate goods, and no effect on final goods. As a result, they suggest more export diversification and investment promotion policies that are more consistent with industrialization.

Part II of the book covers topics on competitiveness and trade. In chapter "Competitiveness and Trade in West Africa", Houeninvo and Gassama consider that domestic markets in Africa and West Africa are too small which justifies efforts toward regional integration that could foster free movement of goods, services, persons, and capital between national markets. They analyze for the period 1995–2011 the impact of the ECOWAS Free Trade Agreement on trade structure, regional specialization, and regional trade performance and its implications for economic growth and income per capita. In chapter "Financial Development, Trade Costs and Bilateral Trade Flows: Connecting the Nexus in ECOWAS", Osabuohien et al. use an augmented-gravity model to report that in ECOWAS countries financial development is a significant determinant of bilateral trade flows for exporting and importing countries. Based on their findings, they recommend that

more credit be made available to the private sector in order to boost bilateral trade flows.

Kouty and Ongono argue in chapter "Upgrading in Value Chain: The Case of Sub-Saharan African Countries" that upgrading in Global Value Chain (GVC) is an efficient way for a country to increase its international competitiveness. They use 2009 firm-level data for three SSA countries, Cameroon, Côte d'Ivoire, and Mauritius, to report that the main determinants of upgrade in GVC are a firm's profit measured by its selling price, firm size, ownership, level of firm integration, justice system, access to finance, and unfair competition from the informal sector. In chapter "Regional Disparities in the WAMZ: Integrating the Role of Market Potential and Structural Change", Omotor and Saka seek to explain the income disparities of member countries of the West African Monetary Zone (WAMZ) for the period 1980–2013 with the use of a New Economy Geography Model of Growth. They find a positive and significant relationship between initial per capita GDP and per capita GDP growth. This implies lack of conditional convergence for both periods of structural change and no structural change which they attribute to an uneven slow-growing pattern of WAMZ member countries. The changing market access variable has a negative impact on per capita GDP and, given that it is on the decline, it can help poorer countries catch up with richer countries.

Finally, in chapter "Is Regional Integration Beneficial for Agricultural Productivity in Sub-Saharan Africa? The Case of CEMAC and WAEMU", Elu and Price use a propensity score matching estimator to show that CFA Zone membership has a positive effect on agricultural value added. Their result supports the view that regional currency union membership can help achieve economic growth and reduce poverty.

The chapters summarized above examine a wide variety of causal relationships between determinants of investment and competitiveness on the one hand and Africa's economic growth on the other hand. While they shed considerable light on the complex nexus between African growth and its causes, they also leave unanswered a wide array of questions and issues that, alone, would justify several more studies. They also help draw lessons that should be kept in mind not only in the interpretation of the large volume of results produced in this book but in the design of future studies. The following are some of the most salient lessons. First, the book has given evidence of the multifaceted nature of economic growth in Africa which implies that progress is possible even incrementally on several fronts through activation of economic and noneconomic pillars. Second, short-term growth has characterized African economies but not durable growth spells. The underlying causes of short-term growth may be totally alien to those of longer growth episodes and one can argue that medium- or long-term growth in Africa is not a succession of short-term growth periods and achieving it requires commitment to structural transformation and non-reversal of enabling reforms.

Third, in many African countries Structural Adjustment Programs (SAPs) and Highly Indebted Poor Countries (HIPC) programs of the 1980s and 1990s have emphasized economic reforms but did not yield long-term growth, even for countries that tried their best to implement them. The question is whether reluctance on

their part to undertake institutional reforms or to reach a threshold in those reforms, assuming one was needed to reap the growth benefits, may condemn them to either short-term growth without development or growth without employment creation. Finally, SSA countries' persistent presence at the bottom of global rankings on income per capita, Human Development Index (HDI), or Index of Corruption Perception may bear a considerable lesson regarding the relation between these indicators and the current poor state of investment and competitiveness in Africa. In other words, the whole book may be construed as a healthy exercise in the assessment of the cost for African countries of not doing the right thing.

Dakar, Senegal Diery Seck
March 2016

Part I
Financial and Physical Investment in Africa

The Performance of African Stock Markets Before and After the Global Financial Crisis

Diery Seck

1 Introduction

One of the biggest events that have affected the world economy in the last 50 years was what is usually referred to as the Global Economic and Financial Crisis, deemed to have occurred in 2007–2009. Its impact and scope were so large that it gave rise to in-depth discussions on the need to better understand the nature of risk in financial markets, examine the adequacy of extant banking regulation, and dissect the process of financial contagion between geographical regions of the world. One of the aspects of contagion, which is the focus of the present study is the extent to which each region was affected by the global crisis with respect to the level of its stock market returns as well as change in its risk profile. Of particular interest is the case of African stock markets because they have historically been under-investigated and seen as marginalized, representing a small percentage of global financial flows and market capitalization.

Three key questions are examined in the study. First, how have African stock markets been affected by the global crisis over time and in comparison to other regions; has the crisis led to change in their respective rates of returns and co-movement with foreign stock markets, especially from the perspective of a US-based investor? Second, what was the behavior of the African stock markets during the recovery that followed the peak of the financial crisis? The third issue is related to the degree of attractiveness of African stock markets for a US-based investor's strategy of international diversification before and during the crisis.

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D. Seck (ed.), *Investment and Competitiveness in Africa*, Advances in African Economic, Social and Political Development, DOI 10.1007/978-3-319-44787-2_1

Several studies have investigated the degree of contagion or co-movement between global markets and African stock markets; Wang and Bessler (2003), Tella et al. (2011), Ntsosa (2011), Hegerty (2013), Duncan and Kabundi (2014), Sugimoto et al. (2014), and Maghyereh et al. (2015). However, they have not examined the performance of these markets from a financial investment perspective and determined the extent to which they could be considered for inclusion in international portfolios held by US-based investors.

The study is organized as follows. The first section provides a detailed analysis of the statistics of returns and risk (total and systematic) of a sample of countries that represent at least 90 % of the total market capitalization of their respective regions. Then, using the perspective of a US-based investor, the performance of each national stock market index is assessed using three common criteria, namely Sharpe's ratio (1964), Treynor's ratio (1965) and Jensen's Alpha (1968). In the second section, the analysis focuses on the capacity of each national stock market index to meet the international diversification condition for a US-based investor. The third section examines the record of national stock market indices in achieving recovery since the onset of the financial crisis. A few summary remarks conclude the study.

2 Performance of National Stock Market Indices Before and During the Global Crisis

The present study uses monthly return data for the pre-crisis period January 2000 to December 2007, and the crisis period January 2008 to February 2015. The national stock market indices of four groups of countries are included in the sample, namely Industrialized countries, African countries, Asian countries and Latin American countries. See Tables 1, 2, 3, and 4 for the detailed list of countries for each region. The perspective of a US-based investor is considered, although that of any other country could also be examined. Therefore, sensitivity of national stock market indices is calculated using their Beta with respect to the US stock market, S&P 500, instead of a proxy for global equity markets e.g. Morgan Stanley Capital International (MSCI) index, given that US-based investors commonly measure the sensitivity of domestic financial assets to the domestic stock market, usually proxied by the S&P 500 index. The risk-free rate of return is proxied by the yield on the short term US Treasury bond. The Dollar-denominated returns of the national stock market are calculated by first dividing the monthly national index series by the monthly exchange rates with the US Dollar and then computing the monthly rates of change expressed in percentage.

Table 1 Statistics of returns on national dollar-denominated stock indices before the crisis (Jan. 2000–Dec. 2007) and since the crisis (Jan. 2008–Feb. 2015), Industrialized countries

	Mean return Pre-crisis	Mean return Crisis	Mean return All period	Stand. Dev. Pre-crisis	Stand. Dev. Crisis	Stand. Dev. All period	US Beta Pre-crisis	US Beta Crisis
Australia	1.221	0.073	0.675	4.816	7.542	6.269	0.882	1.023
Canada	1.066	0.070	0.593	5.318	6.598	5.964	0.964	1.053
France	0.562	−0.176	0.211	5.280	7.449	6.395	0.838	1.050
Germany	0.835	0.394	0.626	6.727	7.750	7.214	1.143	1.203
Italy	0.505	−0.538	0.009	5.500	8.943	7.337	0.761	1.265
Japan	−0.168	0.324	0.066	5.613	5.195	5.409	0.736	0.783
Netherlands	0.416	−0.095	0.173	5.726	7.476	6.602	0.993	1.254
Russia	3.019	−0.518	1.338	9.116	11.033	10.199	1.059	1.524
Spain	0.946	−0.282	0.363	5.654	8.720	7.278	0.807	1.049
Sweden	0.447	0.520	0.481	7.026	7.747	7.357	1.176	1.128
Switzerland	0.701	0.404	0.560	4.090	5.160	4.619	0.651	0.657
UK	0.327	−0.051	0.148	3.873	5.760	4.852	0.606	0.978
S&P500	0.052	0.607	0.316	3.505	4.078	3.787		
Average	0.764	0.056	0.428	5.557	7.188	6.406	0.885	1.081

Source: International Financial Corporation, Online

Table 2 Statistics of returns on national dollar-denominated stock indices before the crisis (Jan. 2000–Dec. 2007) and since the crisis (Jan. 2008–Feb. 2015), African countries

	Mean return Pre-crisis	Mean return Crisis	Mean return All period	Stand. Dev. Pre-crisis	Stand. Dev. Crisis	Stand. Dev. All period	US Beta Pre-crisis	US Beta Crisis
Botswana	1.766	−0.309	0.780	4.601	4.110	4.485	0.235	0.345
BRVM	1.632	0.177	0.941	7.069	6.729	6.929	0.232	0.702
Egypt	1.843	−0.024	0.956	8.778	9.256	9.032	0.835	0.931
Kenya	N.A.	0.629	0.629	N.A.	7.249	7.249	N.A.	0.949
Mauritius	1.526	0.136	0.865	4.477	6.667	5.652	0.336	0.747
Nigeria	2.414	−0.778	0.897	5.428	8.822	7.395	0.248	0.832
South Africa	1.454	0.422	0.963	6.469	8.075	7.274	0.915	1.037
Tunisia	0.821	0.421	0.631	3.756	4.736	4.242	0.178	0.316
Average	1.636	0.084	0.833	5.797	6.955	6.532	0.425	0.732

Source: International Financial Corporation, Online; Bourse Régionale de Valeurs Mobilières (BRVM)

Table 3 Statistics of returns on national dollar-denominated stock indices before the crisis (Jan. 2000–Dec. 2007) and since the crisis (Jan. 2008–Feb. 2015), Asian countries

	Mean return	Mean return	Mean Return	Std. Dev	Std. Dev	Std. Dev.	US Beta	US Beta
	Pre-crisis	Crisis	All period	Pre-crisis	Crisis	All period	Pre-crisis	Crisis
China	1.705	0.002	0.896	7.467	8.126	7.812	0.327	0.649
Hong Kong	0.776	0.104	0.457	5.738	6.718	6.214	0.871	0.886
India	1.859	0.353	1.143	7.606	9.471	8.552	1.215	1.154
Indonesia	1.704	0.873	1.309	9.020	9.059	9.023	1.365	1.270
Korea	1.176	0.130	0.679	7.182	7.467	7.317	1.333	1.250
Pakistan	2.389	0.757	1.613	8.717	7.815	8.318	0.693	0.382
Philippines	0.874	1.056	0.961	7.316	6.878	7.092	1.018	0.769
Turkey	1.655	0.273	0.998	15.081	11.461	13.464	1.856	1.445
Viet Nam	3.076	−0.387	1.374	12.226	9.427	11.047	0.638	0.913
Average	1.690	0.351	1.048	8.928	8.491	8.760	1.035	0.969

Source: International Financial Corporation, Online, OECD, Online

Table 4 Statistics of returns on national dollar-denominated stock indices before the crisis (Jan. 2000–Dec. 2007) and since the crisis (Jan. 2008–Feb. 2015), Latin American Countries

	Mean return	Mean return	Mean return	Stand. Dev.	Stand. Dev.	Stand. Dev.	US Beta	US Beta
	Pre-crisis	Crisis	All period	Pre-crisis	Crisis	All period	Pre-crisis	Crisis
Argentina	0.931	1.159	1.040	11.917	10.793	11.366	1.011	1.433
Brazil	2.138	−0.313	0.973	11.505	9.837	10.785	1.715	1.264
Chile	1.250	0.290	0.794	5.894	6.818	6.350	0.984	0.710
Colombia	3.785	0.030	1.804	9.452	7.870	8.829	1.234	0.966
Mexico	1.670	0.374	1.054	6.644	7.244	6.947	1.127	1.022
Peru	2.839	0.210	1.590	7.403	10.528	9.094	0.787	1.139
Average	2.102	0.292	1.209	8.803	8.848	8.895	1.143	1.089

Source: International Financial Corporation, Online

2.1 The Nature and Extent of the Global Stock Market Crisis[1,2]

Tables 1, 2, 3, and 4 display the average monthly returns, standard deviations and Beta coefficients of the sampled countries for the period before the crisis, January 2000 to December 2007, after the advent of the crisis, January 2008 to February 2015, and for the whole period, January 2000 to February 2015. Table 1 reports the results for the Industrialized countries, grouped as advanced countries of comparable levels of per capita income rather than as a geographical region. For each country the mean return of the index declined sharply from the pre-crisis period to the crisis period. For the 13 countries the average of the mean returns fell from 0.764 to 0.056 %, a drop of −92.67 %. The pre-crisis average of mean returns is consistent with the long term historical return on stock markets in the industrialized world. Six of the 13 countries—France, Italy, The Netherlands, Russia, Spain and the UK—experienced a negative mean stock market return during the crisis period. The standard deviations of monthly returns increased significantly for the Industrialized countries as a whole and individually except for Japan. The Beta coefficients expressed as sensitivity to the US stock market—S&P 500—increased for all the national stock market indices and the average Beta increased by 22.1 % from 0.885 to 1.081. In other words, substantial increase in the total risk and systematic risk of Industrialized countries was a marked consequence of the global financial crisis.

Table 2 reports the same results for the 8 African stock markets. At 1.636 %, the average of their mean monthly returns more than doubled the performance of Industrialized countries during the pre-crisis episode. However, the crisis period average was merely 0.084 %, which constitutes a −94.9 % decline relative to the pre-crisis period. The average standard deviation of monthly returns was comparable for African and Industrialized countries before the crisis, 5.557 % versus 5.797 % respectively, and was about the same during the crisis, 7.188 % versus

[1]The determination of the beginning month for the global financial crisis was based on the examination of the monthly returns of the S&P 500 which represents the largest stock market in the world and the chronological leading role of the US economy in the onset of the crisis. The data show that the S&P 500 recorded the following monthly returns: September 2007: +3.61 %, October 2007: +3.21 %, November 2007: −3.497 %, December 2007: +1.61 % and January 2008:−6.649 %. Therefore, considering that the negative return of January was unusually large and was followed by two consecutive negative monthly returns, the foregoing analysis will consider January 2008 the beginning month of the crisis. The pre-crisis period is deemed to be January 2000 to December 2007 and the crisis period January 2008 to February 2015. The crisis-period is arbitrarily given this name bearing in mind that it includes a recovery period that is specified in the last section of the study.

[2]The national stock market indices under study can, to a large extent, be replicated by Exchange Traded Funds (ETFs) that are assets traded on the stock market that track fairly accurately the movements of their respective stock market indices.

6.955 %. The average Beta of African stock market indices rose from 0.425 before the crisis to 0.732, which underscores their significant increased synchronicity with the US market as a result of the global crisis thus making them less attractive for global portfolio diversification. In summary, a key consequence of the global financial crisis was a sharp decline in the returns of African stock markets, a moderate increase in their total risk as measured by the standard deviation of returns and a large increase in their systematic risk measured by their sensitivity with respect to the S&P500. This evolution is tantamount to a serious loss in global attractiveness.

Tables 3 and 4 provide comparator statistics on returns on 9 Asian and 6 Latin American stock markets. In the case of Asian stock markets two noteworthy results are the sharp drop of monthly returns for China and Viet Nam during the crisis period. The former went from 1.705 to 0.002 % between the two periods while the latter recorded 3.076 and −0.387 % correspondingly. The other Asian stock markets also declined but fared much better than China and Viet Nam. The standard deviations and the Betas of Asian countries remained relatively stable, which suggests that the impact of the global crisis was felt more on the level of returns than on their underlying risk, total or systematic. Compared to African stock markets, Asian mean returns were similar before the crisis 1.636 % versus 1.690 % but suffered lower declines during the crisis—0.084 % versus 0.351 %. However, their total and systematic risks remained higher than for African countries although for both measures they declined. Conversely, they rose for African stock markets.

The performance of Latin American stock markets is reported in Table 4. This region had recorded widely shared impressive rates of return before the crisis with a mean average of 2.102 %. But with the advent of the crisis, the average mean return declined to 0.292 %, Colombia reporting the worst drop from 3.785 to 0.030 % and Argentina improving from 0.931 to 1.159 %. Brazil, the economic giant of the sub-continent also experienced a sharp decline. The standard deviations and Betas of Latin American stock markets remained relatively constant with magnitudes similar to those of Asia. In both regions, the standard deviations of returns are higher than for Africa and Industrialized countries and their Betas are significantly higher than in Africa and identical with Industrialized countries.

In summary, the global financial crisis had its largest negative impact on African stock markets with a reduction in an average of mean returns higher than in any other region. However, one of the consequences of the crisis is that African stock markets have experienced lower total risk and lower systematic risk than in all other regions, which makes them of possible interest for inclusion in global low Beta portfolios.

2.2 The Sharpe Excess Return to Variability Ratio[3,4]

Considering that the investor is assumed to seek to maximize his expected utility in the mean-variance space, Sharpe's ratio (1966) constitutes one simple, but not the only, selection criterion for risky assets, especially for well diversified portfolios.[5] It is the excess return on the asset (return on the asset minus the return on the riskless asset) per unit of total risk measured by the standard deviation of its returns. It is empirically given by:

$$S_n = \frac{\mathrm{E}(R_n) - R_f}{\sigma_n} \tag{1}$$

S_n is the Sharpe ratio, i.e. excess return to variability ratio of the national stock market index; it is the excess return per unit of total risk

$\mathrm{E}(R_n)$ is the average return on the stock market index of country n

R_f is the return on the risk-free asset

σ_n = standard deviation (total risk) of the return on stock market index of country n.

Table 5 reports the values of the Sharpe ratio for national stock markets indices for the sample countries. It shows that, overall, there was a sharp decline of the ratio during the crisis period relative to the pre-crisis period. For the Industrialized countries the average ratio was 0.065 % before and only 0.006 % after. Of the 13 countries reported only 5, Germany, Japan, Sweden, Switzerland and the US (S&P 500) have a positive ratio during the crisis period, which indicates that the average return on the risk-free asset, the US short bond, was higher than the average return on the stock market index of the other 8 countries. It is also noteworthy that, at the national level, 10 countries saw their respective Sharpe ratios deline during the crisis period while for 3 others, Japan, Sweden and the US, it actually increased. The US stock market is in the unusual case of having recorded a negative Sharpe ratio before the crisis and a positive value during the crisis.

The panel on African stock markets displays a marked drop in the average Sharpe ratio with a decrease from 0.233 to 0.0 %. Before the crisis African stock markets had a significantly higher ratio than Industrialized countries and thus offered a more attractive return per unit of total risk; but this situation was inversed in favor of the Industrialized countries with the advent of the crisis. No African country increased its Sharpe ratio during the crisis period and two countries,

[3]The foregoing analysis does not take into account national differences in tax and legal systems and the degree of freedom of access to local stock markets for foreigners.

[4]Alternative criteria that are variants of Sharpe's ratio are proposed by Roy (1952), Sortino and van der Meer (1991), Sharpe (1994) and Modigliani (1997). Several empirical studies have used Sharpe's ratio to examine the performance of mutual fund managers; See Bacon (2008), Barucci (2003), Feibel (2016), Gibbons et al. (1989), Jobson (1981) and Lo (2002).

[5]For portfolio selection in the mean-variance space see Markovitz (1952).

Table 5 Sharpe ratio for monthly returns on national stock indices before and since the crisis

	Sharpe ratio	Sharpe ratio		Sharpe ratio	Sharpe ratio
	Pre-crisis	Crisis		Pre-crisis	Crisis
Industrialized countries			**Asian countries**		
Australia	0.186	−0.002	China	0.185	−0.010
Canada	0.140	−0.003	Hong Kong	0.079	0.003
France	0.045	−0.035	India	0.202	0.028
Germany	0.076	0.040	Indonesia	0.153	0.087
Italy	0.033	−0.070	Korea	0.119	0.006
Japan	−0.088	0.046	Pakistan	0.237	0.086
Netherlands	0.016	−0.024	Philippines	0.075	0.141
Russia	0.296	−0.055	Turkey	0.088	0.016
Spain	0.110	−0.042	Viet Nam	0.225	−0.050
Sweden	0.017	0.056	Average	0.151	0.034
Switzerland	0.092	0.061			
UK	0.001	−0.024	**Latin American countries**		
S&P500	−0.078	0.128	Argentina	0.051	0.099
Average	0.065	0.006	Brazil	0.158	−0.041
			Chile	0.157	0.030
African countries			Colombia	0.366	−0.007
Botswana	0.313	−0.096	Mexico	0.203	0.040
BRVM	0.185	0.013	Peru	0.340	0.012
Egypt	0.173	−0.012	Average	0.212	0.022
Kenya	N.A.	0.075			
Mauritius	0.268	0.007			
Nigeria	0.385	−0.098			
South Africa	0.175	0.041			
Tunisia	0.132	0.070			
Average	0.233	0.000			

Source: Author's calculations

Botswana and Nigeria, suffered severe declines between the two periods. As a result of the crisis, the Sharpe ratios of African and Industrialized countries became much closer, an evolution that mirrors the similarity of their respective crisis period standards deviations of stock returns reported in Tables 1 and 2.

Asian stock markets fared relatively well during the crisis period with an average Sharpe ratio of 0.034 % compared to 0.151 % before the crisis. The countries that had the highest ratios before the crisis, China, India, Pakistan and Viet Nam, suffered the biggest drops in the ratio while the Philippines actually saw its ratio increase. As reported in Table 3, Turkey had the highest total risk during the crisis period but was able to mitigate the decline of its Sharpe ratio. Latin American stock markets report Sharpe ratios that fall between African and Industrialized countries

both in the pre-crisis and the crisis periods. On the one hand, their high performance countries, Colombia and Peru, behaved like their African counterparts, Botswana and Nigeria, with similar large drops during the crisis period. On the other hand, as for Industrialized countries, their average regional Sharpe ratio was divided by 10 between the two periods −0.212 % versus 0.022 %.

Four main comments will summarize the regional Sharpe statistics reported in Table 5. First, in all the regions, countries with the largest ratios before the crisis suffered the biggest drop in comparison to their counterparts. This underscores the usual high risk high return relationship often quoted in modern portfolio theory. Second, African stock markets had the highest average Sharpe ratio before the crisis and the lowest during the crisis. More generally, with respect to the ratio, the ranking of best to worst before the crisis was totally reversed during the crisis. Indeed, before the crisis, the ranking in descending order was Africa, Latin America, Asia and Industrialized countries. Third, for all regions, given the large declines in stock markets reported in Tables 1–4, the risk-free rate and the levels of national total risk did not decrease enough to compensate for the stock market declines and maintain their attractiveness globally. Finally, it should be noted that before the crisis and after, the reward to variability ratio of industrial countries' stock markets has been lower than for other regions, which suggests that shifts in the composition of investors' global portfolios will, in the future, most probably favor stocks in the developing world.

2.3 The Treynor Excess Return to Systematic Risk Ratio

It can be argued that although national stock market indices constitute well diversified portfolios, one could perhaps achieve further diversification of the remaining idiosyncratic component of the national risk with the acquisition of international porfolios. Therefore, the only component of total risk that should be rewarded is the systematic risk component of each asset, either in the form of individual asset or national portfolio. Treynor's ratio (1965) of excess return to systematic risk, measured here as the Beta of the asset with respect to the market portfolio—S&P 500—provides a score that indicates the attractiveness of national stock indices. As for the Sharpe ratio, excess return is the difference between the national stock market return and the risk-free rate proxied by the US short term Government bond.[6]

[6]Treynor's ratio is based on the assumption that CAPM is the equilibrium pricing model for risky assets. Alternative pricing models such as the consumption-based asset pricing model (Breeden 1979), the intertemporal asset pricing model (Merton 1973) and the Arbitrage Pricing Theory (Ross 1976) have proposed different measures of systematic risk which, if applied instead of the CAPM, would yield different ratios of excess return per unit of systematic risk.

$$T_n = \frac{\mathrm{E}(R_n) - R_f}{\beta_n} \tag{2}$$

T_n is the Treynor ratio for the national stock market index of country n; excess return per unit of systematic risk.

$\mathrm{E}(R_n)$ is the average return on the stock market index of country n.

R_f is the return on the risk-free asset.

β_n is the Beta (sensitivity) of the stock market index of country n with respect to the (US) market index.

Table 6 shows the Treynor scores of the sample countries before and during the crisis. Stock markets of Industrialized countries display an average excess return per unit of systematic risk that is 0.515 % before the crisis and −0.032 % during the crisis. The average monthly yield on the US Treasury Short Term Bond was 0.324 % before the crisis and 0.087 % during the crisis, which gives an indication of the opportunity cost of investing in stocks in these countries during the crisis i.e. while bearing systematic risk. The cases of two countries stand out. Unlike for any other Industrialized country, the Japanese stock market has recorded a negative average ratio of −0.668 % before the crisis. In other words, investors were paying instead of being rewarded for bearing its systematic risk during a growing global stock market. But it posted a significantly positive Treynor ratio during the crisis, thus playing a counter-cyclical role in the global market. Therefore, it provided an opportunity to hedge against the global downturn with a long position. Russia's stock market had the highest Treynor ratio before the crisis with 2.545. Its ratio fell to −0.397 during the crisis which resulted in the largest decline between the two periods.

Table 6 Treynor ratio for monthly returns on national stock indices before and since the crisis

	Treynor ratio	Treynor ratio		Treynor ratio	Treynor ratio
	Pre-crisis	Crisis		Pre-crisis	Crisis
Industrialized countries			**Asian countries**		
Australia	1.017	−0.014	China	4.228	−0.131
Canada	0.770	−0.016	Hong Kong	0.518	0.019
France	0.284	−0.251	India	1.263	0.230
Germany	0.447	0.255	Indonesia	1.011	0.618
Italy	0.238	−0.495	Korea	0.640	0.034
Japan	−0.668	0.303	Pakistan	2.979	1.754
Netherlands	0.093	−0.145	Philippines	0.540	1.261
Russia	2.545	−0.397	Turkey	0.717	0.128
Spain	0.770	−0.352	Viet Nam	4.312	−0.519
Sweden	0.104	0.384	Average	1.801	0.377
Switzerland	0.579	0.482			
UK	0.005	−0.141			

(continued)

Table 6 (continued)

	Treynor ratio	Treynor ratio		Treynor ratio	Treynor ratio
	Pre-crisis	Crisis		Pre-crisis	Crisis
			Latin American countries		
Average	0.515	−0.032	Argentina	0.601	0.748
			Brazil	1.058	−0.317
African countries			Chile	0.942	0.286
Botswana	6.146	−1.148	Colombia	2.805	−0.059
BRVM	5.636	0.129	Mexico	1.194	0.281
Egypt	1.820	−0.120	Peru	3.197	0.107
Kenya	N.A.	0.571	Average	1.633	0.174
Mauritius	3.579	0.065			
Nigeria	8.426	−1.040			
South Africa	1.235	0.323			
Tunisia	2.792	1.055			
Average	4.233	−0.021			

Source: Author's calculations

Africa's stock markets report an average Treynor ratio before the crisis that is, at 4.233, more than 8 times that of their Industrialized counterparts. But it experienced the largest drop among regions to a level that is close to the Industrialized countries' score at −0.021 versus −0.032, and worse than for Asia and Latin America. The two countries that had recorded the largest Sharpe ratio declines, Botswana and Nigeria, also recorded the largest Treynor ratio decreases. It should be noted that before the crisis, several individual national stock markets displayed a significantly higher Treynor ratio than even the Industrialized country with the highest score, Russia, which implies that during episodes of global stock market growth, they are very attractive for investment in international stock markets.

Asian and Latin American stock markets did not report pre-crisis Treynor ratios that are comparable to Africa's but performed better than Industrialized countries. However, their ratios during the crisis were higher than in the other two regions, both having suffered comparable declines in the ratio. As was the case with the Sharpe ratio, China and Viet Nam for Asia, and Colombia and Peru for Latin America, had the highest Treynor ratios before the crisis and experienced the largest declines during the crisis. Scrutiny of the Treynor ratios by region seems to indicate that the change in ranking across regions from Africa, Asia, Latin America and Industrialized countries before the crisis to Asia, Latin America, Africa and Industrialized countries, the last two almost tied, may be explained by the larger increase in the respective Betas of African and Industrialized countries. Asia and Latin America actually saw their Betas decrease during the crisis.

Table 7 Jensen's alpha for national stock indices before and since the crisis

Industrialized countries	Jensen's alpha Pre-crisis	Jensen's alpha Crisis	**Asian countries**	Jensen's alpha Pre-crisis	Jensen's alpha Crisis
Australia	1.137	0.027	China	1.470	−0.146
Canada	1.004	0.032	Hong Kong	0.689	0.021
France	0.465	−0.215	India	1.865	0.343
Germany	0.822	0.397	Indonesia	1.751	0.894
Italy	0.388	−0.518	Korea	1.215	0.146
Japan	−0.292	0.213	Pakistan	2.253	0.537
Netherlands	0.362	−0.078	Philippines	0.827	0.941
Russia	2.983	−0.428	Turkey	1.836	0.342
Spain	0.841	−0.320	Viet Nam	2.926	−0.463
Sweden	0.443	0.503	Average	1.648	0.291
Switzerland	0.554	0.258			
UK	0.168	−0.109	**Latin American countries**		
Average	0.740	−0.020	Argentina	0.882	1.225
			Brazil	2.280	−0.294
African countries			Chile	1.194	0.159
Botswana	1.505	−0.539	Colombia	3.797	−0.031
BRVM	1.372	0.044	Mexico	1.652	0.328
Egypt	1.746	−0.095	Peru	2.729	0.195
Kenya	N.A.	0.563	Average	2.089	0.264
Mauritius	1.293	0.015			
Nigeria	2.157	−0.876			
South Africa	1.378	0.380			
Tunisia	0.545	0.183			
Average	1.428	−0.041			

Source: Author's calculations

2.4 Jensen's Alpha for Returns on National Stock Indices

An alternative technique for assessment of the performance of a portfolio is proposed by Jensen (1968). Jensen's Alpha seeks to measure the differential return between the actual average return on the portfolio and the average return that is based on the Capital Asset Pricing Model (CAPM), assuming the model determines the equilibrium prices of risky assets; Sharpe (1964), Lintner (1965) and Mossin (1966). The CAPM-determined average return has three arguments: The expected return on the market portfolio, the return on the risk-free asset and the Beta of the portfolio being evaluated. A positive differential return indicates that the portfolio has a performance that is superior to market expectations and a negative Alpha indicates inferior performance. The relationship is given below.

$$\alpha_n = E(R_n) - \left[R_f + \beta_n\left(E(R_m) - R_f\right)\right] \quad (3)$$

α_n is Jensen's Alpha for the returns on the national stock market index of country n.

$E(R_n)$ is the average return on the stock market index of country n.

$E(R_m)$ is the average return on the market portfolio (S&P 500).

β_n is the Beta of country n.

R_f is the return on the risk-free asset.

Table 7 displays Jensen's Alpha for the national stock market indices before and during the crisis. During the pre-crisis period Industrialized countries reported an average Alpha, the average differential return, equal to 0.740 %, which gives an indication of the strength of this episode' bull market. Recall that the average differential return on the S&P 500, which is also its Alpha given that its Beta is equal to 1 was the difference between its average return and the average yield on the US Short-term Bond: 052 %–0.324 % = −0.272 %. This implies that before the crisis all industrialized countries in the sample performed better than the US, except for Japan which, in addition, has a negative Alpha during the same period.

However, the average differential return of industrialized countries declined significantly to a negative value of −0.20 % during the crisis. Here also the counter-cyclical behavior of the Japanese stock market is confirmed with an Alpha of −0.292 % before the crisis and 0.213 % during the crisis. The case of Sweden is to be noted with an increased Alpha from 0.443 % before the crisis to 0.503 % after. As reported with the previous measures of performance, Russia stands out with the highest Alpha before the crisis and the largest drop during the crisis. The high average Alpha for industrial countries before the crisis raises the issue of the adequacy of the classical CAPM given above as the right asset pricing model considering that, in theory, the average differential return should be equal to zero in an equilibrium market. It can also be argued that an alternative risk-free asset should be considered for the calculation of Alpha or that the periods before and during the crisis are not long enough for the average return of the S&P 500 to be an unbiased estimator of the true expected return on the market portfolio.

3 International Diversification Condition

The three evaluation criteria used above, Sharpe, Treynor and Jensen, have given an accurate view of the performance of national stock indices in various parts of the world, before and during the crisis, using different measurement perspectives. An important issue that needs to be resolved is whether a US-based investor would gain from international diversification and, if so, in which foreign stock markets to invest. Elton et al. (2007, Chap. 12) propose an approach to determine the suitability of foreign stocks as potential candidates for international diversification for a US-based investor (which can also be used for foreign-based investors). The underlying rationale is that a US-based investor should hold non-US securities if

the Sharpe ratio of the foreign stock, using the US risk-free rate in its measurement is higher than the product of the Sharpe ratio of the US stock market index and the correlation coefficient between the US and the foreign stock markets indices. In other words, the difference between the two measures should be positive for the foreign asset to be considered for international diversification. The formula is given below.

$$\frac{\mathrm{E}(R_n) - R_f}{\sigma_n} - \frac{\mathrm{E}(R_{us}) - R_f}{\sigma_{us}} \rho_{n,us} > 0 \tag{4}$$

$\mathrm{E}(R_n)$ is the average return on the stock market index of country n.
$\mathrm{E}(R_{us})$ is the average return on the stock market index of the US, S&P 500; $\mathrm{E}(R_{us}) = E(R_m)$.
σ_n is the standard deviation or total risk of the return on the stock market index of country n.
σ_{us} is the standard deviation or total risk of the return on the US stock market.
R_f is the return on the US risk-free asset.
$\rho_{n,us}$ is the coefficient of correlation between the returns on the markets of country n and the US.

Table 8 reports the score for the international diversification condition of the sample countries before and during the crisis. Before the crisis, all the Industrialized countries, except for Japan, offered scope for international diversification for a US-based investor. Russia, Australia and, to a lesser extent, Canada and Spain, were attractive investment destinations for US capital. Therefore, before the crisis, it made economic sense for the US investor to hold a significant portion of foreign stock in his portfolio. But during the crisis, all the Industrialized countries recorded a negative score of the international diversification condition, which, based on this criterion, disqualified all of them for stock market investment by the US investor and, could be a motive for divestment from these markets and investment solely at home. Therefore, the notion that an internationally diversified portfolio could provide gains through higher returns or lower total risk was not supported by the scores of the Industrialized countries during the crisis period.

Before the crisis, African stock markets reported significantly positive scores on average and thus constituted very attractive investment destinations for the US-based investor. Their average score of 0.258 more than doubled the average score of Industrialized countries, 0.121, with countries, Botswana (0.336) and Nigeria (0.405), surpassing the highest score among Industrialized countries recorded by Russia. But they experienced a major decline in their scores during the crisis period with −0.050, which is comparable to the score of Industrialized countries, −0.081. However, during this period two countries, Kenya and Tunisia, had positive scores albeit close to zero. It is noteworthy that African stock markets suffered the largest decline in their average scores than any other region.

Before the crisis, Asian and Latin American stock markets all reported positive scores on the international diversification condition, Asian markets with a score slightly higher than for Industrialized countries and Latin American with a score

Table 8 International diversification condition for national stock indices

	Int. Div. Pre-crisis	Int. Div. Crisis		Int. Div. Pre-crisis	Int. Div. crisis
Industrialized countries			**Asian countries**		
Australia	0.237	−0.073	China	0.202	−0.049
Canada	0.189	−0.086	Hong Kong	0.121	−0.065
France	0.090	−0.109	India	0.244	−0.036
Germany	0.121	−0.043	Indonesia	0.192	0.012
Italy	0.073	−0.145	Korea	0.167	−0.084
Japan	−0.049	−0.030	Pakistan	0.260	0.065
Netherlands	0.063	−0.114	Philippines	0.113	0.085
Russia	0.327	−0.130	Turkey	0.119	−0.052
Spain	0.151	−0.105	Viet Nam	0.241	−0.049
Sweden	0.062	−0.021	Average	0.184	−0.019
Switzerland	0.140	−0.001			
UK	0.049	−0.112	**Latin American countries**		
Average	0.121	−0.081	Argentina	0.074	0.028
			Brazil	0.195	−0.109
African countries			Chile	0.203	−0.022
Botswana	0.336	−0.130	Colombia	0.399	−0.071
BRVM	0.200	−0.038	Mexico	0.248	−0.034
Egypt	0.200	−0.064	Peru	0.370	−0.046
Kenya	N.A.	0.008	Average	0.248	−0.042
Mauritius	0.297	−0.049			
Nigeria	0.405	−0.146			
South Africa	0.214	−0.026			
Tunisia	0.157	0.045			
Average	0.258	−0.050			

Source: Author's calculations

slightly lower than for African markets. Colombia (0.399) and Peru (0.370) performed very well with scores that rivalled the best scores in Africa. But for both regions, the average score decreased significantly during the crisis to −0.019 for Asia and −0.042 for Latin America. In the cases of Indonesia, Pakistan, the Philippines and Argentina, the score remained positive, which gave moderate scope for international diversification during the crisis. One caveat is that either they suffered a large drop between the two periods—Indonesia and Pakistan—, or they had a low score even during the pre-crisis period—the Philippines and Argentina—, compared to their regional counterparts. In summary, the results indicate that the scope for international diversification for a US-based investor is conditional on the state of the global stock market. In a bull market, foreign stocks are attractive and justify holding of portfolios with a high foreign component; but during a market

downturn, US-based investors face limited opportunities to gain from international diversification and may be better off increasing the domestic component of their stock portfolio.

4 Have African Stock Markets Recovered?

The foregoing analysis has documented the large decline of African stock markets during the crisis, for convenience referring to the period January 2008 to February 2015. It is commonly viewed that the crisis lasted mainly from 2008 to 2009, although the starting and ending months are still debated. Therefore, examination of the possible recovery of African stock markets requires an unambiguous end date of the crisis in order to determine whether such a recovery occurred. Two approaches are proposed. The first one consists in considering the lowest point in the S&P 500 index during the crisis and including all subsequent months in the recovery period. Indeed, the S&P 500 index reached its bottom in March 2009 and since then followed a strong upward trend. Consequently, for the sake of the present analysis, a US-based investor could consider April 2009 as the beginning of the recovery period. The second approach consists in examining if national stock market indices increased enough to reach their levels of January 2008, the month deemed in the present analysis to start the crisis period. In other words, the analysis consists in seeing if all the losses incurred during the crisis, January 2008 to March 2009, were fully recovered afterwards. The second approach is considered first.

Figure 1 gives a graphic evolution of African national stock price indices and the S&P 500 index rebased at January 2008 = 100. First, it shows that the S&P 500 experienced a strong recovery after the downturn and significantly surpassed its January 2008 level by more 60 % in February 2015. Second, 7 of the 8 African stock market indices followed the S&P 500 in its sharp drop to also reach their lowest levels in or around March 2009. Tunisia was an exception because its stock market index grew during the year 2008 when all other African countries started an earlier decrease. But it also declined and reached its bottom in January and February 2009. As a group, African stock market indices did not record a recovery similar to that of the S&P 500. In February 2015, only Kenya, South Africa and Tunisia had exceeded their levels of January 2008. Furthermore, over the years, Nigeria has not been able to rise significantly above the bottom level of its stock market index and remained for several years at or near its bottom. Egypt also experienced an unfavorable record by dipping twice close to its bottom in November 2011 and July 2013. Overall, 5 out of 8 African stock markets have not been able to mount a full recovery by reaching an index level equal to, or higher than, it was in January 2008, 7 years after the onset of the global stock market crisis.

Are African stock markets on the path to medium to long term recovery? Such a recovery could be observed if the trend of their indices after the market (S&P 500) reached bottom was on an upward slope, arguably close to the performance that they recorded before the crisis. Therefore, the statistics of their performance during the recovery period should be close to, or better than, their levels before the crisis.

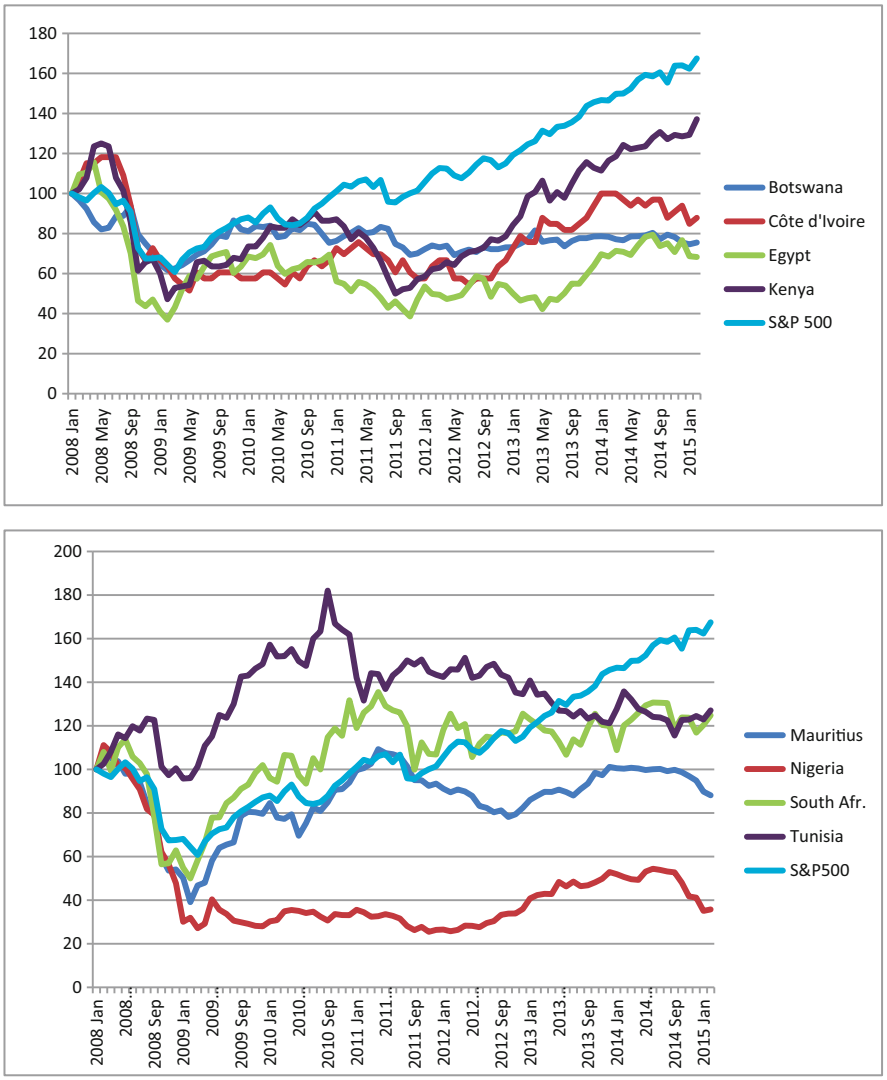

Fig. 1 Dollar-denominated national stock market indices of Africa and S&P 500, Jan. 2008–Feb. 2015. Rebased at January 2008 = 100

In other words, it would be growth as usual after the incident of downturn during the crisis, January 2008 to March 2009. The recovery is considered to cover the period April 2009 to February 2015. Table 9 reports the statistics of returns on the S&P 500 and on African stock market indices before the crisis and during the recovery.[7]

[7]For statistics on the crisis period please refer to Tables 1–4.

Table 9 Statistics of returns on national dollar-denominated stock indices before the crisis (Jan. 2000–Dec. 2007) and during recovery period (Apr. 2009–Feb. 2015)

	Mean return Pre-crisis	Mean return Recovery	Stand. Dev. Pre-crisis	Stand. Dev. Recovery	Beta pre-crisis	Beta recovery
Botswana	1.766	0.326	4.601	3.466	0.235	0.238
BRVM	1.632	0.750	7.069	5.818	0.232	0.519
Egypt	1.843	0.984	8.778	8.245	0.835	0.719
Kenya	N.A.	1.494	N.A.	5.346	N.A.	0.640
Mauritius	1.526	1.010	4.477	4.951	0.336	0.623
Nigeria	2.414	0.643	5.428	7.462	0.248	0.897
South Africa	1.454	1.294	6.469	6.667	0.915	0.918
Tunisia	0.821	0.416	3.756	4.436	0.178	0.131
AVERAGE	1.636	0.865	5.797	5.799	0.425	0.586
S&P500	0.052	1.482	3.505	2.982		

The average return on African stock market indices during the recovery period was 0.865 %, a level significantly lower than that of the S&P 500 which was 1.482 %. In other words, African countries recovered but recorded a performance that was considerably lower than their pre-crisis average return of 1.636 %. Individually, they all recovered but did not record their pre-crisis returns while Tunisia's pre-crisis average return was halved during the recovery period. The total risk of African stock market indices shows mixed results during the recovery period. Three markets, Botswana, BRVM and Egypt, have a lower standard deviation than during the pre-crisis period, while three others, Mauritius, Nigeria and Tunisia, have higher standard deviations. The Betas of the countries have all decreased in comparison to the crisis-period but have mixed results if compared to the pre-crisis period. Two countries, Botswana and South Africa, have unchanged Betas, three have higher Betas, BRVM, Mauritius and Nigeria, while Egypt and Tunisia have Betas that are lower than during the pre-crisis period. In conclusion, African stock markets are on the path to long term recovery with positive average returns and sensitivity levels that are lower than during the crisis although not as low as before the crisis. Therefore, they are gaining attractiveness but not as much as was the case before the breakout of the global financial crisis.

5 Conclusion

The empirical evidence on the performance of African stock markets before and during the global financial crisis shows several striking facts. Before the crisis, January 2000 to December 2007, African stock markets had mean monthly returns that outpaced the returns of all other regions of the world with levels of total risk (standard deviation of returns) that equaled the score of Industrialized countries and

were significantly lower than for Asian and Latin American stock markets. Their average systematic risk (Beta relative to the S&P 500) was significantly lower than that of their counterparts in other regions. However, with the advent of the crisis, January 2008 to February 2015, they suffered a sharp decline in their average returns and a rise in their levels of total as well as systematic risk albeit showing lower risk than in other regions. As a result, their performance was less attractive in a mean-variance space for a US-based investor even if they remain of possible interest for inclusion in global low Beta portfolios.

Evaluation of the performance of the African stock markets before and during the financial crisis is conducted using three criteria: Sharpe's ratio, Treynor's ratio and Jensen's Alpha. For Sharpe's ratio, in all regions, countries with the highest score before the crisis recorded the biggest drop during the crisis in comparison to their counterparts in their respective regions. Furthermore, the ranking of Sharpe's ratio from highest to lowest, African stock markets being the first –Africa, Latin America, Asia and Industrialized countries—, was totally inversed during the crisis. This provides evidence that African stock markets suffered the largest negative impact of the global financial crisis. It is noteworthy that the average reward to variability ratio of industrial countries' stock markets has been lower than for other regions, which suggests that shifts in the composition of investors' global portfolios will, in the future, most probably favor stocks in the developing world.

Not unlike Sharpe's ratio, Treynor's ratio unveils the strong performance of African stock markets before the crisis for every individual country and for the region's average which is a multiple of the average of the ratio of other regions. In other words, African stock markets were attractive as a regional group and individually. But their Treynor score experienced the biggest drop during the crisis and equaled the poor performance of Industrialized stock markets, Asia and Latin America taking the lead during this episode with the help of a decrease in their Betas. The sharp drop in the Treynor score of Industrialized and African stock markets during the crisis may have been caused more by the rise in their respective Betas than by reduction of their average returns. African stock market indices recorded the highest decline in their Jensen's Alpha than any other region because of the sharp rise in their required rate of return (large increase in their Betas) and a lower average return during the crisis thus giving them the lowest score. Other regions were also affected but fared better than Africa thanks to a moderate increase—Industrialized countries—or even a lower Beta—Asia and Latin America—, during the crisis.

Analysis of the attractiveness of African stock markets for inclusion in the portfolio holdings of a US-based investor has revealed that they would have been the best investment destination before the crisis, based on the international diversification condition. However, their scores declined sharply at the individual level and on average. The reduced attractiveness for a US-based investor also affected all other regions which implies that, during the crisis, US-based investors were better-off not including foreign stocks in their portfolios but by investing domestically instead. Conversely, under growth in global equity markets, foreign stocks may gain in attractiveness and be included in the portfolio of a US-based investor.

Inquiry into possible recovery of African stock markets after the global financial market has yielded two key results. If the starting point of the crisis, January 2008, is used as a benchmark to measure the extent of recovery, the S&P 500 has recorded more than 60 % progression by February 2015. In other words it has fully recovered. But during the same period, only three African countries, Kenya, South Africa and Tunisia, recorded national index levels higher than in January 2008, but at levels considerably lower than the S&P 500. The other 5 have still not fully recovered, 7 years after the onset of the crisis. The second result shows that, since the bottom of the S&P 500, March 2009, deemed to be the beginning of the global recovery, African stock markets have recovered but recorded a performance that was significantly lower than during the pre-crisis period. Indeed, their average return was just half what it was before the crisis, their total risk declined moderately and their systematic risk was higher than before the crisis although much lower than during the crisis. In summary, African stock markets are on a path to long term recovery but do not seem to replicate the performance levels that they experienced before the crisis.

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Structural and Institutional Determinants of Investment Activity in Africa

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1 Introduction

As shown in a recent World Bank study, the cross-country variation in investment activity and returns is widening and the variation is even more pronounced in Africa. Between 1980 and 2010, the rate of gross capital formation ranged between 1 and 90 % of production worldwide (see Lim 2014). This widening variation in investment activity is mostly due to the different kinds of frictions present in different economies which, prevents a normalization of the returns from investment activities across countries. This eventually inhibits the potential for regional integration and investment competitiveness in regional blocks. In order to facilitate efforts towards regional integration in Africa, it is important to correctly identify the factors that are responsible for the investment related frictions in African economies. Hence, in this study, we endeavour to provide answers to questions such as, what are the determinants of the relative investment activity in Africa, how do structural and institutional factors influence investments and what are the possible interactions.

Addressing these question in the African context generally requires a slightly broader approach than is used in the literature (see for examples Ndikumana 2005; Love and Zicchino 2006). This is particularly so because of the greater diversity

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D. Seck (ed.), *Investment and Competitiveness in Africa*, Advances in African Economic, Social and Political Development, DOI 10.1007/978-3-319-44787-2_2

that exists in the region in terms of political and institutional frameworks, which are different from the relative homogeneous characteristics of developed economies in Europe and America. The proposition we make in this study is that in addition to the traditional economic factors that determine investment frictions and activity, there exist a wider set of factors including political, security, legal and institutional dimensions that should be accounted for in understanding the dynamics of investment activity and competitiveness in Africa.

The objective of this study is to empirically identify the broad set of factors that explain the differences in investment activity and competitiveness in Africa in the last three decades. The study is particularly different from others in the literature because it considers a broader set of structural and institutional determinants that are important to characterize the problem in the African context and does not lump developed and developing countries together in a panel. Secondly, we approach the problem from an agnostic point of view, in other words, we do not assume any prior knowledge of the nature of the relationship. We allow the data to tell the story the way it is by using nonparametric regression techniques in addition to their parametric counterparts. This allows us to account for possible nonlinearities and complementarities in the relationship.

To preview the results, we find that among the structural variables considered, financial openness appears to be the robust structural determinant of investment activity in Africa. On the other hand, institutional quality appears to be the robust determinant of investment among the institutional variables considered. We also find evidence of nonlinearities in the relationship, suggesting that there are turning points after which the observed effects of the structural or institutional variable are reversed. There is also some evidence that the potentially inhibiting effects of financial openness is dampened at higher levels of institutional quality.

The rest of the paper is organized as follows; Sect. 2 collects some of the relevant literature, Sect. 3 highlights the empirical strategy used along with the data sources, Sect. 4 contains results from the parametric and nonparametric regression analysis, while Sect. 5 is the conclusion with recommendations for policy.

2 Relevant Literature

The theoretical and empirical literature on investment behaviour is quite established and robust. The key references that provide detailed review of the theoretical and econometric literature on investment behaviour can be found in Jorgenson (1971) and Clark et al. (1979). The major theoretical formulations used to define investment behaviour can be classified under; (i) the simple accelerator theory, (ii) liquidity theory, (iii) expected profits theory, (iv) Tobin's Q theory and (v) the neoclassical theory (see Oshikoya 1994).

The neoclassical and accelerator theories are often the most utilized models in the literature especially for empirical tests using data from industrially developed economies. In the past, data availability and structural diversity have limited the

application of this class of models for the establishment of the empirical investment relations in Africa and other developing regions. This is particularly because the key assumptions of the neoclassical theory such as the existence of perfect capital markets, little or no public investments among others are often not satisfied in this regions. These limitations, among others, have narrowed the focus of most studies on investment behaviour in developing countries to concentrating on explaining the causes of variations and the determinants of private investments (see Oshikoya (1994), for example).

Economic size, (i.e GDP) and economic growth are hypothesized to be positively related to investments. This relation is mostly derivable from the flexible accelerator model which assumes that there is a fixed relationship in the production function between the desired capital stock and the level of output (see Fry 1980). Bank credits are also hypothesised to have a positive impact on investment activity. The effect on investments works directly through the stock of credit available to firms. This positive impact have been found in many studies for developing economies (see Levine 2002; Fry 1980).

The impact of government spending and consumption on investment activity is theoretically ambiguous. The reason is because there are at least two known possible channels through which public expenditure could affect investment activity. On the one hand, public sector spending that results in high fiscal deficits may crowd out private investments through high interest rates, credit rationing and higher current and future tax burdens. On the other hand, if most of government spending is concentrated on infrastructure (such as transportation, communication, security, etc.), then government expenditure and investments is likely to be complemetary with private investments (see Blejer and Khan (1984), for early evidence in the literature).

Recently, Lim (2014) has shown that in addition to traditional macroeconomic variables, it is also important to consider structural and institutional variables to understand the worldwide variation in investment activity. Their paper used data from 129 developed and developing countries to show that financial development and institutional quality are reasonably robust determinants of cross-country investment variations. Our study is closely related to the study by Lim (2014) in a broad sense, although we focus on Africa and try to address some of the potential shortcomings arising from the common practise of estimating the relationship using instrument based techniques like GMM. Here, we address this problem by considering nonparametric regression techniques which adequately deals with issues of nonlinearities and cross-sectional dependencies in the relationship.

3 Empirical Strategy and Data

3.1 Parametric Specification

The empirical strategy adopted in the study is theoretically motivated by a standard neoclassical growth formulation, (see Lim (2014), for a similar application), with a constant returns to scale production function in a Cobb-Douglas framework;

$$Y_{it} = e^{z} K_{it}^{\alpha} L_{it}^{1-\alpha}, \tag{1}$$

where Y_{it} is the level of output in country i, e^{z} is technology which is subject to a stochastic AR(1) shock process thus; $z_t = \rho z_{t-1} + \varepsilon$, while K_{it} and L_{it} are the capital and labour inputs used for production in country i, and α is the share of capital in output. Capital stock evolves according to the following equation of motion

$$K_{i,t+1} = (1-\delta)K_{it} + I_{it}. \tag{2}$$

The optimal capital stock in country i at time t is given as the weighted ratio of real output Y_{it} and the cost of capital R_{it} hence

$$K_{it}^{*} = \frac{\alpha Y_{it}}{R_{it}^{\sigma}}, \tag{3}$$

where σ is the substitution elasticity of capital. Using the familiar result from neoclassical growth theory that in steady state with a balanced growth path μ, the growth rate of output, capital and consumption are equal, we can plug in the optimal level of capital (Eq. 3) into the steady state equation of motion for capital (Eq. 2) to obtain an expression for investment as;

$$I_{it} = \frac{\alpha(\delta+\mu)Y_{it}}{R_{it}^{\sigma}} \tag{4}$$

By taking the logarithm of both sides of (Eq. 4), we obtain an estimable equation for investment given as;

$$\ln I_{it} = \ln\alpha + \ln(\delta+\mu_{it}) + \ln Y_{it} - \sigma \ln R_{it}, \tag{5}$$

where $\ln\alpha$ is the constant term and $\ln(\delta+\mu_{it}) \equiv g_{it}$ is the depreciation-adjusted growth rate in country i. To account for the additional structural and institutional variables which the neoclassical growth theory abstracts from, we include additional economic and structural variables in the vector $\mathbf{X}_{it}$ and institutional variables in the vector $\mathbf{Z}_{it}$, plus an error term ε_{it} so that the complete econometric estimation equation becomes

$$i_{it} = \beta + \rho i_{i,t-1} + \phi g_{it} + \varphi y_{it} - \sigma r_{it} + \Omega' \mathbf{X_{it}} + \Psi' \mathbf{Z_{it}} + \varepsilon_{it} \quad (6)$$

Here, the lower-case letters indicate the logarithms of the variables and bold letters are vectors. Further, we introduce an investment smoothing term $i_{i,t-1}$ to account for partial-adjustment behaviour in capital formation observed in the literature (see Eberly et al. 2012).

The baseline regression equation in (6) is primarily estimated by system generalized method of moments (GMM) with parametric robustness tests conducted using fixed effect, random effect and pooled panel data regression techniques. The main advantage for using the system GMM technique is to enable us exploit the efficiency gains that arise from considering the instrument set as a system, especially given that the number of cross-section identifiers are less than the time series (i.e. N < T). This method also allows us to take care of potential endogeniety problems.

3.2 Nonparametric Specification

The GMM specification highlighted in the previous section is often robust when there are obvious concerns about endogenity and one is able to obtain relevant and valid instruments that correctly identify the parameters of interest. Often times, researchers are not always blessed with instruments that satisfy these conditions. Further, the GMM specification may be very restrictive in the sense that it presupposes the existence of a linear relationship with monotonicities and is not able to directly account for complementarities between the right-hand side variables.

In this section, we consider a class of models that are less restrictive in terms of specification of the functional form of the relationship and at the same time capable of handling problems of endogeniety in the relationship between structural and institutional determinants on investment activity in Africa. Specifically, we consider nonparametric regression techniques in the spirit of Racine et al. (2006). However, to justify the application of this technique we first test a parametric version of the model to determine whether the relationship is nonlinear and non-monotic.

To achieve this, we employ Hsiao et al. (2007)'s nonparametric and consistent test for correct specification of parametric model. Our choice of this method is because it admits the mix of continuous and categorical data types. Using this approach, the null hypothesis can be stated as follows: $H_O : E(Y|x) = m(x, \gamma_0)$, for almost all x and for some $\gamma_0 \in \mathcal{B} \subset \mathbb{R}^p$. Where $m(x, \gamma)$ is a known function with γ being a $p \times 1$ vector of unknown parameters which includes a linear regression model as a special case and $\mathcal{B}$ is a compact subset of $\mathbb{R}^p$. The alternative is the negation of H_O, that is $H_1 : E(Y|x) \equiv g(x) \neq m(x, \gamma)$ for all $\gamma \in \mathcal{B}$ on a set with a positive measure. The studentized version of the test statistic from this test is

denoted by J_n.[1] For our application, we use the computed J_n test statistic with $i.i.d$ draws generated from 399 bootstrap resampling with bandwidths selected by local-linear cross-validation. As we will show latter in the results section, the significance test for the parametric model is not satisfied, hence the need for a nonparametric specification which is outlined hereunder.

The generic specification for the nonparametric regression is given thus;

$$y_{it} = g(\mathbf{X}_{it}, \mathbf{Z}_{it}) + \varepsilon_{it}, \quad i = 1, 2 \ldots N, \quad t = 1, 2, \ldots T \tag{7}$$

where $g(.)$ is assumed to be a smooth and continuous but unknown function. $\mathbf{X}_{it}$ is a vector of the economic controls while $\mathbf{Z}_{it}$ is a vector of the institutional and structural variables of interest. Since the GMM and hence parametric specification in (Eq. 6) is a special case of the nonparametric specification, it means that (Eq. 7) is capable of automatically capturing linear and nonlinear effects including interaction and potential endogeneity effects in the relationship without the need for a manual search.

Nonparametric econometric estimation techniques are often computationally involved, and in addition to the computational involvement, nonparametric multiple regressions techniques suffer from two major obstacles. First is the "curse-of-dimensionality" and second is the "difficulty of interpretation". The curse-of-dimensionality arises due to the deterioration of the rates of convergence of kernel methods as the number of regressors increases, which could lead to imprecise but consistent estimation of the object of interest. However, as Huynh and Jacho-Chávez (2009) have shown, this "curse" appears to be a "blessing" in this kind of setup. The reason is because by the nature of the construction of the institutional variables which is often an unobserved component model, their precision is dominated by the overall slow rate of convergence of the nonparametric estimators, and therefore no correction of standard errors is required.

We use the np package in R, developed by Hayfield and Racine (2008) to estimate the nonparametric model. In the data frame, we cast the variable $country_{it}$ as a categorical factor variable and *year* as a ordered factor variable, while the control variables in the X_{it} and Z_{it} vectors are the continuous variables. This is a typical case of nonparametric regression with mix regressors.[2]

[1] Interested readers may want to see Racine (2008; 63–64) for more details.

[2] A gentle description of these estimation strategies can be found in the Racine (2008). Nonparametric Econometrics: A Primer.

3.3 Data

The data set covers 22 African countries over the period 1980–2011.[3] The main sources of the data are the World Bank's World Development Indicators (WDI) and the Polity IV database published by Systemic Peace. Other data series were retrieved from the Penn World Table (PWT) version 8.0. More specifically, output and output growth are measured by real GDP and real GDP growth rate from the WDI. Variables for economic control; government consumption, inflation and trade openness are sourced from the WDI. For robustness we alternate measures of investment using fixed investment rate (fixed capital formation share of GDP) from the WDI and the real capital stock. The cost of capital measured by real interest rate is obtained from the WDI. Financial openness index is obtained from Chinn and Ito (2008, updated). The human development index is retrieved from the PWT and it represents the index of human capital per person based on years of schooling as in Barro and Lee (2013) and returns to education as in Psacharopoulos (1994).

We measure financial development using domestic credit to private sector share of GDP retrieved from the WDI. We proxy institutional quality and institutional structure using scores of executive constraint and scores of democratic accountability respectively which were obtained from polity IV database. These variables are hypothesised to be important in the sense that the quality and structure of institutional mechanisms such as the rule of law, contract enforcement, property rights and judicial system can influence aggregate investment through altering incentive for new investment, or by increasing the sensitivity of investment to technological shocks at the macroeconomic level (Besley 1995; Cooley et al. 2004). To capture the business environment, we use polity scores from polity IV project dataset.

4 Results

4.1 Descriptive Statistics

In Table 1, the summary statistics of the variables used in the analysis are presented. An interesting point to note is the relative sizes of the standard deviation of the structural and institutional variables compared with the economic controls. For example, the standard deviation of financial development, a structural variable, is 25.28 which is relatively large compared to some of the economic controls such as interest rates 13.24 and log GDP 2.30. This provides preliminary support for the

[3]The list of countries are: Botswana, Burundi, Cameroon, Congo, Equatorial Guinea, Gabon, The Gambia, Kenya, Ghana, Malawi, Mauritius, Mozambique, Nigeria, Sierra Leone, South Africa, Swaziland, Tanzania, Uganda, Zambia, Egypt, Morocco, Rwanda.

Table 1 Descriptive statistics

Statistic	N	Mean	Std. dev.	Min	Max
Fixed investments	678	19.96	10.63	−2.42	113.58
Investments	689	92.78	189.12	0.09	1224.88
Financial openness	696	0.29	0.29	0.00	1.00
LGDP	689	26.65	2.30	21.36	30.72
Business environment	671	−1.55	6.46	−10	10
Institutional quality	671	3.38	2.02	1	7
Interest rates	606	5.76	13.24	−53.44	60.69
Inflation	646	14.67	22.23	−17.64	200.03
GDP growth	685	4.28	6.97	−50.25	71.19
Human development	640	1.83	0.41	1.13	2.85
Trade openness	688	71.81	38.07	6.32	275.23
TFP	458	1.55	3.56	0.57	29.67
Institutional structure	671	2.60	3.44	0	10
Financial development	665	21.38	25.21	1.54	167.54
Stock market	241	8.08	22.42	0.00	148.77

argument that structural and institutional variables may have non-trivial effects on investments.

In the Appendix section, Table 8 contains the pairwise correlation matrix for the variables. The interesting combinations are the correlations between the structural and institutional variables. We observe that financial openness, a structural variable, is weakly correlated with the institutional variables. The value of the correlation coefficients between financial openness and institutional quality is $\rho = 0.10$, for institutional structure it is $\rho = 0.18$ and $\rho = 0.11$ for business environment. Although the coefficients are statistically significant, these low correlations values suggest that the relationship between these set of variables are sufficiently weak enough to justify their peripheral inclusion as conditioning variables in the empirical models.

4.2 Benchmark GMM Results

The benchmark results for the GMM specification in Eq. (6) are reported in Table 2. We adopt an incremental approach whereby, we start with the baseline explanatory variables suggested by neo-classical theory and then incrementally include economic, structural and institutional variables to the right hand side consecutively. We start by considering diagnostic tests for the overall model specification. First, the joint significance of the variables included in each of the regressions in Table 2 is given by the Wald χ^2 statistic which is statistically significant for all the regressions. Secondly, tests for over-identifying restriction and instrument validity for the

Table 2 GMM regressions with fixed investment as dependent variable

	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10
Fixed invest$_{t-1}$	0.72***	0.96***	0.83***	0.83***	0.85***	0.77***	0.67***	0.51***	0.78***	0.58***
	(0.16)	(0.21)	(0.17)	(0.17)	(0.17)	(0.15)	(0.15)	(0.18)	(0.15)	(0.19)
LGDP	0.06	0.45	0.12	0.15	0.05	0.04	0.01	0.08	0.02	0.25
	(0.39)	(0.43)	(0.51)	(0.44)	(0.71)	(0.68)	(0.82)	(0.81)	(0.44)	(1.15)
GDP growth	0.42	1.01**	0.76*	0.78*	0.91**	0.73**	0.46	0.09	0.55	0.32
	(0.50)	(0.52)	(0.40)	(0.40)	(0.39)	(0.35)	(0.32)	(0.40)	(0.34)	(0.54)
Interest rate	0.43*	0.75**	0.93***	−0.90***	0.84***	0.76***	0.90***	0.90***	0.48***	1.15*
	(0.22)	(0.33)	(0.27)	(0.26)	(0.31)	(0.25)	(0.29)	(0.27)	(0.16)	(0.67)
Inflation		0.24*	0.33**	0.31**	0.29**	0.17	0.08	0.00	0.12	0.14
		(0.14)	(0.13)	(0.13)	(0.13)	(0.11)	(0.21)	(0.25)	(0.08)	(0.37)
Govt. consumption			0.82**	0.77**	0.68**	0.75**	0.98**	1.09**	0.41**	0.85*
			(0.36)	(0.34)	(0.32)	(0.33)	(0.46)	(0.51)	(0.20)	(0.51)
Financial openness				−2.79	−2.52	−2.67	−4.73	−5.50	−3.40**	−6.89
				(2.66)	(2.72)	(2.55)	(3.54)	(4.00)	(1.69)	(4.35)
Trade openness					0.02	0.02	0.00	−0.02	0.05	−0.01
					(0.04)	(0.04)	(0.05)	(0.05)	(0.04)	(0.09)
Financial development						−0.03	−0.03	−0.02	0.01	−0.00
						(0.04)	(0.05)	(0.06)	(0.02)	(0.06)
Institutional quality							−0.23	0.59	(0.41	(0.31
							(0.57)	(1.54)	(0.77)	(1.49)
Institutional structure								−0.52	−1.99	0.16
								(1.06)	(1.64)	(1.54)
Business environ									0.93	−0.20
									(0.83)	(0.59)

(continued)

Table 2 (continued)

	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10
Human cap. dev.										2.31
										(5.41)
Constant	6.21	9.20	−12.78	−9.97	−11.92	−11.83	−10.48	−7.81	−0.71	−10.46
	(10.25)	(11.63)	(17.38)	(14.63)	(20.13)	(19.85)	(24.43)	(26.47)	(13.06)	(27.05)
N	537	508	508	508	508	490	461	461	429	421
Hansen's J	5.55	1.79	1.86	1.87	1.88	2.07	2.03	2.60	5.86	1.00
Wald χ^2	253***	105***	194***	198***	196***	278***	270***	975***	2211***	227***
AR(2) z	0.99	1.12	0.58	0.61	0.73	0.75	0.38	0.24	0.92	−1.22
Instruments	9	7	8	9	10	11	12	14	17	15

Robust standard errors are reported in parenthesis

Significance symbols on coefficients are *, ** and *** for the 10 %, 5 % and 1 % levels respectively

included instruments as captured by Hansen's J statistic which results indicate that they cannot be rejected at the 5 % level.

A caveat is however important at this point. Because tests of overidentifying restrictions are not very informative about the validity of the moment conditions implied by the underlying economic model, as noted by Parente and Silva (2012), they are therefore not reliable at identifying the parameters of interest. Furthermore, the z-statistic for the Arellano-Bond AR(2) test for second-order autocorrelation in the residuals show that there is no second-order autocorrelation, thereby justifying the non inclusion of more lags of the dependent variable on the right hand side.

Column (M1) in Table 2 contains the specification that represents the baseline neoclassical theory which posits that investment is a function of economic size (LGDP), economic growth and cost of capital (interest rate). In columns (M2) and (M3) we introduce economic controls; inflation and government expenditure respectively. The first category of structural variables we introduce in columns (M4) and (M5) are the open-economy effects measured by financial openness and trade openness which have been shown to be significant determinants of medium term investments (see Loayza et al. 1999; Chinn and Prasad 2003).

The results show that there is evidence of persistence in investment activity as the coefficient on the lagged term ranges between 0.51 and 0.96, and is statistically significant in all the regressions. Also, the estimated signs on economic size, economic growth and interest rate are in line with the apriori expectations. However, although economic size is not significant in all the regressions, we find that the effect of economic growth is statistically significant in some regressions and economically significant in all the regressions. The interesting part about this category of variables is the result on interest rate which is negative and statistically significant. This is interesting because although this is what neoclassical theory postulates, the extant literature has struggled to establish this relationship empirically, and this could be because those studies generally neglect the additional institutional variables which this study accounts for (see Caballero and Engel (1999), Lim (2014), for examples).

The coefficient on inflation surprisingly assumes a positive sign and is statistically significant in some of the regressions contrary to the apriori expectation. Government consumption is positive and statistically significant in all the regressions. In our benchmark regression-column (M5), the coefficient is 0.77. Hence a 1 % increase in the ratio of government consumption to GDP could on average lead to around 0.77 % increase in the level of investment in the economy. This result is not very surprising as the public sector in most African economies are significantly large.

We get negative and non-trivial coefficients on the financial openness variable although the coefficients are not significant in all the regressions. The expected effects of financial openness on investments is not obvious a priori. However, the negative effect observed here could be interpreted in different ways. First, it implies that ceteris paraibus, more financially open economies seem to experience lower levels of investments. This would be the case if foreign direct investments crowd-out domestic investments (see Agosin and Machado (2005), for empirical

evidence). In other words, foreign direct investment flows substitute and displace domestic investments more than one-for-one. Another possible explanation provided in Lim (2014) is that if returns to investments are higher abroad, then greater financial openness could lead to net capital outflows which reduces the level of domestic savings available for domestic investments. Another possible explanation is the financial contagion effect, whereby, financial openness could allow for the transmission of financial crises which could lead to investment contractions in the domestic economy. To pin down the effect that is operative in the African context would be beyond the scope of the present study.

For financial development, just like results available in the literature, it is difficult to make strong conclusions about the effects of financial development on investments activity. However, we would revisit this aspect of the analysis when we consider other specifications used in this study. When we include additional structural and institutional variables in columns (M6, M7, M8, M9, M10), we observe inconsistency in the signs of the variables and besides that, they are all statistically not significant. This inconsistency may be arising from the problems inherent in the estimation technique used here. It is possible that the instrumentation mechanism used for the institutional variables are not valid. More so, it could also be the case that the problem of endogenity which this specification is designed to control for is not a serious concern here. In the sections that follow, we also present results from alternative estimation techniques.

4.3 Robustness to GMM Benchmark

In this section, we consider the robustness of the benchmark results to alternative measurement of the dependent variable. In the previous section, we used the ratio of gross fixed capital formation to GDP which is a flow measure of the value of acquisitions of new or existing fixed assets by the business sector, governments and households. To offer a variant to the conceptualization of investments, we use the gross level of investments (inclusive of inventory accumulation) which is a stock variable as an alternative measure of the dependent variable.

The results for gross investment as dependent variable are reported in Table 3. Here, the overall model diagnostic tests reveals that the instruments used are valid as we cannot reject the null from Hansen's J test of overidentifying restrictions for the instruments. Also, there is no evidence of second-order serial autocorrelation, hence it is sufficient to use only the first period lags as part of the right hand side variables. The Wald χ^2 test also reveal that the variables included in all the regressions are jointly significant, although the results are not reported in the table for the sake of space.

For the robustness results, we focus on column (R10) as the benchmark. The quantitative coefficients from the robustness regressions are not directly comparable to those in Table 2, but the qualitative effects are comparable. We observe that there is even higher persistence in the gross levels of investment activity, as the

Table 3 GMM regressions with gross level of investment as dependent variable

	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10
$Investments_{t-1}$	0.97***	0.97***	0.97***	0.98***	0.98***	0.98***	0.98***	0.98***	0.95***	0.97***
	(0.01)	(0.00)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)
LGDP	0.53	0.23	0.19	0.14	0.23	0.23	0.23	0.38	0.95*	0.67
	(0.40)	(0.22)	(0.25)	(0.27)	(0.33)	(0.31)	(0.36)	(0.24)	(0.57)	(0.84)
GDP growth	0.03	0.26	0.22	0.20	0.29	0.22	0.17	0.16	0.36	0.03
	(0.15)	(0.24)	(0.37)	(0.38)	(0.23)	(0.28)	(0.29)	(0.17)	(0.25)	(0.52)
Interest rate	−0.19	−0.04	0.01	0.01	0.05	0.02	0.01	−0.01	0.10	−0.20
	(0.29)	(0.15)	(0.25)	(0.26)	(0.19)	(0.21)	(0.24)	(0.20)	(0.15)	(0.69)
Inflation		−0.12	−0.11	−0.10	−0.09	−0.20	−0.22	−0.21	−0.16	−0.20
		(0.15)	(0.19)	(0.20)	(0.17)	(0.26)	(0.25)	(0.22)	(0.15)	(0.34)
Govt. consumption			0.02	0.04	0.07	0.14	0.14	0.12	0.03	−0.05
			(0.16)	(0.17)	(0.15)	(0.13)	(0.12)	(0.13)	(0.15)	(0.51)
Financial openness				1.54	1.47	1.41	1.12	1.09	−0.21	2.12
				(1.61)	(1.72)	(1.62)	(1.92)	(1.81)	(2.87)	(1.99)
Trade openness					−0.01	−0.02	−0.02	−0.02	0.02	−0.03
					(0.03)	(0.04)	(0.04)	(0.02)	(0.01)	(0.05)
Financial development						−0.00	−0.01	−0.01	0.03	0.00
						(0.02)	(0.03)	(0.03)	(0.03)	(0.04)
Institutional quality							0.30	1.56**	1.04	1.32*
							(0.28)	(0.76)	(1.22)	(0.72)
Institutional structure								−0.79	−1.79*	−1.12*
								(0.54)	(1.06)	(0.64)
Business environ									0.59	0.23
									(0.56)	(0.23)

(continued)

Table 3 (continued)

	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10
Human cap. development										−0.12
										(2.94)
Constant	16.65	10.11*	8.05	5.73	8.24	8.94	8.70	10.82	29.99	24.07
	(13.17)	(6.12)	(9.18)	(10.33)	(13.96)	(14.12)	(15.77)	(10.64)	(21.30)	(37.35)
N	549	521	519	519	519	501	472	471	434	425
Hansen's J	7.19	0.58	0.65	0.63	0.62	0.52	0.60	2.22	5.51	0.79
AR(2) z	−1.85	−1.30	−1.35	−1.32	−1.40	−1.26	−1.20	−1.14	−1.07	−0.71
Instruments	9	7	8	9	10	11	12	14	17	15

Robust standard errors are reported in parenthesis
Significance symbols on coefficients are *, ** and *** for the 10 %, 5 % and 1 % levels respectively

coefficient ranged between 0.95 and 0.98 in the different robustness regressions. Further, the qualitative signs on the baseline variables of economic size, economic growth and interest rates are preserved although they are mostly not significant. The economic controls here assume the expected signs; as inflation enters with a negative sign and government consumption enters with a positive sign, though again both are not statistically significant.

The interesting aspect of the robustness results is that the effect of institutional variables have now become obvious, and they are mostly consistent and statistically significant. The coefficient on institutional quality is bound by [0.3 and 1.56] and is quite quantitatively significant. Specifically, a 1 % improvement in institutional quality could translate into increase in investment activity of around 1.56 %. By contrasting the negative impact of institutional structure and the positive impact of business environment, it is possible to say something about the importance of institutions in fostering broad based economic opportunities and competition dynamics as highlighted in the influential work by Acemoglu and Johnson (2005). Overall, the regressions with gross investments as dependent variable reaffirms the quantitative and qualitative results obtained in the benchmark regressions and also provides some evidence on the effects of institutional variables.

4.4 Interactions Between Structural and Institutional Variables

In this subsection, we examine the interaction effects of structural and institutional variables on fixed investments. This exercise is to help us obtain further insights on the nature of the complementarities and the conditions under which institutional variables may influence investment patterns, given the structural conditions. Specifically, we interact the main structural variable in the model (i.e. financial openness), with two of the institutional variables used.

From the results which are reported in Table 4, columns (T5) and (T6) report the results for the interaction between financial openness with institutional quality and financial openness with institutional structure respectively. From column (T5) we see that the sign on the interaction coefficient between financial openness and institutional quality is negative. We can interpret this result to mean that the potential negative effect of financial openness on investment is less in countries with higher levels of institutional quality. This relationship is also true for institutional structure. This conclusion should be taken only as indicative at this point since the coefficients are not statistically significant. This relationship will be revisited when we consider the non-parametric regressions.

Table 4 Fixed investments regressions with interaction terms

	T1	T2	T3	T4	T5	T6
Fixed invest$_{t-1}$	0.71***	0.69***	0.70***	0.70***	0.69***	0.68***
	(0.12)	(0.13)	(0.12)	(0.13)	(0.13)	(0.13)
LGDP	0.05	0.07	0.08	0.08	0.14	0.17
	(0.49)	(0.48)	(0.47)	(0.48)	(0.47)	(0.50)
GDP growth	0.11	0.08	0.09	0.08	0.11	0.09
	(0.28)	(0.29)	(0.30)	(0.30)	(0.28)	(0.30)
Interest rate	−0.57***	−0.55***	−0.56***	−0.56***	−0.55***	−0.55***
	(0.16)	(0.14)	(0.16)	(0.17)	(0.15)	(0.15)
Inflation	0.14***	0.09	0.13**	0.14***	0.10	0.10
	(0.05)	(0.09)	(0.05)	(0.05)	(0.08)	(0.07)
Govt. consumption	0.45**	0.49**	0.46*	0.48*	0.45*	0.47*
	(0.20)	(0.24)	(0.25)	(0.26)	(0.24)	(0.25)
Financial openness	−2.80*	−2.87**	−2.89*	−2.71*	−3.45**	−3.10**
	(1.46)	(1.45)	(1.57)	(1.58)	(1.64)	(1.53)
Trade openness	0.01	0.01	0.01	0.01	0.01	0.01
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Financial development		−0.01			0.11	0.07
		(0.03)			(0.16)	(0.08)
Institutional quality			−0.03		0.47	
			(0.35)		(0.48)	
Institutional structure				−0.09		0.21
				(0.25)		(0.31)
Financial opn. × inst.qlty					−3.66	
					(3.66)	
Financial opn. × instruc						−1.96
						(1.89)
Constant	−7.40	−7.02	−7.73	−8.10	−10.71	−10.98
	(13.74)	(13.71)	(13.51)	(13.79)	(14.99)	(15.16)
N	438	434	433	433	429	429
Hansen's J	7.38	7.11	6.76	6.22	6.39	6.30
Wald χ^2	996***	999***	1031***	1129***	1579***	1489***
AR(2) z	0.78	0.78	0.74	0.74	0.73	0.73
Instruments	17	17	17	17	17	17

Robust standard errors are reported in parenthesis
Significance symbols on coefficients are *, ** and *** for the 10 %, 5 % and 1 % levels respectively

4.5 Non-parametric Results

In this section, we begin by justifying the use of nonparametric regression estimation techniques by presenting the results from alternative parametric specifications and conducting a nonparamteric test for correct model specification. In Table 5 the

Table 5 Regression results from parametric models

	Pooled OLS	Fixed effect	Random effect
Constant	−9.26**		−23.12***
	(4.48)		(7.37)
Log(GDP)	0.83***	0.54	1.2***
	(0.15)	(1.48)	(0.26)
GDP growth	0.09	0.01	0.04
	(0.07)	(0.05)	(0.05)
Interest rates	−0.01	0.12***	0.06**
	(0.03)	(0.02)	(0.02)
Inflation	−0.08***	−0.01	−0.03*
	(0.02)	(0.02)	(0.02)
Government consumption	0.26***	0.19***	0.21***
	(0.06)	(0.05)	(0.05)
Financial openness	0.02	2.3**	1.74*
	(0.94)	(1.03)	(0.91)
Trade openness	0.07***	0.13***	0.11***
	(0.01)	(0.02)	(0.01)
Financial development	−0.01	−0.02	0
	(0.01)	(0.02)	(0.02)
Business environment	0.27	−0.83***	−0.71***
	(0.21)	(0.24)	(0.2)
Institutional quality	2***	1.86***	1.85***
	(0.48)	(0.43)	(0.43)
Institutional structure	−1.19***	0.73*	0.58
	(0.38)	(0.44)	(0.37)
Human Development	−2.35**	−5.86**	−5.53***
	(0.99)	(2.62)	(1.16)
R^2	0.29	0.35	0.34
Effect	None	Two-way	Individual

Robust standard errors are reported in parenthesis
Significance symbols on coefficients are *, ** and *** for the 10 %, 5 % and 1 % levels respectively

results for three alternative parametric models are reported including; pooled OLS, panel fixed effect and random effect models.

By concentrating on the results from the fixed effect regression, which has the highest R^2 value among the alternatives, we observe that apart from a few differences, most of the results obtained corroborate the results from the instrument based GMM estimation in Tables 2 and 3. The advantage we have here is that more variables are additionally statistically significant. Of particular interest are the coefficients for trade openness, business environment and human development index. Without much discussion about the results from this class of parametric regressions, since they have already been fully discussed in a previous section, we

Table 6 Optimal bandwith selection

Variable	Bandwidth
LGDP	0.0185
GDP growth	28.674
Interest rate	7.168
Inflation	41.097
Government consumption	3.105
Financial openness	0.9988
Trade openness	18.313
Financial development	2.525
Business environment	11823203
Institutional quality	88815043
Institutional structure	5877867
Human development	0.7205
Factor.Country	0.0531
Factor.Year	0.4915

Notes: Results are based on local-linear regressions and bandwidths are selected by least-squares cross validation. Objective function value is 9.04 achieved on two multistarts. For continuous explanatory variables, we use second-order Gaussian continuous kernel. For the factor variable, we use Aitchison and Aitken kernel method, while Li and Racine kernel method is used for the ordered variable

move straight to consider the results from Hsiao et al. (2007)'s nonparametric and consistent model specification test for this class of models.

The J_n statistic for the null of correct model specification with 399 IID bootstrap replications is 9.33 with a 0.00 p-value. Therefore the null of correct model specification for all the parametric models are rejected at the 1 % level. Some of the implications of these result are as follows. First, a linear specification for the investment relation in Africa maybe too restrictive as it implies that the relationship is constant over time and it ignores potential nonlinearities in the relationship. Secondly, it implies that the conclusions and perhaps policy implications derivable from any parametric specification of this relationship will be sensitive to the kind of model used. In other words, results are likely to be different with different estimation techniques. This is confirmed by the differences in the results obtained from the GMM and panel based estimation techniques reported. These limitations of parametric specifications for the investment relation in Africa motivates our estimation of the more robust and computationally involved nonparamteric relationship between investment and structural and institutional variables.

To estimate a nonparametric regression model, we need to obtain the optimal bandwidth for each of the regressors and since the baseline model is cast in a panel data framework, we are faced with a situation where we have regressors of mixed data type. That is, we have continuous variables which are all the control variables in Eq. (7), a categorical variable which are the countries and an ordered variable which is time. The results for the optimal bandwidth selection for each of the

variables is presented in Table 6. The results are based on local-linear regressions, and bandwidths are selected by least-squares cross validation. The objective function value is 9.04 achieved on two multistarts.[4] For continuous explanatory variables, we use second-order Gaussian continuous kernel. For the factor variable, we use Aitchison and Aitken kernel method, while Li and Racine's kernel method is used for the ordered variable.

4.5.1 Nonparametric Significance Test for Kernel Regression

Nonparametric regressions do not produce point parameter estimates, thus the standard t-testing approach used to identify significant parameters does not apply here. However, there is still a sense in which the significance of the regressors could be tested. We implement univariate nonparametric significance tests for mixed data types based on Racine et al. (2006) and Racine (1997) to all the regressors. This test is comparable to the t-test in parametric regressions. The class of tests formulated by Racine et al. (2006) are known to be robust to functional form misspecification among the class of twice continuously differentiable functions. Also, the null-distribution of the test has correct size and the test has power in the direction of the class of twice continuously differentiable alternatives (see Racine 1997). To conduct this test, one first has to partition the vector of explanatory variables say W into two parts, the variable whose significance is to be tested $W_{(j)}$, and all other conditioning variables $W_{(-j)}$ excluding $W_{(j)}$. The partitioned matrix of conditioning variables (continuous and dummy) is written as $W = \left(W_{(-j)}, W_{(j)}\right)$, where $W_{(-j)} \in \mathbb{R}^{p-j}$ and $W_{(j)} \in \mathbb{R}^{j}$. If the conditional mean $E\left(Y\middle|W\right)$ is independent of a variable or group of variables of interest, then the true but unknown vector of partial derivatives of the conditional mean of dependent variables with respect to these variable is zero. That is, the test is formulated to detect whether a partial derivate equals 0 over the entire domain of the variable in question. The null hypothesis is stated in terms of the vector of partial derivates of the conditional mean, thus;

$$H_O; \frac{\partial E\left(Y|W\right)}{\partial W_{(j)}} = 0 \qquad \text{for all w} \in \text{W}$$

$$H_A; \frac{\partial E\left(Y|W\right)}{\partial W_{(j)}} \neq 0 \qquad \text{for some w} \in \text{W},$$

[4]It is often recommended that at least five multistarts be used to achieve the objective function value when computer performance is high. However, due to the many hours it takes to run this, we have decided to use two multistarts as this is not expected to compromise the results in any significant way.

Table 7 Non-parametric Kernel regression significance tests

Variable	P-values	
	IID	Wild-Rademacher
LGDP	0.84	0.96
GDP growth	0.86	0.9
Interest rate	0.77	0.45
Inflation	0.62	0.72
Government consumption	0.73	0.03**
Financial openness	0.42	0.71
Trade openness	0.28	0.7
Financial development	0.63	0.25
Business environment	0.002**	0.00***
Institutional quality	0.27	0.00***
Institutional structure	0.86	0.92
Human development	0.91	0.47

IID indicates that the p-values are obtained by parametric bootstrap resampling from the normal distribution, whereas, Wild-Rademacher will use a wild bootstrap transformation with Rademacher variables. This approach has the advantage of controlling for heteroscedasticity of unknown form in the DGP
Significance symbols on coefficients are *, ** and *** for the 10 %, 5 % and 1 % levels respectively

where $W_{(j)}$ is the regressor we are testing for and W is the vector of all continuous and ordered regressors.

The results for the significance test are reported in Table 7. The p-values are obtained by bootstrapping because the relevant distributions under the null and alternative hypothesis are non-standard. Column two contains the results for IID bootstraps which shows that only business environment is statistically significant. Too much cannot be said about this result because it does not account for potential heteroscedasticity of unknown form in the data generating process. This motivates the consideration of an alternative bootstraping technique using "wild" bootstraping schemes with Rademacher variables. The results are reported in column 3 of Table 7. We find that with heteroskedasticty accounted for; government consumption, business environment, and institutional quality have statistically significant p-values.

4.5.2 Investment Profile Curves, Surface Plots and Contour Maps

Since nonparametric regressions do not produce coefficients for the regressors, to see the results of nonparametric regression, we need to plot the profile curves, surface curves and or co-plots of the regressors. The investment profile curves with bootstrap standard errors are reported in Fig. 1 and they give an isolated picture of the marginal effect of each regressor on investments. However, since we are specifically interested in the combined effects of structural and institutional variables, we focus on the surface plots and contour maps. We use institutional quality as the baseline institutional variable since it achieves significance in most of the

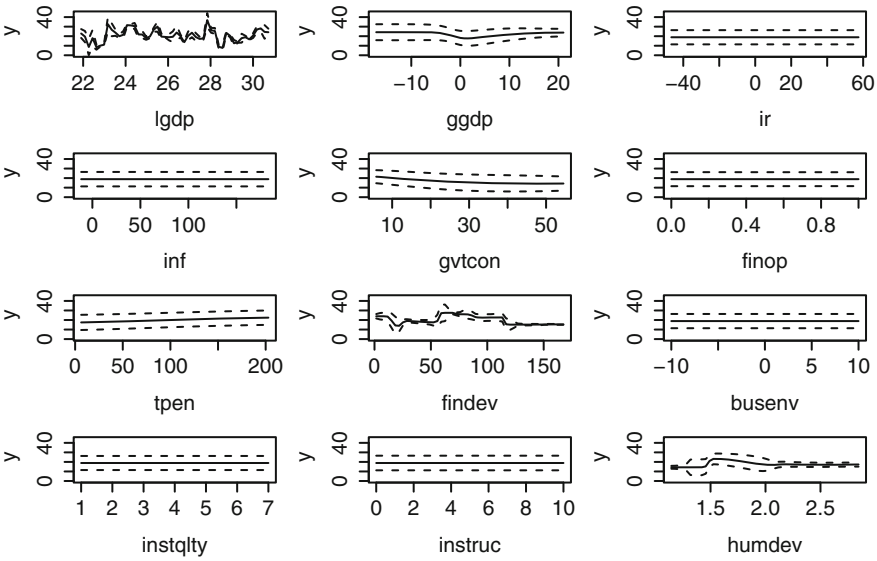

Fig. 1 Investment profile curves with bootstrap error bands

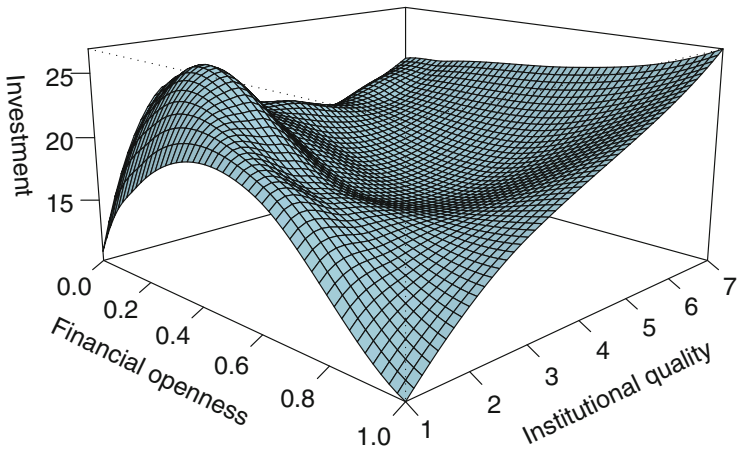

Fig. 2 Fitted surface for kernel regression of investments on Finop. and Instqlty

models compared to the other institutional variables and then we alternate significant structural variables to understand the nature of their combined effects and complementarities on investments.

In Fig. 2 the surface plot for the fitted values of the nonparametric regression of fixed investment on financial openness and institutional quality is reported. From the plot, we observe that the relationship of investments to financial openness and institutional quality appears to be nonlinear, especially in the direction of financial

openness. Also, the partial regression in the direction of each predictor does not appear to change very much as the other predictor varies, suggesting that the additive nonpararmetric model used is likely to be the appropriate specification.

Specifically, we observe from Fig. 2 that at very low levels of financial openness, investment to GDP ratio is almost zero. However, as the level or index of financial openness increases, investments begin to rise and peaks when the level of financial openness is somewhere around 0.4, after which higher levels of the financial openness leads to reductions in the level of investment. This result implies that there is a threshold level of financial openness that is best for these economies. Levels of financial openness less or greater than this threshold will be suboptimal and will lead to reductions in the level of investments.

One possible explanation for this relationship could be the competing and crowding out effects that may be operative between FDI and domestic investments given the level of financial openness. When a country is relatively financially closed to the global financial market, investments are lower since financial mobilization only depends on domestic savings. On the other hand, an economy that is relatively too financially open will attract a lot of FDI which could crowd out domestic investments and with repatriation of funds by foreign investors, domestic investments will eventually shrink. Further, we observe a seemingly linear and monotonically increasing relationship in the direction of institutional quality. In other words better and better institutions lead to more and more investments.

The contour maps are a cross-sectional representation of the three dimensional graphs. In specific terms, the contour maps presented here are two dimensional diagrams that connect specific points of the structural and institutional variable to the same estimated level of investment, i.e., they are Iso-investment lines. In Fig. 3 we report the contour maps for the iso-investment levels given different levels of

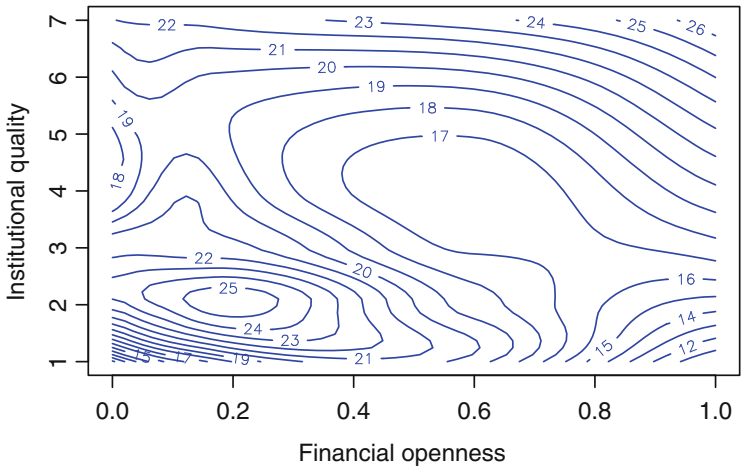

Fig. 3 Contour maps for kernel regression of investments on Finop. and Instqlty

financial openness and institutional quality. We observe that there are two possibilities for the highest iso-investment curve at 25. One is at the point where financial openness is low (around 0.2) and institutional quality is also low (around 2) and the other is when there is very high financial openness (around 0.8) and very high levels of financial quality around 6). This confirms the nonlinear relationship earlier observed and a lot more can be said about this.

In Fig. 4, we report similar results for the case when we use an alternative measure of structural characteristic, in this case, financial development. Again, we observe nonlinearities in the relationship between investment and financial development with institutional quality held constant (see Fig. 4a). Specifically, we find that in spite of institutional quality, higher levels of financial development monotonically leads to higher levels of investment. This is interesting because it implies that even with weak institutions, it is still possible to have high levels of investments and this has generally been the case for many African countries like Nigeria, which in-spite of weak institutions have still managed to attract significant investments especially in the private sector. The results are also similar when we use government consumption as the structural variable as reported in Fig. 5.

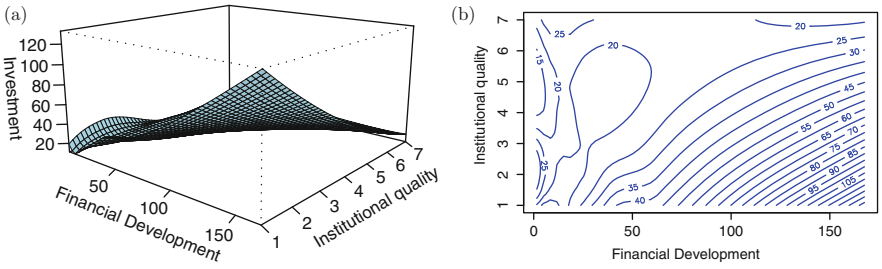

Fig. 4 Fitted values and contour maps for investments on Findev and Instqlty. (**a**) Fitted surface for investments on Findev. (**b**) Contour maps for investments on Findev

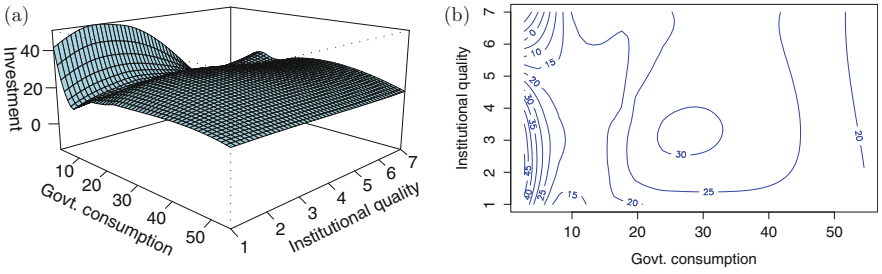

Fig. 5 Fitted values and contour maps for investments on Govtcon and Instqlty. (**a**) Fitted surface for investments on Gvtcon. (**b**) Contour maps for investments on Gvtcon

5 Conclusion

This paper endeavours to uncover the structural and institutional determinants of investment activity in Africa within a neoclassical growth framework. A simple neoclassical model that captures the a priori expectation is described and taken to the data using parametric and nonparametric regression techniques.

We obtain three main findings. First, we find that the main structural determinant of investment in Africa is financial openness, while the main institutional determinant is institutional quality. Secondly, we observe that there are nonlinearities in the relationship between investment and structural characteristics of an economy. Specifically, there is a threshold level of financial openness that guarantees high levels of investments. Thirdly, when we interact the selected structural variable with the institutional variable, we find that the investment inhibiting effects of financial openness is less in countries with higher levels of institutional development.

The simple insight for policy arising from this paper is that in addition to the traditional policy areas such as a stable macroeconomic environment, the investment climate in Africa is characterized by the broader structural and institutional environment in which firms and businesses operate. These includes, financial openness, financial development, government consumption and the governance frameworks such as the control of corruption.

Appendix

Table 8 Correlation with Bonferroni p-values

	Fix. inv	Ln.inv	Ln.GDP	GDP.g	Int. R.	Inf.	Gvt. con.	Fin. op.	Trd. opn.	Fin. dev.	Inst. qlty.	Int. strc.	Bus. env.	Hum. dev.
Fixed investment	1													
linv	−0.13*	1												
LGDP	0.03	−0.65***	1											
GDP growth	0.34***	−0.01	−0.02	1										
Interest rate	0.15*	−0.19***	−0.01	0.11	1									
Inflation	−0.19***	0.20***	−0.02	−0.08	−0.61***	1								
Govt. consumption	0.139*	−0.15**	−0.14*	−0.09	0.10	−0.07	1							
Financial openness	0.007	−0.13*	−0.01	0.03	0.22***	−0.16**	−0.05	1						
Trade openness	0.52***	−0.02	−0.31***	0.26***	0.12	−0.14*	0.208***	0.06	1					
Financial development	0.03	−0.07	0.02	−0.06	0.04	−0.16**	0.21***	0.07	−0.006	1				
Institutional quality	0.16	−0.06	−0.05	0.03	0.07	−0.06	0.20***	0.17***	0.10	0.44***	1			
Institutional structure	0.07	−0.04	−0.12	0.01	0.05	−0.03	0.24***	0.13*	0.18***	0.39***	0.93***	1		
Business environ	0.09	−0.04	−0.07	0.06	0.09	−0.02	0.16**	0.17**	0.11	0.31***	0.93***	0.963***	1	
Human cap. development	0.27***	0.05	0.04	0.04	0.08	−0.13	0.197***	0.28***	0.43***	0.42***	0.44***	0.41***	0.38***	1

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$

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Public Investment and Competitiveness in ECOWAS: An Empirical Investigation

Akpan H. Ekpo

1 Introduction

The contribution of investment to growth and development has never been contested. However, the impact of public investment to growth remains debatable in the economic literature. Several cross-sectional and panel studies have provided mixed results. Nonetheless, the general perception is that public investment particularly at some point in a developing economy's growth process enhances growth. There is no doubt that efficient public investment in hard and soft infrastructure would attract private investment. Since achieving political independence, Governments in the West African sub-region have invested in infrastructure with the aim of fast-tracking growth and development. Direct government investment in infrastructure and creating an enabling environment supported by well thought out policies are crucial to ensuring competition. Hence, public investment lubricates competition which further stimulates growth.

It has recently been argued that public investment supports the delivery of key public services, connects citizens and companies to economic opportunities as well as serve as an important catalyst for economic growth. After 3 years of decline, public investment has started to recover as a share of GDP in emerging markets and low income developing countries but remains at historic lows in developed countries (IMF 2015).

Paper presented at the Sixth Annual Conference on Regional Integration in Africa (ACRIA 6), organized by CREPOL, WAIFEM, WAMI, and WAMA, at WAIFEM Headquarters, Central Bank of Nigeria Learning Centre, Lagos, July 1–3, 2015. The excellent research assistance of Jimoh Olakunle, Doctoral Fellow in WAIFEM is acknowledged. The usual disclaimer applies.

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D. Seck (ed.), *Investment and Competitiveness in Africa*, Advances in African Economic, Social and Political Development, DOI 10.1007/978-3-319-44787-2_3

This position by the IMF is surprising because in the 1960s–1980s, the Fund and its counterpart, the World Bank were 'opposed' to public investment. The Fund intends to assist countries to become more efficient public investors. It is also expected that efficient public investment would break monopoly power and encourage competition. However, it is difficult to measure competition in concrete terms. This is not withstanding the different proxies put together by the World Economic Forum.

The Global Competitiveness Report of the World Economic Forum defines competitiveness as "the set of institution, policies and factors that determine the level of productivity in a country" (World Economic Forum 2008).

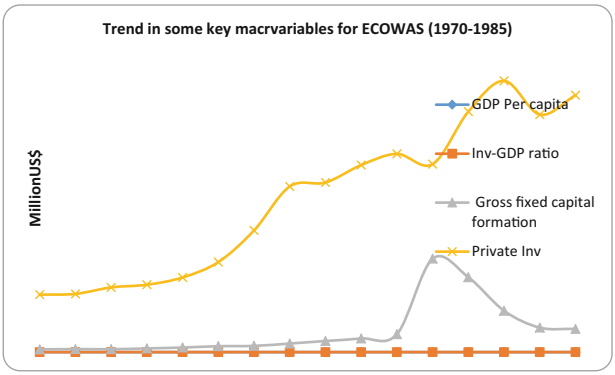
In this analysis, proxies would be used for institutions and policies. Consequently, institutionalized democracy and inflation would capture effective governance and macroeconomic stability.

The objective of this paper is to ascertain whether public investment enhances economic growth and development in the Economic Community of West African States (ECOWAS). The paper is organized as follows: Sect. 2 discusses selected fundamentals on the subject while Sect. 3 undertakes a brief literature review. Section 4 examines the analytical framework; the discussion of the empirics follows in Sect. 5 while the conclusion is provided in Sect. 6. It is expected that the analysis would further contribute to our understanding of the subject as well as further stimulate debate on the public investment—growth and competitiveness nexus.

2 Investment in ECOWAS: Stylized Facts

The figures below provide trend analysis of gross fixed capital formation, investment—GDP ratio, private investment and GDP per capita for ECOWAS covering the period of 1970–1985. 1986–1996; 1997–2007; and 2008–2014. For all the periods except during 2008–2014, gross fixed capital formation (proxy for public investment) remained constant during the period 1970–1978 with a peak between 1981 and 1983 and thereafter declined steadily. The investment/ GDP ratio remained flat during the period 1970–2014. On the other hand, private investment showed a negative trend during 2012–2013.

GDP per capita for the ECOWAS region which stood at US$477.93 in 1970 rose marginally to US$485.2 in 1987 and declined to US$470.4 in 1990. It rose to US $680.8 in 2008, the beginning of the global economic crisis and increased steadily during the crisis and by 2014, GDP per capita jumped to US$780.25. This was due partly to better macroeconomic management as well as increased export commodity prices.



Source: Data compiled from World Development Indicators (2013), The World Bank (2013, World Economic Outlook (2015)

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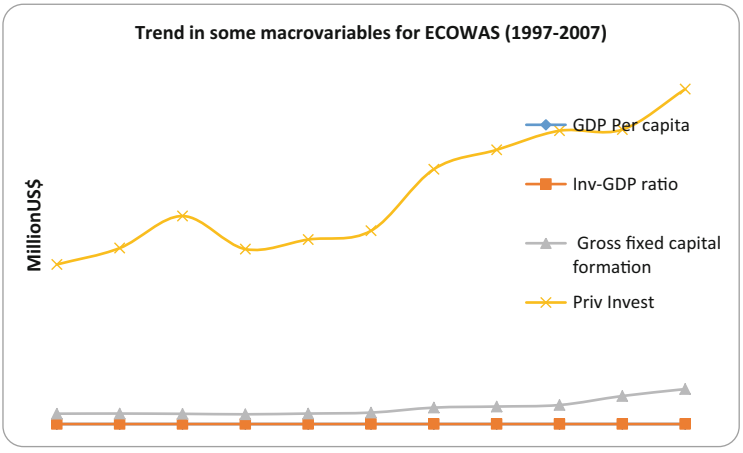

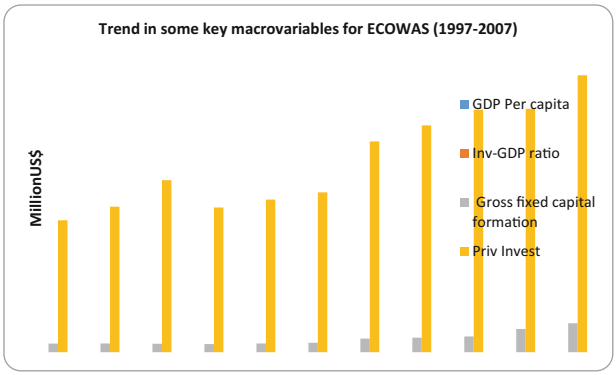

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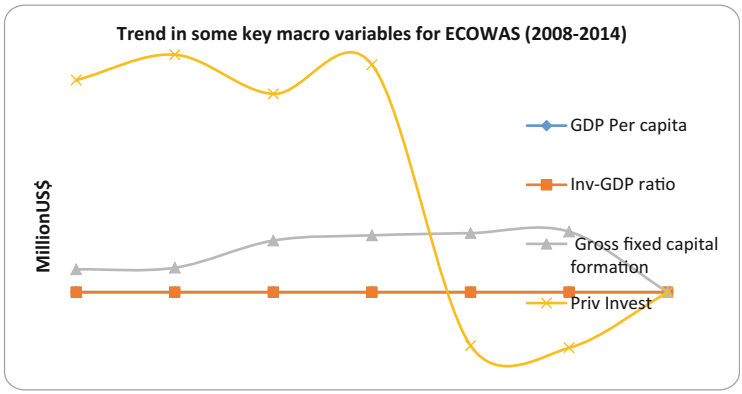

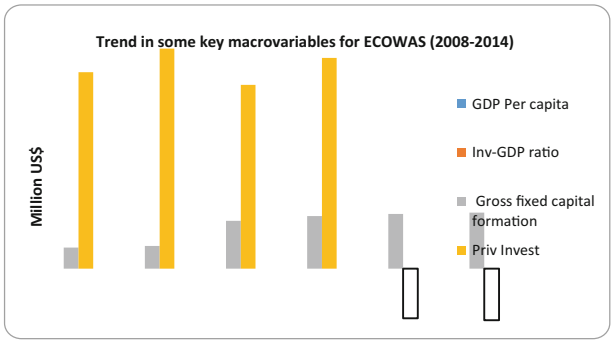

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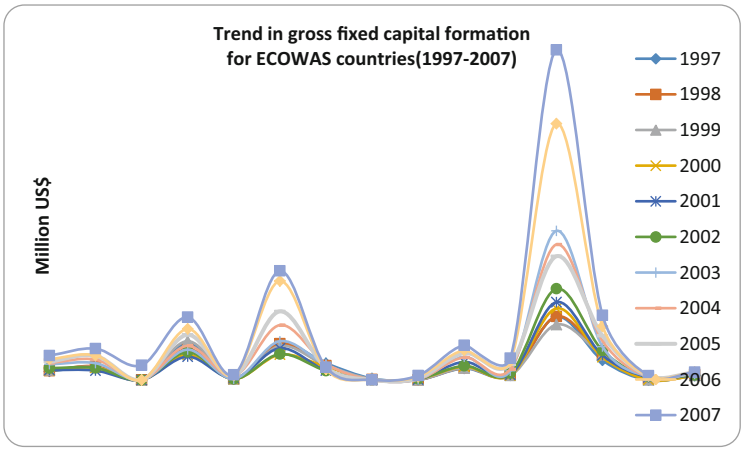
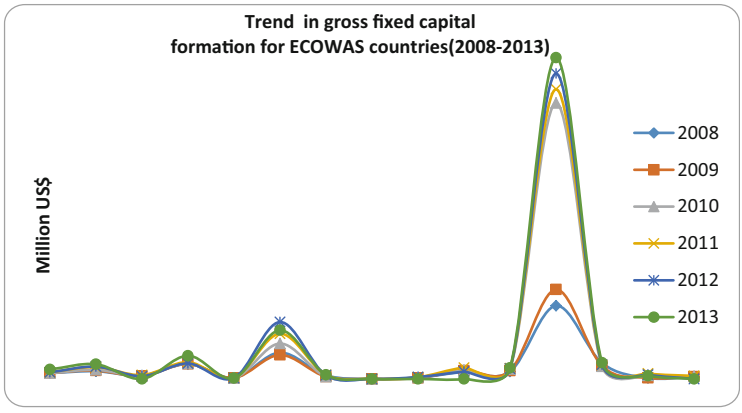




Government Consumption expenditure per capita in ECOWAS trended mixed from 1970 to 2013. In 1970, it was US$76.9 but rose to US$537.4 in 1980. During the global economic crisis, GCE per capita showed marginal increases from US $159.8 in 2010 to US$196.8 in 2013. The share of GCE in GDP averaged about 10 % during the period 1990–2013 while its share in Africa was almost 15 % during the same period (See Table 1).

The investment—GDP ratio and growth of GDP for selected ECOWAS economies are shown in Table 2. Cape Verde recorded high Investment GDP ratio during the period 1980–2013. In 1980, Investment/GDP in Cape Verde stood at 35.2 %. It increased to 40.3 % in 2008 and was almost 39 % in 2013. Togo, Senegal and Sierra-Leone indicated rising trend during the same period. Except for Cote D'Ivoire and Togo, the selected countries had positive growth rates averaging almost 6 % during the period 1980–2012.

Table 1 Government consumption expenditure (GCE) in ECOWAS, 1970–2013

Year	Government consumption expenditure per capita US$	Growth rate of government consumption expenditure (%)	GCE share in GDP (%) In	GCE share in Africa
1970	76.9	–	23.1	39.6
1975	249.5	26.5	28.6	51.5
1980	537.4	−6.0	31.0	58.6
1985	349.1	0.0	26.4	49.9
1990	88.7	1.2	13.7	17.7
1995	51.1	−13.6	11.1	12.0
2000	43.1	2.9	8.7	10.9
2005	68.6	2.4	7.2	12.1
2007	119.5	33.3	9.2	17.1
2008	153.0	13.7	9.9	18.8
2010	159.8	−1.2	10.1	17.5
2011	178.7	7.4	10.2	17.1
2012	179.8	−1.1	9.6	16.9
2013	196.8	5.8	9.7	18.5

Source: Calculated from World Economic data bank

3 Review of Literature

The literature on the impact of public investment on growth and development is wide. In some of the studies, government capital expenditure on infrastructure, education and health are also perceived as public investment. Related studies attempt to ascertain whether public investment crowds in private investment (Barro 1990). However, studies on the West African region are scanty.

Aschauer (1989, 1990) estimated the productivity of public capital inside an aggregate production function and found it to be a major and crucial determinant of growth. Other studies found a negative relationship (Ghali 1998). In a related study, using an endogenous growth model, (Knoop 1999) found that reducing the size of government reduces economy growth. Devarajan et al. (1996) analyzed the link between the share of total government expenditure in GDP and the growth in per capita real GDP and found a negative and significant relationship between the two.

A recent paper examines the effect of the government spending on economic growth utilizing panel data set from sub-Saharan African countries (Yasin 2012). The results from both fixed and random effects estimation show that government spending, trade-openness, and private investment spending have positive and significant effect on economic growth.

There are few country specific studies on the impact of public investment in the growth process. Ekpo (1999) found that disaggregating public investment into investment on specific projects like communications, education and infrastructure enhanced growth and crowded in private investment in Nigeria. Bedia (2007) using

Table 2 Investment/GDP and growth of GDP in selected West African Countries

	Investment/GDP (%)						Growth of GDP (%)					
Country	1980	1990	2000	2008	2010	2013	1980	1990	2000	2008	2010	2012
Cape Verde	35.2	36.9	27.8	40.3	37.6	38.9	8.4	0.69	14.2	6.6	3.6	2.5
Cote D'Ivoire	19.9	8.1	12.7	15.0	14.9	17.0	−10.9	−1.1	−3.7	2.3	2.3	9.4
Ghana	3.6	19.7	21.3	21.4	25.7	23.1	0.4	3.3	3.7	8.4	8.0	7.9
Nigeria	20.3	21.0	15.8	15.9	17.2	14.7	4.2	12.7	5.3	6.2	7.8	6.5
The Gambia	3.7	5.3	4.5	15.8	21.3	20.0	6.2	3.5	5.5	5.7	6.5	6.0
Senegal	17.4	10.1	20.4	31.2	22.0	27.3	−3.3	−0.6	3.2	3.6	4.2	3.4
Sierra-Leone	10.8	6.1	4.5	9.6	31.0	20.7	4.8	3.3	6.6	5.3	5.4	15.2
Togo	32.7	15.2	15.1	17.3	18.8	18.3	14.5	−0.2	−0.7	2.2	4.0	5.6

Source: World Economy Outlook Data Base, IMF

an Error Correction model found that in the short-run, an increase in private investment by 100 % enhanced economic growth by 28 % while 100 % increase in public investment resulted in only 7 % increase in real GDP. In the long-run, 100 % increase in public investment resulted in a 37 % increase in GDP. Hence, in the long-run, in Cote D'Ivoire, the impact of public investment on GDP growth was higher than that of private investment.

We intend to examine the subject matter on the 15 ECOWAS economies for the period 1970–2014. Our paper would differ slightly by defining the control variables within the context of competitiveness. We extract from the work of (Weymouth and Feinbers 2009) which identified three types of competitiveness as follows: (i) Regulatory competitiveness involving the attractiveness of domestic regulatory business environment; (ii) public investment competitiveness capturing the investments that governments make to enhance a country's productivity such as investments in human capital formation and infrastructure; and (iii) External competitiveness which implies an economy's openness to the flow of goods, services and people across its border.

4 Analytical Framework and Methodology

We derive the analytical framework from a neoclassical production function stated as:

$$Y = F(K, L) \tag{1}$$

Where, Y is the level of output, k is the stock of domestic physical capital, and L is the labour force.

We can augment and/or endogenize the aggregate production function to include:

$$Y = g(Gc, Pr, Dem, OPn, GF, Infla) \tag{2}$$

Where:

Y = level of output
G_c = Government Consumption
G_f = Gross Capital Formation
P_r = Private investment
Dem = institutionalized democracy
OPn = Measure of Openness
$Infla$ = Inflation

We have decomposed capital (K) into G_c, G_f and P_r and introduce openness and inflation to capture competitiveness.

Taking total derivatives of Eq. (2) and normalizing the results by the gross domestic product and with some mathematical process would yield (see Appendix for the derivation) the following estimating equation.

$$\Delta y_{it} = \propto_o + \propto_1 Gc_{it} + \propto_2 Pr_{it} + \propto_3 Dem_{it} + \propto_4 OP_{nit}, + \propto_5 - GF_{it,} + \propto_6 Infla_{it} + e_{it} \quad (3)$$

While:

Δ_y = growth in GDP

i = 1,. . .,15

t = 1,. . .,34

$\propto_o$ = Constant term

e_{it} = error term

Equation (4) examines the independent effects of private investment, public investment $\left(G_f\right)$ Government consumption on economic growth. The other parameters serve as control variables.

As a proxy for economic development, Yp = income per capita is regressed as a dependent variable:

$$YP_{it} = \beta_o + \beta_1 Gc_{it} + \beta_2 Pr_{it} + \beta_3 Dem_{it} + \beta_4 OP_{nit} + \beta_5 Gf_{it} + \beta_6 Infla_{it} + \mu_{it}. \quad (4)$$

Furthermore, we analyzed the impact of government total consumption by estimating the following equation:

$$Gc_{it} = \delta_o + \partial_i \Delta y_{it} + \delta_2 Gf_{it} + \delta_3 Dem_{it} + \delta_4 OP_{nit} + Z_{it}. \quad (5)$$

The paper utilizes panel data from 15 ECOWAS economies; the period is based on the availability of continuous data for the period under study.

5 Discussion of Results: The Empirics

The descriptive statistics of the estimated equations are presented in Tables 3 and 4. Table 3 describes some characteristics of the variables—growth (ygrowth), per capita GDP (Yp), Private investment (Pr), government final consumption (Gc), Openness (Opn), gross fixed capital formation (Gf) and inflation rate (Infla). Variable Gf has the highest average mean and median values of 20.000 and 19.925 respectively during the period. This may be explained by the high consumption expenditure embarked upon the governments of ECOWAS states over time. This is followed by the average mean and median values of the Pr.

Infla variable has demonstrated the greatest spread over time as observed from the standard deviation value of 32.753 compared to other variables. This may also be connected to the increasing level of inflation within the region. In Nigeria for example, among other factors, Nigerian Naira depreciation together with the

Table 3 Descriptive statistics

	Y_growth	Yp	Pr	Gc	Opn	Gf	Infla
Mean	3.358	0.0396	19.515	19.951	0.557	20.000	17.995
Median	3.785	0.0396	18.741	19.590	0.530	19.925	7.583
Std dev	5.434	0.161	3.242	2.179	0.242	1.494	32.753
Skewness	−0.438	−0.438	0.836	1.154	0.232	0.312	4.064
Kurtosis	8.765	6.635	2.915	4.258	3.424	3.285	27.579
J-B prob	0.000	0.000	0.000	0.000	0.000	0.015	0.000

Table 4 Correlation between variables

	Y_growth	Yp	Pr	Gc	Opn	Gf	Infla
Y_growth	1						
Yp		1					
Pr	−0.034	−0.067	1				
Gc	0.008	0.379	0.915	1			
Opn	0.021	0.160	−0.047	−0.025	1		
Gf	0.124	0.379	0.378	0.506	−0.091	1	
Infla	−0.176	−0.075	−0.203	−0.162	−0.240	−0.042	1

frequent fuel crisis partly contributing to the inflation rate experienced in recent times. Hence, the inflation rate becomes a more volatile variable.

Both the y-growth and Yp (growth and per capita GDP) variables appear with negative skewness (−5.434 and −0.438) while all the variables come with positive kurtosis. On the normality test, the J-B probability is 0 for each of the variables showing that none of them is normally distributed across the period.

The correlation between any two variables as illustrated in Table 2 is relatively low. The highest correlation coefficient occurs between private investment and government final consumption (0.915). The correlation between growth and each of its determinants is low and between Per capita GDP and each variable is equally low. As a pre-test of multi-collinearity, the correlation coefficients whether positive or negative are not potential cause of multi-collinearity problem. It follows therefore that the threat of multi-collinearity is absolutely reduced.

All the variables were tested for their time series properties and most of them were integrated of degree I(1). The process and the results of the stationarity tests are presented in the Appendix. The models were estimated using both fixed-effects and random effects. In panel data, the dependent variable is often influenced by two types of unobserved factors. The fixed effects assumes constancy over-time while the random effect assumes variability over-time. It is expected that the fixed-effects would remove the effects of any time-invariant unobserved attribute of each country. On the other hand, in the random effects, the unobserved attribute of each country is uncorrelated with each explanatory variable at all times. The results are presented in Tables 5, 6 and 7.

Table 5 Dependent variable: Y growth
Method: panel lease squares
Sample period: 1971–2011
Fixed effects

Variable	Coefficient	Std. Error	t. Statistic	Prob.
C	–	–	–	–
P_R	−0.2644	0.1451	−1.8210***	0.0712
Gc	4.9686	2.3800	2.0876**	0.0390
Dem	0.0112	0.0290	0.3881	0.6986
OP_N	12.9894	6.6760	1.9456***	0.0541
GF	1.1609	1.5242	0.7616	0.4478
INFLA	−0.0405	0.0241	−1.6812***	0.0954
$R^2 = 0.312$ Akaike info criterion = 6.4934 F-statistic = 1.13 Schwartz criterion = 7.3892 DW = 2.28				

**significant at 5 % level; ***significant at 10 %

The results from the estimation techniques show that government spending has positive effect on economic growth and is statistically significant at the 5 % level. These results are consistent with previous studies (Ekpo 1999; Aschauer 1989; Ram 1996; Yasin 2012; Fosu 2012). Public investment, proxied by gross capital formation is positively related to growth but not statistically significant under the fixed effects. Openness and democracy are positively linked to growth. While openness is statistically significant at the 10 % level, democracy is not. This could be attributable to the fact that western type democracy is yet to be entrenched in the economies of the region. It is interesting to note that private investment is negatively linked to growth. This result is puzzling based on the fact that in theory, the private sector is the engine of growth. However, the private sector in its modern form is not well developed in the region. Inflation has a negative relationship to growth and is statistically significant; a 1 % increase in inflation would reduce growth by 0.04 %.

Using income per capita as a measure of economic development, the results from both fixed and random effects seem interesting (see Tables 6 and 7). The results indicate that government spending and public investment have positive impact on development and are statistically significant. On the other hand, openness and private investment have negative relationship with development. The results appear contrary to economic theory. However, it should be noted that the kind of trade between economies in the sub-region and the rest of the world is unequal. The share of trade by the sub-region in world trade is negligible.

Regarding over-all, government consumption, the results appear mixed as well. Growth in gdp, public investment and democracy have positive relationship with government spending while openness shows a negative impact and it is not statistically significant (Table 8).

We next examine the results of the Vector Error Correction (VECM) estimates. The estimates explain the speed with which the variables are adjusted in their short run dynamic behaviour to the long run equilibrium condition. In each of the equation, there is an expected significant negative coefficient of the error correction term.

Table 6 Dependent variable: Yp
Method: panel least squares
Sample period: 1971–2011
Fixed effects

Variable	Coefficient	Std. Error	t. Statistic	Prob.
C	–	–	–	–
P_R	−0.0038	0.0028	−1.3582*	0.1770
Gc	0.2265	0.0469	4.8201**	0.000
Dem	−0.0001	0.0005	−0.2656	0.7910
OP_N	−0.3039	0.1318	−2.3054**	0.0229
GF	0.1202	0.0300	3.9950**	0.0001
INFLA	0.0004	0.0004	1.0142	0.3126
$R^2 = 0.61$ Akaike info criterion = −1.356 F-Statistic = 3.93 Schwartz criterion −0.4603 DW = 2.27				

**significant at 5 % level; *significant at 10 %

Table 7 Dependent variable: Yp
Method: panel least squares
Sample period: 1971–2011
Random effect

Variable	Coefficient	Std. Error	t. Statistic	Prob.
C	0.0671	0.0565	1.1878	0.2367
P_R	−0.0032	0.0027	−1.1873	0.2369
Gc	0.2571	0.0428	5.9981**	0.000
Dem	0.0001	0.0005	0.3943	0.6938
OP_N	−0.2568	0.1195	−2.1474**	0.0333
GF	0.1518	0.0271	5.6033**	0.000
INFLA	0.0003	0.0004	0.9228	0.3575
$R^2 = 0.42$ Akaike info criterion = −1.4455 F-Statistic = 18.85 Schwartz criterion −1.3117 DW = 2.1				

**significant at 5 % level

Table 8 Dependent variable: Gc
Method: panel least squares
Sample period: 1971–2011

Variable	Coefficient	Std. Error	t. Statistic	Prob.
C	−0.0578	0.0320	−1.8026***	0.0724
Y growth	0.0085	0.0054	1.5552***	0.1209
G_F	0.2163	0.0936	2.3108**	0.0215
Dem	0.0005	0.0018	0.2876	0.7738
OP_N	−0.1562	0.2638	−0.5928	0.5540
$R^2 = 0.45$ Akaike info criterion = 1.580 F-Statistic = 5.70 Schwartz criterion = 2.084 DW = 1.54				

**significant at 5 % level; ***significant at 10 %

For the growth equation, the coefficient is −0.039 implying that the speed of adjustment is about 3.9 % per year. For the economic development equation, the coefficient is −0.004 and this translates to about 0.4 %; hence the speed of adjustment in this case is just 0.4 % while for the government final consumption equation, the

Table 9 Vector error correction estimates

Equations	ΔYgrowth		ΔYp		Δ Gc	
Variable	Coeff	t-stat	Coeff	t-stat	Coeff	t-stat
Y_growth					−0.002	−0.240
Pr	−0.456	−0.746	−0.011	−0.954		
Gc	4.113	1.342	0.234	4.196		
Dem	0.012	0.431	$-9.29E^{-05}$	−0.183	0.001	0.624
Opn	1.549	0.690	0.0426	1.041		1.9155
Gf	−0.034	−0.019	0.172	5.368	0.343	3.079
Infla	0.013	0.519	0.001	1.446		
ECt-1	−0.039	−2.226	−0.004	−11.199	0.074	−2.553
R^2	0.45		0.71		0.300	
F-stat	9.210		27.4871		16.162	
Akaike AIC	6.506		−1.5045		1.996	
Schwarz-SC	6.764		−1.2463		2.106	

speed of adjustment is about 7.4 %. It appears that the variables (government final consumption inclusive) in the government final consumption equation have the highest speed of adjustment compared to the other cases. It follows that these variables adjust rapidly from the short run to the long run equilibrium condition (Table 9).

6 Conclusion

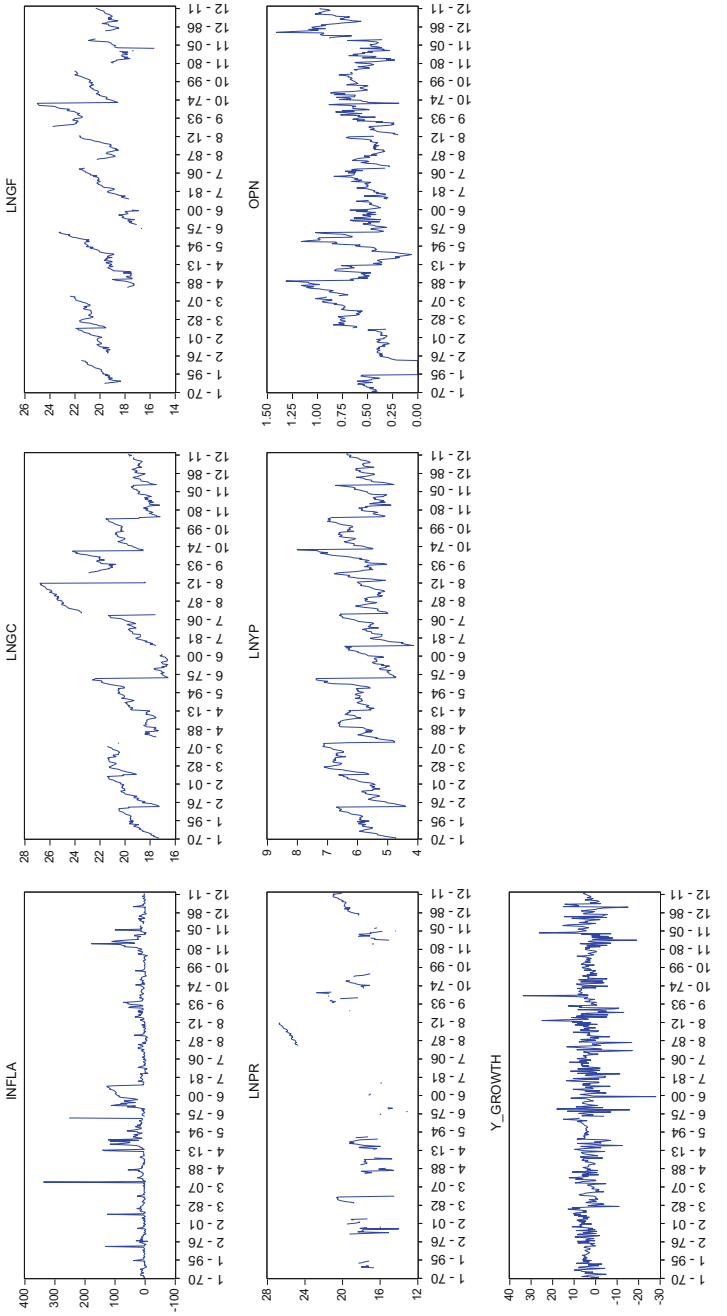
We investigated the impact of public investment on growth and development in ECOWAS defining competitiveness in the context of openness, democracy and inflation. The results from the panel analysis suggest that public investment proxied by government capital formation has positive relationship with growth and development and were statistically significant at both fixed and random effects. Private investment, contrary to theory did not enhance growth in the sub-region during the period 1970–2013. In the same vein, openness did not stimulate growth and development in the sub-region during the same period. This is not surprising when we consider the fact that trade between countries in ECOWAS and the rest of the world is unequal. Furthermore, the share of ECOWAS trade in global trade is negligible.

Institutionalized democracy had a positive relationship to growth under the fixed effect scenario but a negative link with economic development under fixed effects. The relationship to development under the random effect is positive. In all cases, the relationships are not statistically significant.

It must be stated that though the analysis did not directly capture the quality of government investment, the results nonetheless confirm the positive role of government in fast-tracking growth and development in the sub-region.

Appendix

Test of Stationarity



The above illustrates an informal test of stationarity. Both inflation(infla) and growth (y_growth) appear to have a slow decay over time and so they do not seem to have conspicous trend and hence demonstrate some stationarity status. The informal test however would not give a clear picture on stationarity status of variables.

Levin & Chu Panel Unit Root test results

Variable	Levin, Lin & Chu (Prob)	Order of integration	Decision
y_growth	0.000	I(0)	Stationary
Yp	0.788		Non-stationary
ΔYp	0.000	I(1)	Stationary
Pr	0.456		Non-stationary
ΔPr	0.000	I(1)	Stationary
Gc	0.9997		Non-stationary
ΔGc	0.000	I(1)	Stationary
Opn	0.181		Non-stationary
ΔOpn	0.000	I(1)	Stationary
Gf	0.722		Non-stationary
ΔGf	0.000	I(1)	Stationary
Infla	0.000	I(0)	Stationary

Source: Author's computation using E-views

The stationarity status of the variables y_growth, Yp, Pr, Gc Opn, Gf and Infla is observed using the Levin, Lin & Chu (LLC) panel unit root test. The LLC is based on the assumption that there is a common persistence of parameters across cross-sections.

The test equation used for the stationarity test for each of the variables is based on the graphical illustration as to whether each variable has an intercept or trend.

Among all the variables used for this study, only two are stationary in their level form. However, the variables tagged institutionalized democracy (Dem) is left out since it takes the form of a dummy representation in the analysis.

The growth variable (y_growth) is just stationary at level with probability value 0.000 which is less than the conventional 0.05 level. As expected, the inflation variable (infla) is also found with no unit root at its level (0.000). On this basis, both the growth and inflation variables are integrated of order 0.

Other variables such as Per capita GDP (Yp), private investment (Pr), government final consumption (Gc), Openness (Opn) and gross fixed capital formation (Gf) are stationary only after taking their first differences, hence they are integrated of order 1. The overall results of the stationarity test follow from the fact that most economic variables appear to be integrated in their first differences.

Cointegration results

Series	No. of CE(s)	Fisher stat* (Trace Test)	Prob	Fisher stat (Max-Eigen test)	Prob
Y_growth, Pr, Gc, Dem, Opn, Gf, Infla					
	None	112.7	0.000	69.75	0.000
	At most 1	77.37	0.000	30.23	0.000
	At most 2	52.79	0.000	22.40	0.000
	At most 3	34.14	0.000	19.36	0.000
	At most 4	18.07	0.000	14.70	0.000

Series	No. of CE (s)	Fisher stat* (Trace Test)	Prob	Fisher stat (Max-Eigen test)	Prob
Yp, Pr, Gc, Dem, Opn, Gf, Infla					
	None	118.8	0.000	80.44	0.000
	At most 1	84.76	0.000	38.21	0.000
	At most 2	54.58	0.000	33.50	0.000
	At most 3	26.47	0.000	14.68	0.000
	At most 4	14.76	0.000	12.38	0.000

Series	No. of CE(s)	Fisher stat* (Trace Test)	Prob	Fisher stat (Max-Eigen test)	Prob
Gc, Y_growth, Gf, Dem, Opn	None	240.0	0.000	127.6	0.000
	At most 1	137.3	0.000	80.05	0.000
	At most 2	70.24	0.000	53.51	0.000
	At most 3	44.15	0.000	29.72	0.000
	At most 4	49.20	0.000	49.20	0.000

*stable and significant

Kao-residual co integration

	ADF	
Series	t-stat	Prob
Y_growth, Pr, Gc, Dem, Opn, Gf, Infla	−8.122	0.000
Yp, Pr, Gc, Dem, Opn, Gf, Infla	−8.239	0.000
Gc, Y_growth, Gf, Dem, Opn	−7.541	0.000

Pedroni residual cointegration

	Panel v-stat		Panel rho stat		Panel PP stat		Panel ADF stat	
Series	Stat	Prob	Stat	pro	Stat	Prob	Stat	Prob
Y_growth, Pr, Gc, Dem, Opn, Gf, Infla	−0.992	0.839	−0.237	0.406	−5.243	0.000	−4.431	0.000

Group Rho stat		Group PP stat		Group ADF stat	
Stat	Prob	Stat	Prob	Stat	Prob
1.362	0.913	−5.047	0.000	−3.697	0.000

	Panel v-stat		Panel rho stat		Panel PP stat		Panel ADF stat	
Series	Stat	Prob	Stat	Pro	Stat	Prob	Stat	Prob
Yp, Pr, Gc, Dem, Opn, Gf, Infla	−405.0515	1.000	−0.1573	0.4375	−7.820	0.000	−2.817	0.028

Group Rho stat		Group PP stat		Group ADF stat	
Stat	Prob	Stat	Prob	Stat	Prob
1.1755	0.8801	−7.2764	0.000	−2.231	0.013

	Panel v-stat		Panel rho stat		Panel PP stat		Panel ADF stat	
Series	Stat	Prob	Stat	Pro	Stat	Prob	Stat	Prob
Gc, Y_growth, Gf, Dem, Opn	2.5978	0.005	−6.6657	0.000	−9.3128	0.000	−9.3531	0.000

Group Rho stat		Group PP stat		Group ADF stat	
Stat	Prob	Stat	Prob	Stat	Prob
−4.950	0.000	−10.458	0.000	−10.5265	0.000

The above tables discuss the long run relationship among the variables used. First, the cointegration test is performed for three different equations. These are the growth (Y_growth), the economic development (Per capita GDP) and the government final consumption (Gc) equations. The three variants of panel cointegration tests carried out are the Johansen Fisher Panel cointegration test, the Kao Residual cointegration test and the Pedroni Residual cointegration test. These become necessary to ascertain the robustness of the estimation results.

In the test for the long run relationship among the variables using the Johansen Fisher Panel cointegration test, a linear deterministic trend is assumed with lag interval of 11 in first differences.

For the growth equation where growth is endogenously defined and determined by the private investment, government final consumption, state of democracy, openness, government fixed capital formation; there is evidence of a long run relationship among these variables.

The Johansen cointegration test has demonstrated five cointegrating vectors for both the Trace test statistics and the Max-Eigen value statistics; all with probability values 0.000. The number of cointegrating vectors displayed is a clear indication of the stability of the system since the greater the number of the cointegrating vectors, the more stable the system is.

The Kao Residual test gives similar results of a long run relationship as demonstrated by the t-statistics of −8.122. In the same way, the Pedroni cointegation test shows that the variables are cointegrated especially for the Panel PP statistics (−5.243), Panel ADF statistics (−4.43), Group PP statistics (−5.047) and the Group ADF statistics (−3.697).

The long run relationship among the variables in the growth equation follows the interaction between the determinants and growth. It further demonstrates that these variables seem to be fundamental to growth in the ECOWAS region.

The Economic development equation shows similar trend. In this case too using all the three variants of cointegration tests, there exists a long run relationship among the variables in the economic development equation including the endogenous variable itself. Exactly five cointegrating vectors too were displayed for both Trace and Max-Eigen value statistics. This also shows that the model operates under a stable system. The Kao statistics also shows evidence of a long run relationship among the variables in question based on its ADF t-statistics of −8.239. The Pedroni cointegration test gives similar results of cointegration among the variables as observed from the Panel PP statistics (−7.819), Panel ADF statistics (−2.817) Group PP statistics (−7.276) and Group ADF statistics (−2.231).

All the three variants also demonstrate a long run relationship between the government final consumption and its determinants.

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Physical Investment, Health Investment and Income Growth in Africa

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1 Introduction

For many decades, Africa has been known as region with low income. Relatively, Africa's income compared to other regions of the world occupies the bottom position of income ranking. Many of the economies in Africa have agricultural products and natural resources as their major source of foreign exchange. As a result, they are vulnerable to external shocks which cause disappointment in overall economic performance. One of the prominent factors among these shocks that have affected so many African countries in the past is sharp decline in world commodity prices. In addition to these external shocks, there are several domestic factors (such as low human capital development, inadequate physical capital like infrastructure, health challenges, and civil unrest to mention a few) that have impeded the size and growth of income in Africa.

Over the years, several studies have identified different determinants of income. For instance, physical investment such as infrastructural development has been identified as an important ingredient for income growth (see Aschauer 1989; Banerjee et al. 2009). Such studies argued that efficient infrastructure is critical for ensuring the effective functioning of the economy, as it is an important factor determining the location of economic activity. Also, Empirical investigations have shown that good health and productivity are positively related (see Sorkin 1977; Savedoff and Schultz 2000; Bloom et al. 2004; Peykarjou et al. 2011). In the same

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D. Seck (ed.), *Investment and Competitiveness in Africa*, Advances in African Economic, Social and Political Development, DOI 10.1007/978-3-319-44787-2_4

way, according to World Bank (1993), health and per capita income have positive relationship. Good health is very important for human capital development as it improves workers' physical and mental capabilities which all lead to increased productivity. Health is vital to a country's productivity. Good health makes labour force to operate at full level of efficiency. However, bad health condition affects productivity negatively as ill workers absent from jobs or exerts effort below full potential during production.

Based on the aforementioned, it becomes germane to investigate the role of physical investment and health investment on income in Africa. Thus, the basic questions in this study are: has health investment improved income in Africa? Has physical investment improved income in Africa? And, is there evidence of conditional convergence in Africa's income? Given the aforementioned research questions, the objectives of this paper are in threefolds: one, to examine the effect of physical investment on income in Africa; two, to analyse the effect of health investment on income in Africa; and to investigate the evidence of conditional convergence in Africa's income.

The rest of the paper is structured as follows. Section 2 presents the overview of Africa's income; where comparison is made between Africa and the rest of the world, and among the sub-regions in Africa. Section 3 presents a brief review of the literature where theoretical positions and empirical evidences are provided. Section 4 describes the methodology employed in this study and thereafter, the results are presented. And finally, Sect. 5 presents the summary and conclusion of the study.

2 Overview of Africa's Income

This section provides an overview of Africa's income relative to that of the rest of the world in terms of the size of per capita income (PCI) and its growth pattern. In order of sequencing, annual averages of PCI and PCI percentages distribution in Africa and some selected regions of the world are presented, after which concentration is placed on Africa and its sub-regions. Lastly, average regional physical investment, health investment and PCI in Africa and its sub-regions are presented.

In Table 1, 3 year averages of PCI in different groups of countries and regions of the world over the period of 1996–2013 are presented. Below the PCI in each cell is the percentage distribution of PCI in comparison with high income group of countries. By PCI ranking, among all the regions and groups presented (nine in all), Africa occupied the seventh position, higher than only South Asia and low income groups in all the years covered. Although not revealed in the Table, Africa remains the poorest continent in the world. But when compared to some sub-regions of the world, Table 1 shows that, Africa has higher average PCI than only South Asia. The picture of Africa's income is more appreciated when the average African PCI is compared with that of high income countries. It is alarming to see that the

Table 1 Annual averages of PCI and PCI percentage distribution in Africa and rest of the World (Constant 2005 US Million Dollars), 1996–2013

Regions	1996–98	1999–01	2002–04	2005–07	2008–10	2011–13
High income	25323.68	27349.4	28713.02	30797.8	30779.57	31515.91
Europe and Central Asia	15247.95 60.21 %	16598.18 60.69 %	17610.67 61.33 %	19101.8 62.02 %	19275.44 62.62 %	19494.43 61.86 %
World	6200.64 24.49 %	6554.63 23.97 %	6825.26 23.77 %	7364.64 23.91 %	7495.6 24.35 %	7767.64 24.65 %
Latin America and Caribbean	4654 18.38 %	4746.82 17.36 %	4789.79 16.68 %	5301.59 17.21 %	5628.12 18.29 %	6016.43 19.09 %
East Asia and Pacific	3890.71 15.36 %	4058.91 14.84 %	4394.56 15.31 %	4955.12 16.09 %	5424.68 17.62 %	6028.21 19.13 %
All Middle Incomes	1469.67 5.8 %	1570.74 5.74 %	1732.92 6.04 %	2073.83 6.73 %	2390.93 7.77 %	2726.9 8.65 %
Africa	1372.38 5.42 %	1473.16 5.39 %	1592.36 5.55 %	1808.96 5.87 %	1930.64 6.27 %	1963.6 6.23 %
South Asia	497.79 1.97 %	556.21 2.03 %	615.33 2.14 %	748.52 2.43 %	878.58 2.85 %	1022.92 3.25 %
Low Income	290.57 1.15 %	301.17 1.1 %	316.48 1.1 %	352.68 1.15 %	391.7 1.27 %	438.06 1.39 %

Source: World Development Indicators (WDI 2014)

PCI of an average African nation only accounts for between 5.39 and 6.27 % of what it is in an average high income country from 1996 to 2013.

Another important thing to note in Table 1 is that the average PCI in Africa lies between that of all middle income and low income groups of countries, with average for all middle income lying above that of Africa, while that of low income lies below Africa for all the averages calculated. Looking closely at Table 1, virtually all the groups of countries, including Africa experienced PCI increase over the period of 1996–2013. But instead for Africa to accelerate and catch up with other higher income earners in the world, despite having enough room for growth, the region lacks the pace that can make it catch up with the closest possible (all middle income). For the period covered, the gap between Africa and all middle income groups of countries widens as years approach 2013. This can be observed by taking the difference between the percentages of high income group countries' PCI both group of countries accounted for. Given the statistics, it is clear that Africa has not been competing effectively in terms of PCI among other groups of countries in the world as presented in Table 1.

Having reviewed the relationship between Africa and the world at large, reviewing the happenings within Africa is also of paramount importance for two reasons: one, to identify the sub-regions' (West Africa, East Africa, Central Africa, North Africa, and Southern Africa) contributions to Africa's PCI; two, to identify the pace of growth in PCI for all the sub-regions. An examination of this will give a clear picture of the fundamentals of the position of Africa in Table 1.

As previously presented, the first row of Table 2 shows the annual averages of PCI in Africa, while other rows presents two things: the total PCI for each

Table 2 Annual averages of PCI and PCI percentage distribution in Africa and its sub-regions (Constant 2005 US Million Dollars), 1996–2013

Regions	1996–98	1999–01	2002–04	2005–07	2008–10	2011–13
Africa	1372.38	1473.16	1592.36	1808.96	1930.64	1963.60
West Africa	500.31 36.46 %	530.73 36.03 %	555.73 34.90 %	611.15 33.78 %	662.72 34.33 %	701.49 35.72 %
East Africa	1229.83 89.61 %	1317.23 89.42 %	1295.17 81.34 %	1427.60 78.92 %	1519.12 78.68 %	1675.38 85.32 %
Central Africa	1650.55 120.27 %	1834.51 124.53 %	2305.56 144.79 %	2750.03 152.02 %	2906.07 150.52 %	2910.90 148.24 %
North Africa	2358.44 171.85 %	2560.34 173.80 %	2725.02 171.13 %	3119.64 172.45 %	3385.42 175.35 %	2915.01 148.45 %
South Africa	2935.15 213.87 %	3032.85 205.87 %	3217.59 202.06 %	3595.53 198.76 %	3803.33 197.00 %	4077.80 207.67 %

Source: World Development Indicators (WDI 2014)

sub-region and percentage each sub-regions accounted for in average Africa's income. Within Africa, West Africa has the least PCI. West Africa accounted for between 33.78 and 36.46 % of the average Africa's PCI for the period covered. However, Southern Africa is the richest in Africa as its contribution to Africa's PCI ranges from 197 to 213 % of Africa's average income. North Africa, Central Africa and East Africa occupy second, third and fourth position, respectively. One of the most striking features of Table 2 is that Nigeria, being the largest economy in Africa belongs to West African region which has the least PCI.

Comparing Table 2 with Table 1, it is obvious that if not for West Africa and East Africa, Africa's average PCI would have been higher than that of the all middle income group of countries[1]. Thus, West Africa and East Africa constitute a major drag to other sub-regions of the continent. Also, in terms of the pace of the growth in PCI, only Central Africa is outstanding as it recorded greatest percentage increases over the years; other sub-regions display consistent pattern of drop in their PCI growth with North Africa having the largest decrease.

Given the above statistics in Table 2, it is clear that West Africa performs worst within Africa, followed by East Africa. However, the performance of East Africa is far better than that of West Africa.

In Table 3, trend analysis of basic variables of interest in the study is presented. Consequently, the Table shows the relationship among physical investment as percentage of GDP, health investment as percentage of GDP, and per capita income growth in aggregate Africa and its five sub-regions from 1996 to 2012. Aggregate Africa statistic is presented at the top-most panel which is then followed by other sub-regions.

On the aggregate, Africa recorded consistent positive per capita income growth. Also, Physical and Health investment as percentages of GDP recorded consistent

[1]Compare Central Africa, North Africa and Southern Africa in Table 2 with All Middle Income in Table 1.

Table 3 Average regional physical investment, health investment and per capita income growth in Africa and its sub-regions (1996–2012)

Indicators	1996–98	1999–01	2002–04	2005–07	2008–10	2011–12	Average
Africa							
Physical investment (% of GDP)	21.68	20.12	20.21	21.34	22.86	25.15	21.89
Health investment (% of GDP)	5.14	5.30	5.55	5.86	6.10	6.27	5.70
Per capita income growth	4.00	1.66	2.20	3.23	1.86	2.01	2.49
West Africa							
Physical investment (% of GDP)	15.41	14.30	16.02	19.32	21.10	24.10	18.38
Health investment (% of GDP)	5.99	6.11	6.13	6.64	6.99	7.11	6.49
Per capita income growth rate	4.16	2.09	1.71	2.57	2.00	2.47	2.50
East Africa							
Physical investment (% of GDP)	16.10	16.50	17.80	20.12	21.48	25.98	19.67
Health investment (% of GDP)	4.57	4.94	5.32	6.15	6.06	6.25	5.55
Per capita income growth rate	1.60	0.71	0.46	2.84	1.64	2.98	1.74
Central Africa							
Physical investment (% of GDP)	41.45	33.70	29.76	26.22	27.07	29.58	31.30
Health investment (% of GDP)	4.58	4.51	4.92	4.33	4.63	4.42	4.56
Per capita income growth rate	9.99	2.44	5.05	4.04	2.04	1.98	4.26
North Africa							
Physical investment (% of GDP)	18.45	19.97	20.63	23.12	26.28	23.95	22.07
Health investment (% of GDP)	4.20	4.32	4.67	4.48	5.17	5.68	4.75

(continued)

Table 3 (continued)

Indicators	1996–98	1999–01	2002–04	2005–07	2008–10	2011–12	Average
Per capita income growth rate	3.53	2.14	3.29	4.38	2.24	4.68	3.38
Southern Africa							
Physical investment (% of GDP)	28.20	24.75	22.35	20.23	23.20	23.57	23.71
Health investment (% of GDP)	6.31	6.38	6.53	6.96	8.00	8.50	7.11
Per capita income growth rate	1.32	1.23	2.90	3.74	1.41	2.61	2.20

Source: WDI (2014)

increase over the period covered. Physical investment as percentage of GDP increases from 21.68 to 25.15 %. This shows that in Africa, the average increase in the percentage of GDP that went into physical investment between 1996 and 2012 was 3.47 %. Also, health investment as a percentage of GDP, recorded 1.13 % improvement from 1996 to 2012.

On the average (see the last column of Table 3), among the sub-regions, Central Africa came first and West Africa came last as regards investment in physical capital; Southern, Northern and East Africa occupied the second, third and fourth position, respectively. In terms of health investment, Southern Africa came first and Central Africa came last, while West, East and North Africa occupied second, third and fourth position, respectively.

The above statistics reflects that while it is easier to appraise the relationship among physical investment, health investment and per capita income growth in Africa at aggregate level, it requires further evidence to do the same for the sub-regions. For this reason, it becomes important to disaggregate Africa into various categories. This will assist in identifying the specific relationship among the three variables.

3 Literature Review

3.1 Some Theoretical Positions

Growth models generally have identified several factors that can contribute to economic growth. In the 1950s and 1960s, research focused on the link between saving, investment and growth. Conventionally, savings is regarded as a fundamental element for investment. The theory by Harrod (1939) and Domar (1946)

called the Harrod-Domar model explained that an economy's growth rate is directly determined by the rate of investment. As an alternative to the Harrod-Domar growth analysis, the neoclassical growth model, inspired by the Solow model of long-run growth was developed. This model assumed a continuous production function relating output to the inputs of capital and labour which are substitutable and exhibit constant returns to scale. The neoclassical model in the works of Solow (1956) and Swan (1956) argued that steady state growth depends on technological progress and population growth. However, because technological progress is not forthcoming in the short-run, per capita output does not grow. In the short-run, increase in per capita output only depends on increase in saving rate. As an improvement to the neoclassical model, endogenous growth model was developed (see Arrow 1962).

Endogenous model posited that long-run growth rate of output per worker is determined by variables within the model as against the neoclassical model. The model explored alternative productivity channels through which investment affects growth. This school of thought attached greater significance to certain types of investment that create externalities and generate an additional productivity boost through production spill overs or the associated diffusion of technology (Jorgenson and Stiroh 2000). According to Romer (1986), it never really mattered what the government did in models with exogenous technical change and exogenous population growth. The new growth theory did not simply criticize the neoclassical growth theory but extended the latter by introducing endogenous technical progress in growth models. The endogenous growth models emphasized technical progress resulting from the rate of investment, the size of the capital stock, and the stock of human capital. It explored alternate productivity channels through which investment affects growth and attaches greater significance to certain types of investment that create externalities and generate an additional productivity boost through production spill-overs or the associated diffusion of technology (Jorgenson and Stiroh 2000).

3.2 Some Empirical Evidences

Several studies have been carried out to empirically investigate some fundamental determinants of per capital income growth rate. Among these determinants is investment, which is consistent with economic growth theories. Overtime, the concept of investment has been broadened to include physical capital investment that comprises private and public capital investment; human capital investment that consists of expenditures on education and health, which can also be of private, or public; and research and development investment. Review of empirical evidences in this study centres on the role of physical and health investment in promoting economic growth.

Different empirical studies in the past have produced diverse results based on the methodologies used and data employed. Empirical studies on physical capital

investment and economic growth are more disaggregated. Some studies investigated infrastructural investment such as transportation (see Aschauer 1989; Amaghionyeodiwe and Folawewo 1998; Banerjee et al. 2009; Akinyosoye 2010), private investment (see Ghura and Hadjimichael 1996; Ghani and Din 2006) and public investment (see Ghani and Din 2006; Warner 2014).

Aschauer (1989) in his study of the G7 countries for the period of 1966–1985 employed panel data econometric technique to analyse the relationship between public infrastructure capital and aggregate output of private sector from a specified Cobb-Douglas function. The result of the study indicated an output elasticity of 0.34 to 0.73, which shows that public infrastructure capital is important in explaining aggregate output of the private sector. Consistent with these findings are the results of the study by Munnell (1992) and Moomaw et al. (1995), among others. Also, in a more recent study, Banerjee et al. (2009) in their study on China between 1986 and 2005 investigated the effect of access to transportation network on regional demographic and economic outcomes. They compared the estimates of ordinary least squares (OLS) to that of two-stage least squares (2SLS) as a means of achieving the objective of their study. The result of the study established that proximity to transportation networks have a large positive causal effect on per capita GDP growth rates across sectors. The comparison between OLS and 2SLS showed that the 2SLS estimates were larger in magnitude and much noisier than the OLS estimates. Akinyosoye (2010) in his study of infrastructural development in Nigeria argued that for Nigeria to attain or surpass average growth rates of Asian countries, contribution of infrastructure to GDP has to increase by a factor of 9 in "tangible" spending (i.e. from 1.9 to 18 % per annum) over 15 years; and to achieve that over 10 years, it will require increased infrastructure spending by a factor of 12 (that is, from 1.9 to 24 %) per annum.

In a study of sub-Sahara African countries by Ghura and Hadjimichael (1996), they empirically investigated the determinants of per capita economic growth from 1981 to 1992. They found that an increase in private investment has a relatively large positive impact on per capita growth. Also, public policies that lower the budget deficit in relation to GDP (without reducing government investment), reduce the rate of inflation, maintain external competitiveness, promote structural reforms, encourage human capital development, and slow population growth. Finally, they found that per capita income converges after controlling for human capital development and public policies.

Like in the case of physical capital investment, empirical studies on health investment and economic growth are of two main types—some investigated health (such as life expectancy and child mortality) and growth, while some examined health expenditure and growth. Most of the studies that investigated health and growth argued that good health has a significant positive relationship with economic growth. However, results from most of the studies that investigated health expenditure and growth are mixed; with some finding significant positive relationship, and some suggesting the reverse.

Aghion et al. (2010) examined health and growth in OECD countries, using cross-country panel regressions between 1940 and 1980. The study found a

significant positive impact of health on growth, the result which is consistent with studies like Bloom et al. (2004); however, they found that the relationship weakened from 1960 onwards. The interpretation of the finding reflected an age-specific productivity effect of health. As at 1960, a large share of the growth in life expectancy at birth appears to be as a result of reduction in mortality at old age, but they find that it is mostly the decrease in the mortality of individuals aged 40 or less that matters for growth. In an earlier related study, Bhargava et al. (2001) argued that the effect of health on economic growth is larger in developing countries than in developed ones. This result is not farfetched as developed economies are close to their potentials whereas developing countries are still far from reaching their potentials. Thus, there are more rooms for expansion in developing countries than developed ones.

In a study of 15 OECD countries from 1990 to 2006, Çetin and Ecevit (2010) employed pooled regression technique to investigate the effect of public health expenditures as a percentage of total health expenditures, used as proxy for health on economic growth. The study concluded that there was no statistically significant relationship between health expenditures and economic growth. This result is consistent with the study by Taban (2006) on Turkish economy where there was evidence for a two-way causality between life expectancy at birth and economic growth, but there was no evidence for causal relationship between health expenditures and economic growth.

4 Methodology

The empirical model for the study is built on neoclassical growth theoretical framework. Based on the fundamental assumption of the framework that income is a function of capital and labour, and coupled with several empirical findings, the model estimated for the study is presented below as follows.

$$\begin{aligned} Y_{it} = \; & \beta_0 + \beta_1 \ln Y_{it-1} + \beta_2 \ln P_{it} + \beta_3 \ln H_{it} + \beta_4 pop_{it} \\ & + \beta_5 \inf_{it} + \beta_6 open_{it} + \beta_7 \ln m2_{it} + \beta_8 \ln C_{it} + \varepsilon^{Y}{}_{it}, \beta_1 < 0, \\ & \beta_2 \, and \, \beta_3 > 0 \end{aligned} \tag{1}$$

where '*i*' indexes countries, '*t*' indexes time, and '*ln*' means variables are in their log form. 'Y_{it}' is the growth rate of real income per capita, 'Y_{it-1}' is initial level of real income per capita. 'P_{it}' is physical investment, the variable 'H_{it}' measures health investment, 'pop_{it}' is population growth employed as a proxy for labour force growth, 'inf_{it}' is inflation, '$open_{it}$' is openness defined as total trade as a percentage of GDP, the variable '$m2_{it}$' defined as broad money measures the development of financial markets, 'C_{it}' is government consumption. From equation 1, *P, H, m2, and C* are all in their per capita forms. The a priori expectations of the major variables in the model are presented in equation (1). β_1 investigates the

evidence of conditional convergence, β_2 measures the effect of physical investment, and finally, β_3 measures the effect of health investment.

The three specific objectives of the research are investigated by employing a dynamic panel data estimation technique. As a result, this study adopts the "system generalised method of moment (GMM)" estimator, proposed by Arellano and Bover (1995) and Blundell and Bond (1998). Income is proxied by growth rate of gross domestic product (GDP) per capita, gross fixed capital formation proxied physical capital, and health expenditure is used to represent health investment.

To mitigate the effect of heterogeneity, various models are estimated across 3 different categories within the continent. One, sub-regions category which comprises West Africa, East Africa, Central Africa, Southern Africa, and Northern Africa; two, oil producing category which consist of oil producing and non-oil producing countries—oil producers are countries that produce oil in commercial level and non-oil producer are those that do not produce oil in commercial level. Countries that newly discovered oil in commercial level are not included as oil producers in this study. Three, population size category, determined by dividing Africa into two using population size. To do this, the mid-population across Africa is determined after which countries that fall below the mid-point are categorised as low populated and countries above are categorised as high populated.

Data used in this study cover African countries from the period 1996–2012. The choice of this period is due to data availability, especially data on health expenditure. All the variables are measured at 2005 constant prices, in US Dollars, where applicable and are sourced from the World Bank's World Development Indicators (WDI 2014).

5 Discussion of Results

Empirical analysis focuses on the three specific objectives of the study. For a more robust analysis, as earlier stated, this study compares results within several categories of countries in Africa. Generally, for all the models estimated, Hansen diagnostics tests show that the models are correctly specified. The Hansen J test statistic indicates that the instruments are appropriate as they are uncorrelated with the disturbance process, thus, this makes the instruments valid and satisfy the orthogonality conditions. Also, autocorrelation tests (AR1and AR2) indicate that there is no problem of serial correlation in the models as evidenced by AR2.

5.1 Descriptive Statistics

The descriptive statistics focuses on some selected variables as presented in Table 4. The Table is presented in such a way that facilitates comparisons of Africa's statistics with other categories of West, East, Central, Southern, and North Africa; oil and

Table 4 Descriptive statistics of major variables: aggregate Africa and other categories

Variable	Mean	SD	Min	Max	CV	Variable	Mean	SD	Min	Max	CV
Africa						West Africa					
PC	1660.89	2470.95	53.10	13889.95	1.48	PC	586.18	445.65	53.10	2749.48	0.76
PCGRT	2.61	8.93	−62.47	142.07	3.41	PCGRT	2.50	7.89	−33.98	91.67	3.15
PHYINV	21.69	16.99	−2.42	219.07	0.78	PHYINV	18.04	8.84	−2.42	58.96	0.49
HLTINV	5.69	2.32	1.54	18.41	0.41	HLTINV	6.46	2.87	3.44	18.41	0.44
POPN	15500000	12900000	76417	169000000	1.48	POPN	16400000	32200000	408790	169000000	1.97
East Africa						Central Africa					
PC	1392.79	2907.93	128.13	13889.95	2.09	PC	2410.01	3168.54	201.73	13518.04	1.31
PCGRT	1.67	4.34	−17.95	10.67	2.60	PCGRT	4.34	14.61	−11.17	142.07	3.36
PHYINV	19.00	7.67	2.00	47.85	0.81	PHYINV	31.21	34.49	2.1	219.07	1.11
HLTINV	5.51	1.89	2.60	11.62	0.34	HLTINV	4.57	1.92	1.54	11.81	0.42
POPN	12400000	12500000	76417	47800000	1.01	POPN	12400000	15800000	132323	65700000	1.27
Southern Africa						North Africa					
PC	3399.99	1813.42	596.96	6693.75	0.53	PC	2729.56	2151.27	499.06	9099.07	0.79
PCGRT	2.18	2.75	−8.69	11.03	1.26	PCGRT	3.31	12.40	−62.47	102.78	3.75
PHYINV	23.72	10.65	8.42	74.82	0.45	PHYINV	21.83	5.87	8.97	38.24	0.27
HLTINV	7.03	1.67	3.85	11.73	0.24	HLTINV	4.70	1.16	2.25	7.47	0.25
POPN	10700000	18200000	984506	52300000	1.70	POPN	30200000	21500000	4837354	8070000	0.71
Oil producers						Non-oil producers					
PC	3096.75	2912.36	201.73	13518.04	0.94	PC	1185.90	2102.91	53.10	13889.95	1.77
PCGRT	3.80	14.57	−62.47	142.07	3.83	PCGRT	2.22	5.96	−33.98	91.67	2.68
PHYINV	25.17	28.92	2.10	219.07	1.15	PHYINV	20.50	9.85	−2.42	79.35	0.48
HLTINV	4.81	1.73	1.54	9.14	0.36	HLTINV	6.00	2.42	2.60	18.41	0.40
POPN	32300000	37300000	1108698	169000000	1.16	POPN	9929790	10600000	76417	47800000	1.07

(continued)

Table 4 (continued)

Variable	Mean	SD	Min	Max	CV	Variable	Mean	SD	Min	Max	CV
High population countries						Low population countries					
PC	1170.36	1294.31	196.17	5885.22	1.11	PC	1868.72	2800.57	53.10	13889.95	1.50
PCGRT	2.48	3.88	−15.28	30.34	1.56	PCGRT	2.67	10.35	−62.47	142.07	3.88
PHYINV	19.45	7.31	2.1	47.85	0.38	PHYINV	22.68	19.72	−2.42	219.07	0.87
HLTINV	5.51	1.53	3.14	9.56	0.28	HLTINV	5.77	2.59	1.54	18.41	0.45
POPN	39500000	30200000	15500000	169000000	0.76	POPN	5462457	4630107	76417	15500000	0.85

Note that PC is per capita GDP, PCGRT is growth rate of per capita GDP, PHYINV is physical investment, HLTINV is health investment, POPN is population

non-oil producing countries; and, high and low populated countries. The analysis therefore follows a specific pattern. Essentially, comparisons are made across regions and groups. For clarity and simplicity of analysis, the mean value is used for discussions, while other statistics, defined and explained above are only presented in Table 4.

The Table presented the average value (Mean), standard deviation (SD), minimum (Min) and maximum (Max) values, and coefficient of variation (CV) of variables. From the Table, an analysis of per capital GDP (PC) and physical investment (PHYINV) shows that West and East Africa are below Africa average, whereas Southern, North and Central Africa fall above it. Also, oil producing and low populated group of countries are above Africa average while, non-oil producing and high populated group of countries fall below. From this statistics, it can be inferred that perhaps population size distract the concentration of any government from physical investment for some recurrent expenditure. For growth of per capita GDP (PCGRT), Central Africa, North Africa, oil producing and low populated group of countries are above Africa average, while other groups of countries fall below. However, average health investment (HLTINV) in West Africa, Southern Africa, non-oil producing and low populated categories are greater than Africa average. Finally, population size (POPN) reveals that on the average, North Africa, West Africa and oil producing countries have more people than East Africa, Southern Africa, Central Africa, and non-oil producing group of countries.

5.2 Empirical Findings

The empirical findings for the study are presented in Tables 5 and 6; where aggregate African results are contained in Table 5, and that of sub-group of countries given in Table 6. First, results of a baseline regression is presented in Table 5 (model 1), thereafter the estimation results of impact of different investment measures are provided in models 2, 3 and 4. Specifically, physical investment is introduced in model 2, health investment in model 3, and both in model 4. The baseline regression is carried out mainly for Africa.

From Table 5, for the baseline regression (model 1), three variables namely money supply, openness, and inflation are found to be highly significant in the determination of income. growth. Other variables such as initial GDP per capita, population growth and government consumption all have moderate explanatory power. For all the variables, the direction of effect are as expected, except for government consumption which has a negative sign. The negative relationship results are inconsistent with the *a priori* expectation. However, the result perhaps is a reflection of the characteristics of the various economies in Africa. To justify this further, theory suggests that budget deficit reduces government saving—which is an integral part of national saving[2]. When government runs budget deficits, it

[2]See DeLong and Olney (2009), page 91.

Table 5 System GMM for physical investment, health investment, and income growth in Africa (1996–2012)

Variables	(1)	(2)	(3)	(4)
Initial GDP per capita (log)	−4.46* (−1.85)	−6.85*** (−2.64)	−5*** (−3.33)	−5.49*** (−3.01)
Population growth	1.94* (1.66)	0.26 (0.48)	1.16* (1.76)	0.37 (0.67)
M2	2.84** (1.99)	0.51 (0.56)	0.58 (0.52)	0.9 (0.71)
Openness	0.05*** (2.76)	0.04** (2.1)	0.07*** (2.72)	0.04*** (2.49)
Inflation	−0.01*** (−4.4)	−0.004*** (−3.37)	0.001 (0.8)	−0.004*** (−2.73)
Government consumption	−4.46* (−1.85)	0.4 (1.25)	0.57** (2.14)	0.35 (1.39)
Physical investment (log)		4.86*** (3.49)		2.96*** (2.59)
Health investment			4.09*** (3.2)	0.26 (0.17)
Hansen test Chi-Sq	47.13 [1.000]	44.31 [1.000]	47.50 [1.000]	44.65 [1.000]
AR(1)	−2.05 [0.040]	−2.44 [0.014]	−2.20 [0.028]	−2.42 [0.015]
AR(2)	−1.48 [0.140]	−1.14 [0.254]	−0.97 [0.333]	−1.12 [0.263]
Number of observation	684	659	655	649

Note: t-statistics of the GMM are in parentheses, while the figures in bracket are p-values for Hansen test and serial correlation test. ***, **,* represent statistical significance at 1 %, 5 % and 10 %, respectively

borrows to cover up. The implication of this is in twofolds. First, government saving reduces; second, as government raises funds through bonds, part of what should be private saving available for investment gets into the coffers of government which spends them on consumption. This deteriorate the economy more if greater percentage of the consumption is for foreign produced goods, as experienced in many of the countries in Africa. Thus, such result only portrays the structure of the economies in Africa.

The introduction of physical investment and health investment in models 2, 3 and 4 changes both the relationship and significance of some of the variables from what is obtained in model 1. The major variable that changes as a result of the introduction is government consumption, which changes from a negative relationship to a positive one, but it only becomes significant with the inclusion of health expenditure in model 3.

It is important to note that the investment variables are only found to be significant when used separately; however, when both are jointly used in model 4, only physical investment is highly significant. This shows that for the general

Table 6 System GMM for physical investment, health investment, and income growth: Africa and other categories (1996–2012)

Variables	(1) Africa	(2) West Africa	(3) East Africa	(4) Central Africa	(5) Southern Africa	(6) Northern Africa	(7) Oil Producer	(8) Non-Oil Producer	(9) High Populated	(10) Low Populated
Initial GDP per capita (log)	−5.49*** (−3.01)	−6.09*** (−2.6)	−3.34** (−2.17)	−17.32** (−1.95)	−3.54** (−2.15)	−4.69*** (−6.07)	−35.52** (−2.41)	−4.31*** (−4.84)	−4.19*** (−3.32)	−6.6** (−2.36)
Population growth	0.37 (0.67)	1.63* (1.84)	−0.78*** (−2.5)	−1.2 (−0.58)	−0.28 (−1.48)	−1.75 (−1.11)	2.23 (1.07)	−0.17 (−0.38)	−0.45 (−0.51)	0.24 (0.39)
M2	0.9 (0.71)	1.71 (0.96)	−0.5 (−0.67)	1.99 (0.93)	−0.85 (−0.77)	−0.77 (−0.69)	0.24 (0.12)	−0.17 (−0.29)	−1.76 (−1.21)	0.57 (0.45)
Openness	0.04*** (2.49)	0.02 (1.49)	−0.03 (−1.32)	0.09*** (2.9)	−0.03 (−1.2)	0.07* (1.9)	−0.02 (−0.32)	0.001 (0.08)	0.06** (1.93)	0.05*** (3.06)
Inflation	−0.004*** (−2.73)	0.02 (0.99)	−0.09** (−2.23)	−0.004** (−2.14)	0.01 (0.07)	0.09*** (3.04)	−0.01** (−2.11)	−0.02 (-0.67)	−0.004*** (−3.91)	−0.01* (−1.85)
Government consumption	0.35 (1.39)	1.22*** (2.7)	−0.47* (−1.76)	0.35 (0.39)	0.81*** (2.62)	−0.17 (−0.82)	3.22 (1.37)	0.21 (0.81)	0.9** (1.96)	0.35 (0.97)
Physical investment	2.96*** (2.59)	0.23 (0.14)	3.72*** (4.00)	5.7 (1.09)	2.38** (2.11)	2.76** (1.99)	20.59** (2.13)	2.71*** (2.85)	1.12 (0.76)	3.94** (2.39)
Health investment	0.26 (0.17)	4.1*** (3.33)	0.88 (1.00)	4.43** (2.03)	0.04 (0.05)	−0.55 (−0.47)	4.9** (1.96)	1.56** (2.07)	4.43** (1.95)	0.44 (0.28)
Hansen test Chi-Sq	44.65 [1.000]	10.48 [1.000]	6.14 [1.000]	0.00 [1.000]	0.00 [1.000]	0.00 [1.000]	7.01 [1.000]	31.07 [1.000]	12.38 [1.000]	28.79 [1.000]
AR(1)	−2.42 [0.015]	−2.08 [0.038]	−2.74 [0.006]	−1.32 [0.186]	−1.71 [0.087]	−1.61 [0.107]	−1.83 [0.067]	−3.76 [0.000]	−1.66 [0.097]	−2.01 [0.044]
AR(2)	−1.12 [0.263]	0.94 [0.347]	−0.44 [0.662]	−1.26 [0.206]	−0.39 [0.695]	0.72 [0.471]	−1.12 [0.264]	−0.62 [0.534]	−0.09 [0.929]	−1.13 [0.261]
Number of observation	649	198	183	118	76	68	152	488	210	439

Note: t-statistics of the GMM are in parentheses, while the figures in bracket are p-values for Hansen test and serial correlation test. ***, **,* represent statistical significance at 1 %, 5 % and 10 %, respectively

model for Africa, physical investment plays higher role than health investment in boosting Africa's growth.

In Table 6, the encompassing results for the study are presented. The Table contains results of 10 different models comprising aggregate Africa result in model 1 and other groups of countries in models 2–10. The results indicate that physical investment's coefficient is consistent with *a priori* expectation for all the models as it displays positive relationship with income. This shows that as physical investment increases in Africa and in all the groups of countries considered, it raises income in Africa; and causes income differences within Africa as one group of country is compared with another. However, in terms of its explanatory power, it is highly significant for seven groups of countries—Africa, East Africa, Southern Africa, North Africa, oil producer, non-oil producer, and low populated; and insignificant for the remaining three groups—West Africa, Central Africa and high populated.

Health investment's coefficient is also consistent with *a priori* expectation in all the models, except for model 6 (North Africa), as it displays positive relationship with income. This shows that as health investment increases, it raises income in Africa at large, and causes income differences in other group of countries in Africa. Considering the explanatory power of the variable, it is found to be significant in five models (West Africa, Central Africa, oil producing, non-oil producing, and high populated) and insignificant in the remaining five.

A comparison of the two types of investment considered in this study, it can be concluded that for Africa, its sub-regions and its several groups of countries, physical investment influences income differentials more than health investment. This calls for improvement in both types of investment so as to boost the level of income in Africa vis-a-vis the rest of the world on one hand; and within the different groups of countries in Africa. More importantly, health investment should be taken seriously in Africa and its group of countries, especially those with insignificant results. By doing this, productivity would be enhanced as labour force operate at full capacity and efficiently due to improved health status.

To investigate the last objective of the study that focuses on conditional convergence in Africa, initial GDP per capita variable is examined. The coefficient is consistent with *a priori* expectation as it displays negative relationship with GDP per capita growth. Also, the variable is highly significant in all the models. This result is consistent with findings by past studies like Burnside and Dollar (2000), Easterly et al. (2003), and Dalgaard et al. (2004), among others. Thus, this study confirms conditional convergence among the economies in Africa and all other groups of countries.

6 Summary and Conclusion

This study investigated the relationship between physical investment, health investment and income growth in Africa over the period of 1996 to 2012. Similarly, it investigated the evidence of conditional convergence in Africa. As a means of achieving the study's objectives, Africa was classified into nine sub-groups of countries namely West, East, Central, Southern, and North Africa; oil and non-oil producer; and high and low populated group of countries.

The dependent variable for all the models estimated is growth rate of GDP per capita, used as proxy for income. The results of the study are as follows. Physical investment has significant positive relationship with income in Africa and other six groups of countries (East Africa, Southern Africa, North Africa, oil producer, non-oil producer, and Low populated). Unlike physical investment, health investment has insignificant positive relationship with income in Africa as a whole. However, for other groups of countries, health investment has significant positive relationship with income in five groups of countries (West Africa, Central Africa, oil producing, non-oil producing, and high populated). Finally, the study found evidence for conditional convergence among the economies in Africa and all other groups of countries.

Based on the findings, physical investment affects income more than health investment in Africa in general and majority of the groups of countries investigated. This calls for improvement in both types of investment so as to boost income in Africa in line practice in the rest of the world on one hand; and on the other, within Africa for comparable growth across the different groups of country. More importantly, health investment should be taken seriously in Africa and its group of countries, especially those with insignificant results.

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Do Market Size and Remittances Explain Foreign Direct Investment Flows to Sub-Sahara Africa?

William A. Amponsah and Pablo Garcia-Fuentes

1 Introduction

With global economies becoming more integrated, there has been dramatic increase in the flows of foreign direct investment (FDI)[1]. Global FDI flows to developing countries have been growing since the 1980s when many countries initiated business-friendly reforms and policies to attract FDI as a critical external source of development finance. International production, foreign sales, employment and assets of foreign affiliates of transnational corporations (TNCs) have expanded and substantially exceeded the value of world exports for some time (Barrel and Pain 1997; UNCTAD 2011). TNCs generated value-added of approximately $16 trillion in 2010, about a quarter of global GDP. Foreign affiliates of TNCs accounted for more than 10 % of global GDP and one-third of world exports (UNCTAD 2011).

UNCTAD (2014) confirms the need for domestically led investment formation in Africa. Indeed, there appears to be no discernible change in investment rates over the past two decades in Africa, having changed from a paltry 18 % of GDP

Paper submitted to the Sixth Annual Conference on Regional Integration in Africa (ACRIA 6), July 1–2, 2015, Lagos, Nigeria

[1]The International Monetary Fund defines FDI as an investment that represents at least 10 % of voting stocks in an enterprise operating in a country other than that of the investor. In this study, FDI is net inflows of foreign direct investment as a share of host country GDP and represents at least 10 % of voting stock, and it is the sum of equity capital, reinvestment of earnings, and other long term and short term capital.

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D. Seck (ed.), *Investment and Competitiveness in Africa*, Advances in African Economic, Social and Political Development, DOI 10.1007/978-3-319-44787-2_5

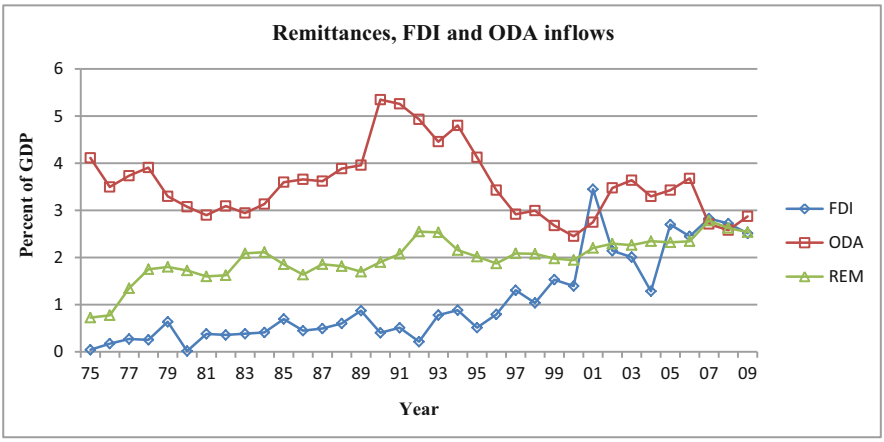

Fig. 1 Net FDI inflows, net ODA inflows, and remittances inflows as percent of GDP to Africa, 1975–2009. *Source*: Own calculations using data from *World Developments Indicators*, online version, World Bank (2012). *Note*: The figures include all the countries in Africa as grouped in the *UNCTAD Handbook of Statistics* (2011)

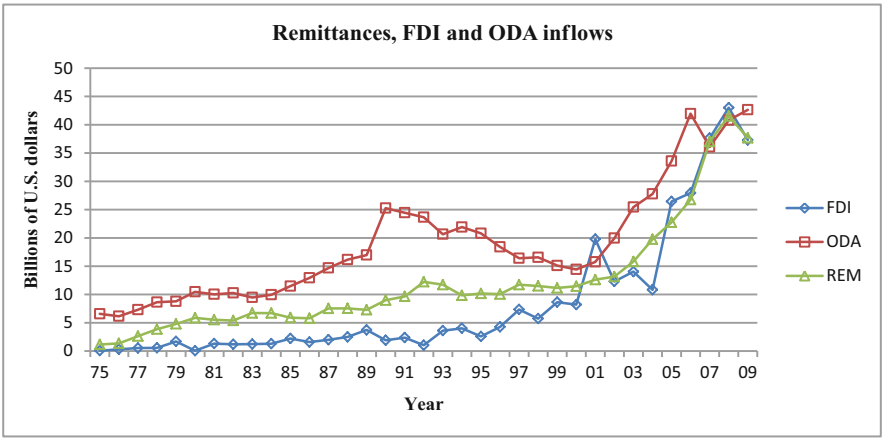

Fig. 2 Net FDI inflows, net ODA inflows, and Remittances inflows in billions of U.S. dollars to Africa, 1975–2009. *Source*: Own calculations using data from *World Developments Indicators*, online version, World Bank (2012)

(1990–1999) to 19 % (2000–2011). These rates are low compared to the average of 24 % (1990–1999) and 26 % (2000–2011) for all developing countries.

Another important source of external finance to the African region is remittances[2]. As can be gleaned in Figs. 1 and 2, remittances to the region have been

[2]Remittances are the sum of workers' remittances, compensation of employees and migrants' transfers received by individuals in the migrant home country.

growing next in importance to FDI. Remittances affect households' consumption since they increase disposable incomes of recipients.

Recent increase in FDI from 2000 to 2008, its recent rebound along with the recent economic growth spurt, as well as increased flows of remittances (see Figs. 1 and 2) provide motivation to understand whether FDI flows to Africa are influenced by remittances and market size. For this study, we focus on Sub-Saharan Africa (SSA). To the authors' knowledge, there has not been any prior empirical study on the effect of remittances and market size on FDI flows to SSA.

In this study, we empirically assess the effect of remittances and per capita GDP on net FDI inflows to 40 SSA countries[3] which covers the period from 1981 to 2013. To accomplish this objective, we follow Bajo-Rubio and Sosvilla-Rivero's (1994) cost minimization approach to derive the TNC's optimal level of capital at the foreign plant. We apply two econometric methods. Method 1 is a simple ordinary least squares (OLS) estimation. Method 2 is the panel generalized method of moments (PGMM) instrumental variable estimation with country fixed effects. Our results suggest that market size (using per capita GDP as a proxy), foreign capital stocks relative to GDP and imports relative to GDP (representing trade openness) have significant positive effects on net FDI inflows to SSA. Moreover, remittances relative GDP have a negative effect on FDI inflows. However, when combined multiplicatively with per capita GDP, remittances have significant positive overall effect on net FDI inflows to SSA. Therefore, it is important to extend the study to account for countries in which per capita GDP above a certain threshold allows for complementary effect of remittances and per capita GDP on net FDI inflows.

2 Background

TNCs from developing and transition economies have gained inroads in investing in Africa in the past few years in the petroleum and gas industries, and accounted for 21 % of FDI flows to the region over the 2005–2008 period, compared to 18 % in the 1995–1999 period (UNCTAD 2010). Investors from China, Malaysia, India, and the Gulf Cooperation Council (GCC) are the most active. In 2009, investors from South Africa also accounted for $1.6 billion in FDI flows to Africa. These sources of investment are providing new economic opportunities to Africa, even as sources of ODA relative to GDP destined to Africa have continued to decline[4] (see Figs. 1 and 2).

Global FDI inflows were projected to reach from $1.4 trillion to 1.6 trillion in 2011 building upon a modest recovery but below the 2007 pre-financial crisis peak of $2 trillion (UNCTAD 2011). Developing and transition economies attracted half of global FDI flows in 2009, and have continued to be favorable destinations for FDI

[3]The 40 countries are listed beneath the descriptive statistics in Appendix 3.

[4]This will bode well for Africa since ODA is expected to eventually dwindle following the recent global economic recession.

to date. FDI inflows into the African continent had been relatively meager through the 1990s. However, it more than doubled from $9 billion in 2000 to $28 billion in 2004 and reached a peak in 2008 during the resource boom of that period (UNCTAD 2009; see Figs. 1 and 2). The effects of the global financial crisis and falling commodity prices caused FDI inflows to Africa to fall in 2009 (UNCTAD 2010). This was followed through 2012 by the Arab Spring insurgence in North Africa. Since the global rebound from the recent recession, however, capital flows to the SSA region, in particular, rose from 2012 to 2013 when net FDI inflows to the region grew 16 % to $43 billion in 2013, boosted by new hydrocarbon discoveries in many countries.

Furthermore, World Bank data show that gross capital formation rose an estimated 8 % in 2013 to 23.4 % of GDP and fueled expansion of the region's production capacity.

Moreover, economic activity has been quite robust recently in SSA. Supported by strong domestic demand, GDP growth in the region grew to 4.7 % in 2013 from the rate of 3.5 % in 2012. In fact, excluding South Africa that experienced a slower growth rate of 1.9 %, growth in the rest of SSA was 6.1 % in 2013 and the region's market size is projected to continue to expand (World Bank 2014). That has marked the SSA region recently as one of the fastest-growing in the world, buoyed by strong investment demand and robust private consumption. This market growth trend is expected to accelerate with emerging protocols in support of regional integration in SSA.

The rest of the paper is organized as follows. The next section presents review of relevant literature, followed by a description of the methodology and data used in the study. The following section presents discussion of the results. Finally, discussions, conclusions and suggestions for further research are presented.

3 Literature Review

FDI is considered crucial as an engine of technological development and economic growth, with much of the benefit arising from positive 'spillover' effects (Love and Lage-Hidalgo 2000). Kokko (1994) argues that this effect may arise from a process of competitive interaction between foreign and domestic firms. Balasubramanyam et al. (1996) provide evidence that FDI is a major element of economic growth in developing countries, but that this effect is restricted to countries which have relatively open, export-promoting macroeconomic policy. According to Morrisset (2000), openness to FDI not only enhances international trade but also contributes to integrating the host country or region into the global economy. Bengoa and Sanchez-Robles (2003), Campos and Kinoshita (2002), Hansen and Rand (2006), and Li and Liu (2005) report positive relationship between FDI and economic growth.

There is extensive literature[5] on the determinants of FDI. Some relate the effects of exchange rate on FDI (Barrel and Pain 1996; Cushman 1985, 1988); the

[5]Please see Sect. 3 of the paper for a more comprehensive review of the literature.

relationship between labor costs and FDI (Culem 1988; Cushman 1987; Love and Lage-Hidalgo 2000); the relationship between political factors and FDI (Haggard 1989; Nigh 1985; Tuman and Emert 2004); the impacts of trade issues such as trade openness, protection and agreements on FDI (Agosin and Machado 2006; Waldkirch 2003); and the relationship between host country market size and FDI (Barrel and Pain 1996; Love and Lage-Hidalgo 2000).

Market size is important in explaining the location of FDI. The host country's market size provides indication of the level of demand for goods and services in its economy. The relationship between market size and FDI is found to be positive in the literature (Bajo-Rubio and Sosvilla-Rivero 1994; Barrel and Pain 1996; Billington 1999; Culem 1988; Cushman 1985, 1988; Gopinath et al. 1999). It appears that economies with a larger market are more attractive to foreign investors. For example, Fedderke and Romm's (2006) study on the determinants of FDI into South Africa suggests that augmenting market size is a potential strategy in attracting FDI. Typically, studies use either gross domestic product (GDP) or gross national product (GNP) as the proxy for host country market size. It is expected that an increase in per capita GDP would increase the market size for the goods and services produced by the TNC's subsidiary in the host country or region. Dornbusch and Fischer (1994, p. 59) have also suggested that the level of output (GDP) is related to consumption demand and the money available for spending.

Giuliano and Ruiz-Arranz (2009) have found that remittances boost economic growth in countries with less developed financial systems by providing an alternative means to finance investment and helping overcome liquidity constraints. Remittances are important as a source of external financing as well as part of the recipient individuals' disposable income. Glytsos (2005) adds up remittances and GDP to construct a type of host country disposable income to capture the demand effect of remittances on consumption, investment and imports. The author finds a significant positive effect of this disposable income on consumption. The motivation for migrants' remitting part of their earnings to relatives in their native country may be influenced by the end-use of remittances. Rapoport and Docquier (2006) identify altruism, exchange, strategic behavior, coinsurance, inheritance, and investment as motives behind migrant remittance flows at the microeconomic level. Admittedly, the microeconomic rationale for remittances is beyond this study. Nevertheless, regardless of the motive driving migrant remittances, consumption and loan repayment toward improved living standards lead the uses of migrant remittances at the initial stages (Gupta 2005; Connell 1980; Ahlburg 1991). Other studies have documented that the use of remittances switches in favor of investment in education and entrepreneurial ventures at a later period (Borovnik 2003; Clark 2004; Findley and Sow 1998). To the extent that remittances lead to increasing disposable income, it is likely that it raises the demand for goods and services in the economy.

According to the World Bank (2007, p. 54), workers' remittances have become second only to FDI as a source of external financing and foreign exchange for

developing countries. In 2005, remittances totaled $188 billion; twice the amount of official assistance received by developing countries. By 2009, remittance flows to developing countries reached $307 billion and has continued to grow. Mohapatra et al. (2010) indicated that flows of remittances would reach $374 billion in 2012.

African countries have been part of the overall rising global trend, although they receive about 4 % of total global remittances[6] (Fig. 1). By inducing intra-family or intra-community income transfers, remittances mitigate the effects of poverty in Africa by increasing the recipient's income for purchasing goods and services[7]. In that sense, remittances augment recipient households' resources, smooth consumption, provide working capital, and have multiplier effects through increased household spending (Gupta et al. 2007; Gupta 2005; Diatta and Mbow 1999; Findley and Sow 1998).

The literature on FDI flows to the African region (mainly based on events and data through the 1990s) explain those factors that would potentially make African countries appealing as location for FDI (Dupasquier and Osakwe 2005; Mwilima 2003). Empirical studies such as Lemi and Asefa (2003), Asiedu (2002), and Onyeiwu and Shrestha (2004) also find that political instability, institutional and macroeconomic uncertainties (including inflation), and poor regulatory frameworks significantly and negatively impact FDI flows to Africa. Furthermore, Asiedu (2002) finds that factors such as higher returns to investment, better infrastructure and openness to trade that positively and significantly impact FDI flows to other developing countries do not necessarily have significant impacts on FDI flows to Africa. Reinhart and Rogoff (2002) find that the incidence of wars, high inflation and distortions from capital controls in the foreign exchange market negatively and significantly impact FDI flows to Africa.

In regards to the relationship between FDI and remittances and GDP, Garcia-Fuentes and Kennedy (2011) find a positive and significant effect of remittances on aggregate FDI inflows to the Latin America and Caribbean (LAC) region, although it depends on the level of per capita GDP of the host country. The authors' study covers a sample of 14 LAC countries for the 1983–2003 period.

[6]The top recipient of remittances is India. Countries in Latin America and the Caribbean receive about 25 % of all remittances, as do countries in the East Asia and Pacific region.

[7]Lucas and Stark (1985), identified pure altruism, pure self-interest, and tempered altruism (or enlightened self-interest) as the microeconomic determinants of remittances using evidence from Botswana.

4 Methodology and Data

4.1 Model

This section introduces the theoretical method used for the analysis of the net inflows of FDI to SSA. The model follows Bajo-Rubio and Sosvilla-Rivero's (1994) cost minimization approach that has been used in various studies of FDI (Love and Lage-Hidalgo 2000; Marchant et al. 2002; Pain 1993). The approach assumes that a TNC undertakes FDI by minimizing its cost and allows for deriving the optimal capital input for investing abroad (please see Appendix 1 for the full derivation of the model). The TNC's desired capital stock at the foreign plant (see Eq. 21) can be represented by:

$$K_t^* = f\left(q_f, RUC\right) \tag{1}$$

where K_t^* represents the TNC's desired capital stock at the foreign plant, which depends positively on both the host country's demand $\left(q_f\right)$ and relative unit costs (RUC) between home and host country.

However, according to Barrel and Pain (1996), the desired and actual capital stocks at the foreign plant are likely to differ in each time period because of adjustment costs due to delivery lags, delays due to searching for suitable investments overseas, and/or delays affecting planning permission. Given these constraints, a partial adjustment model is an appropriate specification for net FDI inflows as a share of GDP, which can be specified as a lag function of the difference between desired and actual capital stocks and replacement investment due to capital stock depreciation. The partial adjustment model is defined as in Bajo-Rubio and Sosvilla-Rivero (1994), Barrel and Pain (1996) and Love and Lage-Hidalgo (2000) as follows:

$$FDI_t = \gamma\left(K_t^* - K_{t-1}\right) + \delta K_{t-1} \tag{2}$$

where FDI_t is net FDI inflows as a share of GDP in year t, γ is a distributed lag function and δ is the depreciation rate of capital.

Equation (2) delineates that net FDI inflows at the beginning of period t are explained by the difference between the desired capital stock in period t and the actual capital stock in period $t-1$ plus replacement capital at the foreign plant. Equation (2) can be rewritten as follows:

$$FDI_t = \gamma K_t^* + (\delta - \gamma)K_{t-1} \tag{3}$$

where net FDI inflows are a function of the factors that determine the desired capital stock Eq. (1) and the lagged value of capital stock at the foreign plant.

Foreign market demand is given by q_f in Eq. (1). In the literature, the usual proxies used for q_f are measures of either GDP or GNP to capture the effect of the host country market size on FDI; what is referred to as the market size hypothesis[8]. It assumes a positive relationship between host country demand and the expected sales of TNC subsidiaries. Bajo-Rubio and Sosvilla-Rivero (1994); Filippaios et al. (2003); Lall et al. (2003); Love and Lage-Hidalgo (2000); and Marchant et al. (2002) find positive and significant effects of GDP on FDI. Barrel and Pain (1996); Culem (1988); Cushman (1985, 1987, 1988) show the relationship between FDI and GNP. Therefore, both GNP and GDP have been used to capture the effect of host country income in attracting FDI, where an increase in the host country's income is expected to increase FDI inflows.

Glytsos (2005) has estimated the demand generated by remittances on consumption, investment, and imports through a type of country disposable income in the following macro-econometric model:

$$C_t = \alpha_0 + \alpha_1 Y_t + \alpha_2 C_{t-1},$$
$$I_t = \beta_0 + \beta_1 Y_t + \beta_2 K_{t-1},$$
$$M_t = \gamma_0 + \gamma_1 Y_t + \gamma_2 Y_{t-1} + \gamma_3 M_{t-1}$$

and

$$Y_t = C_t + I_t + G_t + X_t - M_t + R_t$$

where C_t, I_t, and M_t represent consumption, investment and imports respectively. The identity indicates that Y_t is the country's disposable income and remittances (R_t) are part of the country's disposable income but not part of its GDP. Glytsos (2005) found a positive and significant effect of income (Y_t) on consumption for Egypt, Greece, Jordan, Morocco and Portugal. Therefore, it appears that by increasing disposable income, remittances may increase individuals' consumption demand in the host country.

Additionally, reviewed literature suggests controlling for the effects of exchange rate, imports, and inflation on FDI inflows. For example, foreign currency depreciation against the TNC's home country currency can influence FDI inflows. Depreciation of the host country's currency may provide an opportunity for the TNC to capitalize its returns to a higher rate relative to host country firms (Aliber, as cited in Bajo-Rubio and Sosvilla-Rivero 1994). Also, host country currency depreciation can stimulate foreign investment (Froot and Stein 1991). Some studies find strong negative effects of exchange rate on FDI (Cushman 1985; Blonigen and Feenstra 1996; Froot and Stein 1991). However, Waldkirch (2003) finds a positive relationship between exchange rate and FDI, while Stevens (1998) finds an

[8]Moosa's (2002) Chap. 2 provides a description of the theories of FDI.

ambiguous relationship between exchange rate and FDI. In this study, we expect exchange rate to have a negative effect on FDI inflows[9].

Studies on the relationship between FDI and trade are not unambiguous. First, under trade restriction scenarios it is likely that FDI and trade behave as substitutes. However, in open market economies with relatively less trade restrictions, FDI and trade are more likely to be complements. Mundell (1957) studies the international movement of goods and factors and suggests that they behave as substitutes. On the other hand, Markusen (1983) presents several models that suggest that factor mobility promotes trade. In addition, Billington (1999), Brenton et al. (1999), and Globerman and Shapiro (1999) find complementary relationships between international flows of goods and factors. Barrel and Pain (1996) also argue that the exports of TNCs (host country imports) can promote FDI in downstream services which are consumer service facilities such as dealer networks, after sale repairs and maintenance outlets. Furthermore, they argue that exports are jointly endogenous and include the lagged value of exports in the estimated model. In this study, we control for host country imports lagged one period; where imports are expected to serve as either a complement or a substitute to net FDI inflows.

A potential proxy for host country macroeconomic stability is inflation (Barro and Sala-i-Martin 2004, p. 520). Romer (2006, p. 550) argues that higher inflation can discourage long term investment since it may be perceived as representing government inefficiencies indicating government policies that may hurt capital holders. High inflation is also tied to exchange rate volatility, political instability and other undesirable factors (Temple 1999, p. 144). Negative relationships between inflation and investment, and between inflation and growth are found in Bruno and Easterly (1998); Cukierman et al. (1993); and Fischer (1993). Therefore, since macroeconomic instability may affect the expectations of international investors with respect to profits, inflation is expected to have a negative impact on net FDI inflows.

The above discussion suggests that it is likely that remittances affect the desired capital stock in Eq. (1) through foreign market demand (q_f). Therefore, the model for the desired capital stock at the foreign plant must be extended to include the effects of remittances, exchange rate, imports, and inflation. The extended model is given by:

$$K_f^* = f\left(q_f, REM, ER, IM, INF, w_h/w_f\right) \tag{4}$$

where q_f, REM, ER, IM, INF and w_h/w_f, denote host country demand, remittances as a share of GDP, real exchange rate, host country imports as a share of GDP lagged one period, inflation, and the ratio of home country to host country wages, respectively. The host country demand (q_f) is proxied by per capita GDP.

[9]This implies that appreciation of the host country's currency against the U.S. dollar is expected to negatively affect FDI inflows.

Finally, the empirical specification of Eq. (3) is defined as:

$$FDI_t = \beta_0 + \beta_1 LnGDPP_t + \beta_2 LnREM_t + \beta_3 LnGDPP_t{*}LnREM_t + \beta_4 LnER_t + \beta_5 IM_{t-1} + \beta_6 LnINF_t + \beta_7 Ln\left(w_h/w_f\right)_t + \beta_8 LnK_{t-1} + a_i + \mu_t + \varepsilon_t \quad (5)$$

where *GDPP* is host country per capita GDP (a proxy for host country demand); a_i denotes an unobservable country effect; μ_t denotes an unobservable time effect; and ε_{it} is the idiosyncratic error which is assumed to be independently and identically distributed with zero mean and variance σ_ε^2. *Ln* is the natural logarithm operator.

4.2 Data

This study covers the period from 1981 to 2013 for a sample of 40 SSA countries. Complete variable definitions and data sources and descriptive statistics are provided in Appendices 2 and 3, respectively. The dependent variable is net FDI inflows as share of GDP and is obtained from the World Development Indicators (WDI) online version (2014). Per capita GDP is obtained from the Penn World Tables version 7.0. The host country import data is obtained from the WDI online version (2014). Real exchange rate is constructed using data from the International Financial Statistics (IFS) CD-ROM (2014). Inflation data is also obtained from the IFS CD-ROM (2014). The data used to construct the proxy for wages is obtained from the Bureau of Economic Analysis (BEA) and the U.S. Bureau of Labor Statistics. However, we could not obtain continuous time series data for all the 40 African countries in the study. Therefore, we decided to exclude that variable in order not to introduce any estimation bias. Foreign capital stock data is obtained from the UNCTAD's *World Investment Report* Annex Tables (2014). Additionally, consistent with Love and Lage-Hidalgo (2000), we include the real interest rate differentials of the U.S. and the host country to measure the relative user cost of capital. Data on interest rates are obtained from the WDI online version (2014).

Remittances comprise workers' remittances, compensation of employees and migrants' transfers received by individuals in the migrant's home country. Remittances data is obtained from the WDI online version (2014). Workers' remittances are private transfers from migrant workers who reside in the migrant's host country for more than a year to people in the migrant's home country. Compensation of employees is the income of migrants who lived in the host country for less than a year. Migrant transfers are transfers from one country to another, at the time of migration, of the net worth of migrants who lived in the host country for more than a year.

5 Empirical Results

This section provides the results of the regressions based on the model specification given by Eq. (6). Table 1 provides the correlation matrix of the key variables included in the model. It reveals rather significant but generally fairly low correlations between the explanatory variables and the dependent variable, the highest being the positive and significant correlation on the ratio of foreign capital stock to GDP.

Similarly, there are generally low and significant correlation between the explanatory variables. Therefore, there does not appear to be any multicollinearity problem.

Table 2 is the OLS estimation of Eq. (5) with country fixed effects (due to a Haussman test) and a linear time trend (Cameron and Trivedi 2009, p. 267). As expected, host country GDP per capita is significant and positively related to net FDI, which confirms that market size is an important determinant of FDI in SSA (Lall et al. 2003; Love and Lage-Hidalgo 2000; and Tuman and Emert 2004). Foreign capital stock also has the expected sign and is significant. However, all other variables were not significant.

Table 3 presents the results of panel generalized methods of moment instrumental variable (PGMM-IV) using past (first and second lags) values of remittances as internal instruments to account for potential endogeneity of remittances (see Cameron and Trivedi 2009). The results appear to be quite robust.

As expected, host country GDP per capita is significant and positively related to net FDI, which confirms that market size is an important determinant of FDI in SSA. However, remittances have a negative direct effect on FDI inflows, but the coefficient on the interaction term suggests a positive indirect relation between remittances and FDI inflows. The significance level and signs on remittances and the interaction term suggest a threshold of host country GDP per capita that determines whether remittances have a positive effect on incoming FDI[10]. Furthermore, the positive sign of the interactive term suggests that remittances and per capita GDP have a significant complementary effect on net FDI inflows to SSA. The positive impact of remittances on net FDI given the threshold of per capita GDP appear to suggest that, on average, remittances strengthen the impact of market size in attracting FDI to SSA countries. Therefore, it is possible that by increasing disposable income and conditional on a per capita GDP threshold, remittances may raise aggregate demand in the African countries and increase FDI inflows. Furthermore, if FDI positively affects economic growth in African countries, then as suggested in Bengoa and Sanchez-Robles (2003), increased

[10]The appropriate per capita GDP threshold is the log value of per capita GDP that makes the sum of remittances and the interaction term positive, or $log\, human\, capital \geq \left(-\frac{\beta_{remittances}}{\beta_{interaction\ term}}\right)$. If both estimates are positive (negative), then remittances has an unambiguously positive (negative) effect on net FDI inflows.

Table 1 Correlation matrix

Variables	1	2	3	4	5	6	7
1. FDI/GDP	1						
2. Ln per capita GDP	0.0406	1					
3. Ln remittances/GDP	0.1095***	−0.1959***	1				
4. Ln real exchange rate	0.0375	0.3055***	0.0220	1			
5. Ln imports/GDP	0.3940***	0.2771***	0.3443***	0.1004***	1		
6. Ln inflation	−0.0462	−0.1691***	−0.0864**	0.2603***	−0.2218***	1	
7. Ln foreign capital stock/GDP	0.4207***	0.3549***	0.0947**	0.1914***	0.4607***	−0.1651***	1

Note: Observations: 860. Asterisks indicate significance at the 10 % (*), 5 % (**) and 1 % (***) levels respectively. Ln is the natural logarithm operator

Table 2 Remittances, per capita GDP and net FDI inflows to SSA, OLS estimation, 1981–2013

Explanatory variables	Model 1
Constant	−1.1554** (−2.72)
Ln per capita GDP	0.0651** (2.59)
Ln remittances/GDP	−0.0029 (−0.41)
Ln remittances/GDP * Ln per capita GDP	0.0003 (0.34)
Ln real exchange rate	0.0016 (0.28)
Ln imports/GDP_{t-1}	0.0170 (1.22)
Ln inflation	−0.0004 (−0.02)
Ln foreign capital stock/GDP_{t-1}	0.0058** (2.12)
Time	0.0003 (1.13)
Country dummies	Yes
R-squared	0.4948
Obs.	863
Countries	40

Note: Asterisks indicate significance at the 10 % (*), 5 % (**) and 1 % (***) levels respectively. Values in parenthesis are t-values. Country fixed effects are not reported to save space. Ln is the natural logarithm operator

remittances may indirectly contribute to economic growth. A necessary extension of this study is to determine such threshold levels for all 40 countries included in the study.

The real exchange rate effect on FDI is positive but not significant. However, host country imports have a positive and significant effect on FDI inflows. This appears to suggest that openness to trade that allows for imports of capital goods complement FDI inflows. Inflation negatively affects FDI, but the result is not significant. Relative wages to host SSA country wages was omitted because of insufficient data for many SSA countries. Lastly, as expected lagged foreign capital stock has a positive and significant effect on net FDI inflows.

6 Conclusions

This study primarily determines the effect of remittances and per capita GDP on net FDI inflows by using a sample of 40 SSA countries over the period from 1981 to 2013. The most important findings stemming from the PGMM-IV model are that

Table 3 Remittances, per capita GDP and net FDI inflows to SSA, Panel GMM-IV estimation, 1981–2013

Explanatory variables	Model 2
Constant	−1.7874*** (−5.03)
Ln per capita GDP	0.0399*** (2.98)
Ln remittances/GDP	−0.0200** (−2.13)
Ln remittances/GDP * Ln per capita GDP	0.0024** (2.05)
Ln real exchange rate	0.0027 (0.57)
Ln imports/GDP_{t-1}	0.0186** (2.18)
Ln inflation	−0.0216 (−1.40)
Ln foreign capital stock/GDP_{t-1}	0.0061** (2.72)
Time	0.0007*** (4.04)
Country dummies	Yes
R-squared	0.6055
Obs.	841
Countries	40
Hansen J-statistic	2.258
Hansen J-statistic p-value	0.3234

Note: Asterisks indicate significance at the 10 % (*), 5 % (**) and 1 % (***) levels respectively. Model 2 is panel GMM-IV estimation with country fixed effects and uses the first and second lags of remittances. Values in parenthesis are t-values. Country fixed effects are not reported to save space. The p-value for the Hansen J-statistic suggests failure to reject the null hypothesis, so that the instruments are valid. Ln is the natural logarithm operator

per capita GDP has a positive and significant effect on FDI inflows, and that there is a positive effect of remittances on net FDI inflows. What is not determined is at what potential threshold of host country per capita GDP that remittances explains increased FDI inflows. The results also suggest complementary effect of remittances and per capita GDP on net FDI inflows. The first finding is consistent with the theory of market size and studies that find a positive relationship between FDI and market size for developing countries, such as Bengoa and Sanchez-Robles (2003). This result is contrary to Asiedu's (2002) finding of an "adverse regional effect" in attracting FDI to Africa, but is consistent with the model on economic geography that fundamentally suggests locating economic activities in proximity to large markets where consumption demand would likely be greater (Krugman 1991). Therefore, it leads to the conclusion that a larger more diverse and regionally integrated SSA market (along with potentially liberalized business and skilled labor movement), would likely attract even greater FDI. Remittances have a direct

negative and significant effect on FDI inflows to SSA. However, the complementary effect of remittances and per capita GDP on net FDI inflows suggests that remittances by SSA migrants abroad may strengthen the impact of market size in attracting FDI to the African region, especially as ODA continues to dwindle. A necessary exercise would be in finding at what threshold for host country GDP per capita would determine whether remittances have a positive effect on FDI inflows to the country.

The above results have important implications for SSA in seeking to reverse decades of relatively low investment and FDI inflows to catalyze growth and development. It provides indication of potential impacts of remittances in complementing economic growth to enhance inflows of FDI. However, there is fierce competition for FDI flows among developing countries. Cognizant of low domestically generated investment and that SSA is not the most popular destination for FDI, policy initiatives, and efforts to regionally integrate the SSA market must take into serious consideration opportunities to harness economies of scale presented by its large market size, increased trade openness, and the potential to continue building up stocks of physical capital and other business assets so as to make the region more attractive for FDI inflows to the region in order to catalyze economic growth.

Appendix 1

Derivation of the Econometric Model

The model assumes that the TNC decides first on whether or not to undertake FDI which requires a decision on the output level in the foreign country. Then, for the TNC undertaking FDI, total costs are defined as a function of costs of production in both the TNC's home and foreign plants. So, total costs are given by:

$$TC = c_h(q_h)q_h + c_f(q_f)q_f \tag{6}$$

where TC is total costs, c_h and q_h are unit costs and output level in the home plant, c_f and q_f are unit costs and output level in the foreign plant, subscripts h and f are for home and foreign.

The constraint for total cost minimization is given by total output demand (TD) as:

$$TD = q_h + q_f \tag{7}$$

The associated Lagrangian function is defined as:

$$L = c_h(q_h)q_h + c_f\left(q_f\right)q_f + \lambda\left(TD - q_h - q_f\right) \tag{8}$$

and the first order conditions for the cost minimization problem are given by:

$$\partial L/\partial q_h = c_h'(q_h)q_h + c_h(q_h) - \lambda = 0, \tag{9}$$

$$\frac{\partial L}{\partial q_f} = c_f'(q_f)q_f + c_f\left(q_f\right) - \lambda = 0, \text{and} \tag{10}$$

$$\partial L/\partial \lambda = TD - q_h - q_f = 0 \tag{11}$$

where $c_h' = \partial c_h/\partial q_h$ and $c_f' = \partial c_f/\partial q_f$. Equations (9) and (10) are marginal costs in the home and foreign plants respectively.

By equating (9) and (10) and solving for home output (q_h) and then substituting this result into Eq. (11), we obtain the equilibrium output at the foreign plant. Therefore, foreign production is given as:

$$q_f = \varnothing_1 TD + \varnothing_2 RUC \tag{12}$$

where $\varnothing_1 = c_h'/\left(c_h' + c_f'\right)$ and $\varnothing_2 = 1/\left(c_h' + c_f'\right)$ which are assumed to be positive, and $RUC = c_h - c_f$ which represents relative unit costs between home country and host country. Equation (12) shows that the foreign plant's output is positively related to both total demand and relative unit costs.

Next, the TNC has to determine the level of inputs for producing in the foreign plant. A Cobb-Douglas production function is assumed to represent foreign production as follows:

$$q_f = L_f^{\propto} K_f^{\beta} \tag{13}$$

Then, the costs associated with foreign production are given by:

$$C_f = w_f L_f + r_f K_f \tag{14}$$

where w and r are real wage and real user cost of capital respectively.

Assuming the foreign plant's costs are minimized, the Lagrangian function is defined as:

$$L = w_f L_f + r_f K_f + \lambda\left(q_f - L_f^{\propto} K_f^{\beta}\right) \tag{15}$$

The first order conditions for the cost minimization problem are given by:

$$\partial L/\partial L_f = w_f - \lambda \propto \left(q_f/L_f\right) = 0, \tag{16}$$

$$\frac{\partial L}{\partial K_f} = r_f - \lambda\beta\left(\frac{q_f}{K_f}\right) = 0, \text{and} \tag{17}$$

$$\partial L/\partial\lambda = q_f - L_f^{\propto} K_f^{\beta} = 0 \tag{18}$$

Dividing Eq. (16) by Eq. (17) and then rearranging yields:

$$w_f L_f/\propto q_f = r_f K_f/\beta q_f \tag{19}$$

Taking L_f from Eq. (18) and substituting it into (19) yields K_f as:

$$K_f = \left[(\beta/\propto)\left(w_f/q_f\right)\right]^{\propto/(\propto+\beta)} q_f{}^{1/(\propto+\beta)} \tag{20}$$

Plugging Eq. (12) into Eq. (20) yields the final expression for the TNC's desired capital stock (a capital stock level that solves the cost minimization problem) at the foreign plant as:

$$K_f^* = \left[(\beta/\propto)\left(w_f/q_f\right)\right]^{\propto/(\propto+\beta)} \left[\varnothing_1 TD + \varnothing_2 RUC\right]^{1/(\propto+\beta)} \tag{21}$$

Appendix 2

Variable Definitions and Data Sources

Variable name	Variable definition	Source
FDI/GDP	Ratio of real net FDI inflows to real GDP	Own calculations
Net FDI inflows	Net FDI inflows balance of payment values in current U.S. dollars	World Development Indicators online version, World Bank (2014)
Real GDP	Host country real GDP at 2005 constant prices	Penn World Table Version 7.1, 2014
Real per capita GDP	Real per capita GDP at 2005 constant prices	Penn World Table Version 7.1, 2014
Remittances	Workers' remittances and compensation of employees received in current U.S. dollars	World Development Indicators online version, World Bank (2014)
Remittances/GDP* real per capita GDP	Interaction of the Ln of real remittances/real GDP and Ln of real per capita GDP	Own calculations
Real exchange rate	Real exchange rate. Dollars per unit of foreign currency. It is defined as in Waldkirch (2003). It is computed by	Own calculations

(continued)

Variable name	Variable definition	Source
	multiplying the nominal exchange rate by the ratio of the host country CPI to the U.S. CPI plus 0.001	
Ln Imports/GDP	Natural log of the ratio imports to GDP	World Development Indicators online version, World Bank (2014)
Ln inflation	Natural log of 1 plus the annual change of the GDP deflator	Own calculations from International Financial Statistics CD-ROM, IMF, 2014
Ln U.S. r-Ln Host Country r	U.S. real interest rate and host country real interest rate differential	Own calculations. Real interest rate data is from the World Development Indicators online version, World Bank (2014)
Foreign capital stock	Host country foreign capital stock	UNCTAD, Division on Investment and Enterprise. http://unctadstat.unctad.org/ReportFolders/reportFolders.aspx
GDP deflator	GDP deflator	World Development Indicators online version, World Bank (2012)
Nominal exchange rate	U.S. dollars per unit of host country currency	International Financial Statistics CD-ROM, IMF, 2014.
CPI	Consumer price index	World Development Indicators online version, World Bank (2014)

Appendix 3

Summary Statistics, Annual Values for the Period 1981–2013

Variable	N	Mean	Std. Dev.	Minimum	Maximum
FDI/GDP	863	0.0347	0.0864	−0.0859	1.6182
Ln per capita GDP	863	6.6359	1.0990	4.7351	9.6075
Ln remittances/GDP	863	−4.6722	2.1461	−14.7571	0.0628
Ln real exchange rate	863	−4.3062	2.3364	−9.4712	3.6465
Ln imports/GDP	860	−0.9880	0.5549	−3.5126	1.4465
Ln inflation	863	0.1017	0.1318	−0.3449	1.0348
Ln foreign capital stock/GDP	863	−2.0508	1.3018	−8.1593	2.0712
Remittances/GDP	863	0.0487	0.1241	0.0000	1.0648

The SSA countries included in the study are Angola, Burundi, Benin, Burkina Faso, Botswana, Central African Republic, Chad, Cote d'Ivoire, Cameroon, Comoros, Cape Verde, Ethiopia, Gabon, Ghana, Guinea, The Gambia, Guinea-Bissau, Equatorial Guinea, Kenya, Liberia, Lesotho, Madagascar, Mali, Mozambique,

Mauritania, Mauritius, Malawi, Namibia, Niger, Nigeria, Rwanda, Sudan, Senegal, Sao Tome and Principe, Swaziland, Seychelles, Togo, Uganda, South Africa and Zambia.

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Trade and Foreign Direct Investment Nexus in West Africa: Does Export Category Matter?

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1 Introduction

Trade and Foreign Direct Investments are the key divers of economic integration and the globalization process. The widely held view is that both trade and FDI are beneficial, as the former can stimulate innovation, productivity, competitiveness, and diversification; and the latter increases the capital stock, provides new job opportunities, and promotes the transfer of technology. Thus there have been profound calls within international organizations for developing countries to encourage both trade and FDI in order achieve robust economic growth and development (see Williamson 2004). However, critics argue that trade, particularly imports, can create undue competition and stifle indigenous manufacturing; and inward FDI can also displace domestic firms. Similarly, from a source country perspective, outward FDI can lead to loss of jobs as multinationals move job opportunities overseas. While these debates are based on the individual effects of FDI and trade in home or host economy, the more prominent contention is how these two cross-border economic activities interact with each other. Thus, the question of whether FDI substitutes or complements trade has been debated in both economic and political spheres.

Economic and international business theories show that multinationals face the decision to serve a foreign country either through trade or FDI, of which both strategies are competing, and thus substitutes. This inverse relationship between foreign production and trade usually occurs when FDI is horizontal, and thus the

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D. Seck (ed.), *Investment and Competitiveness in Africa*, Advances in African Economic, Social and Political Development, DOI 10.1007/978-3-319-44787-2_6

same good is produced in both home and host country. On one hand, multinationals either export the goods from the home country to the host country or produce them in the host country through foreign investment. On the other hand, when production is split into different stages, where the upstream and downstream processes are located in different countries, FDI and trade can coexist. For instance, the parent company's investment in the production of final goods in the host country promotes the exports of intermediate goods (typically parts and components) from the home country to the host country. Thus vertical FDI allows for the coexistence of FDI and trade. In addition to the differences in effect on trade as a result of the form of FDI (vertical or horizontal), the existence of multi-product firms allows the coexistence of both strategies. Multi-product firms can alternate between foreign investment for a particular good and exporting for another in serving a foreign market, resulting in combinations of complementary and competing relationships.

Furthermore, there exists a "third party" effect which can yield a combination of complementary and substitution relationship between FDI and trade. This occurs when FDI inflow from a particular source country into the host country stimulates or debars trade between the host country and other countries. As available data to capture this complex interplay of FDI and trade across countries and firms is largely insufficient, the empirical investigation of the FDI-trade association has not reached a consensus. This lack of consensus points to the need for evidence-based research to support policies on trade and FDI promotion. From a policy perspective, it is pertinent to understand the type of FDI inflows prevalent in the country, as well as the source and sector it is channelled to, and its effect on trade.

While much of the investigation of the FDI-trade relationship in literature has been based on the effect of source country outward FDI on its export of final or intermediate goods, little attention has been given to the effect of inward FDI on host country's exports.[1] The typical north-south trade and FDI pattern involves production of intermediate goods (parts and components) in high-skill abundant countries in the north, and export for final assembly in low-skill abundant countries in the south (predominantly Asian countries). Thus low labour-cost production is the key motivator for such FDI and trade. However, the effect of FDI on the exports of natural resource-abundant host countries of West Africa have not been examined. The present study therefore fills this gap by examining the effect of inward FDI on ECOWAS exports to the EU, which is a major FDI source and export destination in West Africa.

Contrary to previous studies that conceptualize coexistence of FDI and trade when upstream activities[2] in the source country stimulate export of intermediates for downstream production in host countries (Markusen 1997, 2002), we present a

[1] A few studies based in Asian countries, particularly China have investigated the FDI-trade nexus from a host country perspective (See Chunlai 1997; Zhang and Song 2000; Liu et al. 2001; Zhang and Felmingham 2001; and Min 2010).

[2] These are the initial stages within the production value chain, which includes of extractive activities. While downstream activities refer to the processes that involve the conversion to final goods, as well as the distribution and sale.

"commodity-proximity" model. This model illustrates how multinationals' presence in upstream production in resource-abundant host countries is likely to stimulate the extraction and/or the processing of raw materials into intermediate goods for onward exporting to source countries where downstream activities takes place.

Thus, using disaggregated exports data, this paper examines the trade and FDI relation between West African countries and the EU. Results from a theoretically augmented gravity model show that the effect of multinational investment activities on host country's exports differ across exports categories. Specifically, while increased inflow of FDI promotes the export of primary goods from ECOWAS to the EU, it reduces exports of intermediate goods and has no significant effect on final goods exports. A similar result was found when the FDI-Trade relation between ECOWAS and the BICS was considered.[3] One plausible explanation for this persistent observation is that FDI into the region remain resource-seeking. Rather than cast doubts on the usefulness of FDI inflows, the result suggest that the sectoral target of such capital inflow is important to the trade performance of recipient economy.[4]

The remainder of the study is organised as follows. Section 2 examines the trade and investment between ECOWAS and the EU. Section 3 explores the theoretical foundation of FDI-Trade link while the Sect. 4 reviews the empirical evidence on the link. Section 5 describes the methodology and data while Sect. 6 presents the results of the empirical analysis. Section 7 concludes.

2 Stylized Facts on ECOWAS-EU Trade

Trade in the ECOWAS region is dominated by few countries namely Nigeria, Ghana and Cote D'Ivoire which together account for about 75 % of intra-regional exports between 2010 and 2013. However, about 90 % of the regions' trade are conducted with trading partners outside the region, making it important to investigate the trends and directions of such trade. Figure 1 shows the shares of ECOWAS exports accounted for by the different economic groups between 1995 and 2013. During this period, members of the BRICS, EU-28 and the Free Trade Agreement of the Americas (FTAA) received over 70 % of ECOWAS' total exports, indicating that these groups comprise ECOWAS' major trading partners.

EU-28 remains the major destination of exports from ECOWAS, accounting for over 30 % of the region's exports in 2013, although this represents a decline from its share of about 43 % in 1995. While trade between the EU and ECOWAS can be

[3]BICS means Brazil, India, China and South Africa. We excluded Russia from the analysis due to lack of adequate data.

[4]Sectors in this case refer to primary, intermediate and final goods producing sectors of the economy.

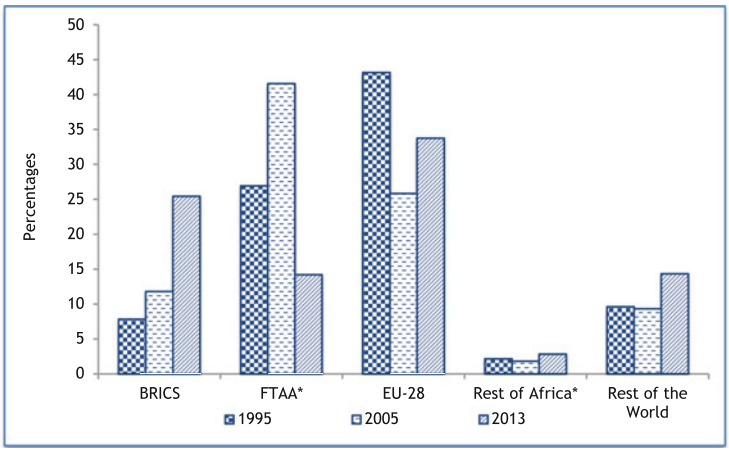


Fig. 1 Shares of economic groups in ECOWAS' exports, 1995–2013

traced to their colonial affinity, it was arguably strengthened by the EU-ACP Economic Partnership Agreement (EPA).[5] However, the decline in the EU's share of ECOWAS' exports can be attributed to the negative effects of both the global financial crisis and the Euro crisis as well as the emergence of new competitors in global trade. Trade between ECOWAS and these new competitors (i.e. Brazil, Russia, China, India and South Africa, coined as BRICS) has increased significantly in the past decade. This is reflected in the continuous increase in the share of the BRICS in ECOWAS' exports from less than 10 % in 1995 to about a quarter of total exports in 2013. The trend is not surprising given the increasing contributions of China, India and Brazil to global trade.

A similar trend is observable in ECOWAS imports as depicted in Fig. 6 in Appendix. While the share of the EU-28 in ECOWAS imports has been reducing over time, the reverse is true for the BRICS. This may imply that the BRICS (especially China) has gained reasonable competitive edge over the EU in exporting to ECOWAS member states. Trade between ECOWAS and other African countries (excluding South Africa) remains very low, accounting for less than 3 % of both ECOWAS' total imports and exports between 1995 and 2013.

In sum, there is no doubt that the EU remains ECOWAS major trading partner although its contribution has been reducing while ECOWAS' trade with the BRICS (excluding Russia) has increased drastically over time.

[5]The EU-ACP EPA is an agreement which grants African, Caribbean and Pacific (ACP) countries duty free access to the European market. It started as a non-reciprocal preferential trade agreement but was later replaced by a reciprocal relationship in order to be in compliance with WTO regulations.

Table 1 Shares of product categories in total ECOWAS exports to the world (in percentages)

Year	Final goods	Intermediate goods	Primary goods
2000	4.2	9.9	85.9
2003	7.6	13.2	79.2
2007	4.8	13.0	82.2
2010	5.0	29.0	66.0

Source: Authors' computations from UN Comtrade statistics database, 2014

An analysis of a country's trade based on the Broad Economic Categories (BEC)[6] can provide useful information about changes in the economic structure, export sophistication and product value chain development. For example, BEC allows us to see the gradual transition of a country from being a net exporter of primary goods to being a major supplier of intermediate and final goods. However insufficient data has marred and discouraged the conduct of such analysis for African countries. Nonetheless, we maximize the use of available data in examining ECOWAS trade across different export categories.

As shown in Table 1, primary goods remain ECOWAS dominant export category although it declined between 2007 and 2010. The share of intermediate goods in total ECOWAS exports increased from about 10 % in 2000 to about 30 % in 2010, while those of final goods remain steady at about 5 %.

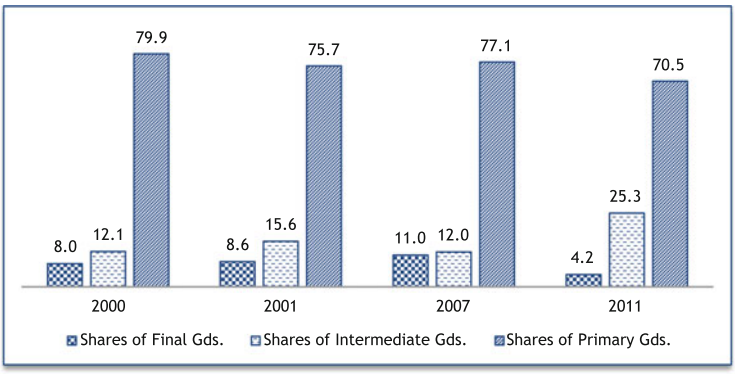
In terms of trade with the EU, sufficient data are only available for seven out of the EU-28 and these countries are among the top ten EU economies and ECOWAS' major trading partners in the EU.[7] Figure 2 shows the shares of the different exports categories from ten ECOWAS members to the seven EU countries (EU-7). It is evident that primary goods dominate the exports of ECOWAS to the EU as they accounted for over 70 % of total exports since 2000.

3 Theoretical Foundations of the FDI-Trade Link

The theoretical literature on the relationship between FDI and trade has evolved from models that view them as competing/alternative strategies of firms, to models that allow for their coexistence. Earlier models used tenets of the traditional trade theory to elaborate the substitutability argument. The models that solely predicted substitutability of FDI and trade in the traditional trade theories were both elaborate and intuitively appealing. Based on the Heckscher-Ohlin framework, given two factors of production (capital and labour), two countries, and two perfectly

[6]Given the paucity of data on intermediate goods trade in Africa, the analysis in this section is limited to only 10 members of the 15-member ECOWAS and limited to some years between 2000 and 2010. The 10 members are Benin, Burkina Faso, Cote D'Ivoire, Gambia, Ghana, Mali, Niger, Nigeria, Senegal and Togo.

[7]The seven EU countries are UK, Spain, Netherlands, Italy, Germany, France and Belgium.



Source: Authors' Computations from UN Comtrade Statistics Database, 2014.

Fig. 2 ECOWAS exports to selected EU countries in terms of BEC. *Source*: Authors' computations from UN Comtrade Statistics Database, 2014

competitive goods ($2 \times 2 \times 2$ model); trade takes place as differences in factor intensities and thus factor prices leads one country to export capital intensive good, and the other to export labour intensive good. This is based on the key assumption that factors are mobile within countries, but immobile between countries. FDI theory found its way into the standard theory by the relaxation of the assumption of immobility of factors of production across countries. Mundell (1957) showed that in the presence of restrictions to trade, factor returns differentials exists, leading to factor movements (especially capital) from a country of lower return to one of higher return. Thus trade and capital movements were viewed as substitutes, with the latter referred as direct investment (see Kindleberger 1969).

Further development of the FDI theory reflected on the idea of its substitutability with trade. Dunning (1977) summarized the motives for serving a foreign market in the OLI paradigm/eclectic theory—which states that Ownership, Locational, and Internalisation advantages are necessary conditions for FDI to occur. The ownership advantages consist of intangible assets such as technological ability and managerial skills that will provide some leverage for a firm to compete in a foreign country. These advantages have to be high enough to offset both the fixed costs of setting up new pant as well as the uncertainties of operating in a foreign country, otherwise trade becomes preferred. Locational advantages consist of factor endowments and tariffs that attract a multinational to a specific location. In particular, differences in trade barriers inform the choice of a firm to serve a foreign market either through trade or FDI. Internalisation advantages imply that the choice between FDI and trade are alternative strategies as firms will choose to direct investment abroad rather than exportation or licensing when the transaction and organization costs of these alternative arrangements outweigh the costs of internalizing the market. The OLI eclectic theory states that all three advantages must be present before there will be FDI, and no one of them is sufficient (Soderston and

Reed 1994). Thus the theory presented a strong case to support the substitutability of FDI and trade.

The observation in the 1970s that most of global trade occurred among developed countries with similar factor intensities and the growing share of intra-industry trade was in striking contradiction with the standard trade theories at the time. Also, the assumption that trade flows were inter-sectoral and across dissimilar countries which held sway in the theoretical trade literature of most of the twentieth century, fell short of realities of an increasing globalized world. Thus the new trade theory that emerged in the early 1980s assumed that firms operated in imperfect markets, selling differentiated goods and were characterized by increasing returns to scale.[8]

The assumptions of the "new" trade theory informed the adjustments to the theory of multinational corporations. Markusen (1984) showed that a firm can concentrate intangible activities (such as R&D) in a location (headquarters), and replicate the production of the same good across plants in different locations. Thus the presence of multi-plant economies of scale motivates a firm to engage in horizontal FDI as an alternative to trade. On the other hand, Helpman (1984) showed that a firm can exploit differences in factor prices (H-O framework) by defragmenting the production process across various locations. Thus the vertically integrated firm that emerges will engage in intra-firm trade in intermediate goods.

The categorization of FDI into horizontal and vertical forms was the key in explaining the coexistence of FDI and trade in theoretical literature. Brainard (1993) provided the "proximity-concentration trade-off "model which shows how variations in transport costs, trade and investment barriers, and scale economies at the plant level affect the decision to export or conduct FDI. The trade-off implies that a firm will engage in horizontal FDI when transport costs and trade barriers are high and investment barriers and plant-level scale economies are low (proximity advantage); and export when the opposite is the case (concentration advantage). However, the study also showed that in a multi-stage production scenario, where there are upstream and downstream activities within an industry, FDI and trade can coexist as the affiliates engage in the production of final goods in the downstream, and production and exportation of intermediate goods occurs in the upstream.

Figure 3 illustrates the Brainard (1993) model. The first configuration shows that the firm chooses to penetrate the foreign market through exports when there are concentration advantages: low transportation costs, low trade barriers, and high investment barriers. The second configuration shows that proximity advantages (opposite conditions for concentration) are associated with horizontal FDI which leads to the displacement of trade. In the third scenario where production is defragmented into stages, the parent in the upstream exports intermediate goods to the affiliate in the downstream engaged in production and sales of final goods. Thus this scenario allows for the coexistence of FDI and trade. To the extent that

[8]Krugman (1979, 1980) made profound contributions to the development of the "new" trade theory.

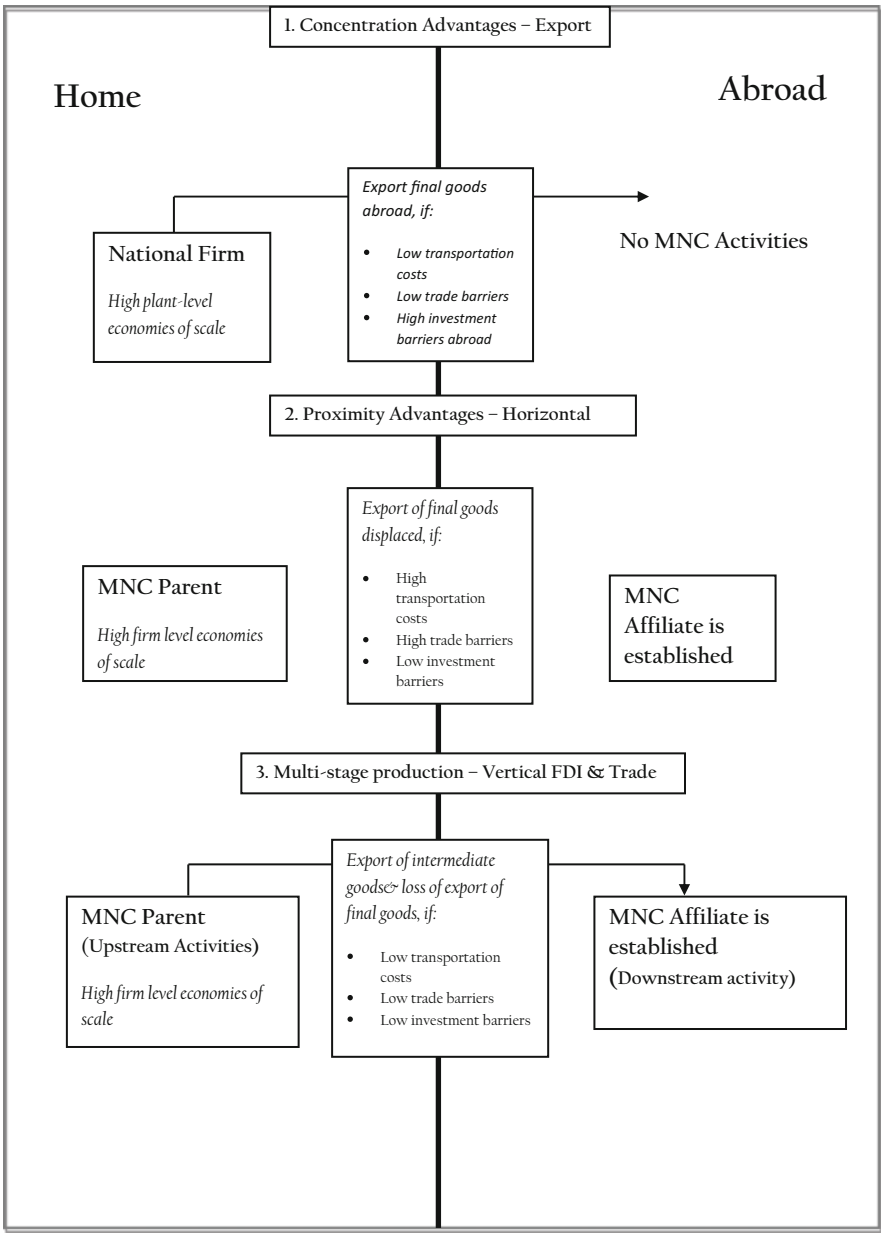


Fig. 3 Brainard (1993) proximity-concentration hypothesis and multi-stage production

export of intermediate goods outweighs the loss of export of final goods, multinational activity complements trade. Thus the Brainard framework provided an insightful decomposition of the association between FDI and trade.

The idea that vertical FDI allows for the coexistence of FDI and trade was elaborated by Markusen (1997, 2002). The models showed that relative sizes and factor endowments of countries determine the type of FDI attracted, and thus affect the direction of impact on trade. In the Markusen model, horizontal FDI dominates when the two countries have different sizes and factor endowments in the presence of high trade costs and firm-level scale economies. The country with the parent firm/headquarters is usually small in size and skilled labour dominant, while the host country is larger in size and dominated by unskilled labour. Final goods production occurs in both source and host countries, but the parent firm transfers knowledge based (intangible) assets to the affiliate. The size of the host country is the key determinant of horizontal FDI as it serves as a market for the final goods. For the vertical model, the parent firm is skilled-labour abundant and exports intermediate goods and intangible headquarter services to the affiliate. The intermediate good usually consists of parts and components which utilize skilled labour, while the assembly of final goods is based in the host country. While some of the final goods are sold in the host country's market, some of it is also exported to the source county. Thus FDI and trade coexist as the establishment of the affiliate leads to the export of intermediate goods and the import of final goods.

A different approach towards explaining the coexistence of FDI and trade was taken by Head and Reis (2004). Their model showed that allowing for multi-product firms clarifies the coexistence of FDI and exports. According to the study, while single product firms have to choose FDI over exporting when the fixed costs of establishing a foreign plant is less than the trade costs, a multi-product firm can alternate both strategies over different products, and thus engage in both FDI and trade. In addition Head and Reis extended the Markusen (1997, 2002) framework to include "branching", which occurs when upstream production based only in the source country, while the downstream production and sales are carried out in both source and host country. Figure 4 shows the configurations of Markusen (1997, 2002) vertical FDI coexistence with trade and Head and Reis (2004) branching model.

In both cases, upstream production is based in the source country and intermediate goods are exported for downstream production in the host country. The main difference being that in the first case, both exportation of intermediate goods and importation of final goods occurs, while in the second case, only the former occurs as final goods production and sales also occurs in source country.

The present study presents an entirely different configuration to the FDI-trade coexistence analysis. The existing models available in theoretical literature do not seem to fit into the interplay of FDI and trade in African countries.

The major departure from the previous models is that while the abundance of unskilled labour and size attracted multinational activity to the host country, the abundance of natural resources[9] plays a key role in attracting FDI in West African

[9]Asiedu (2006) and Asiedu and Gyimah-Brempong (2008) show the primary sector attracts most of the FDI in Africa, and availability of natural resources is a strong determinant of the location of multinationals.

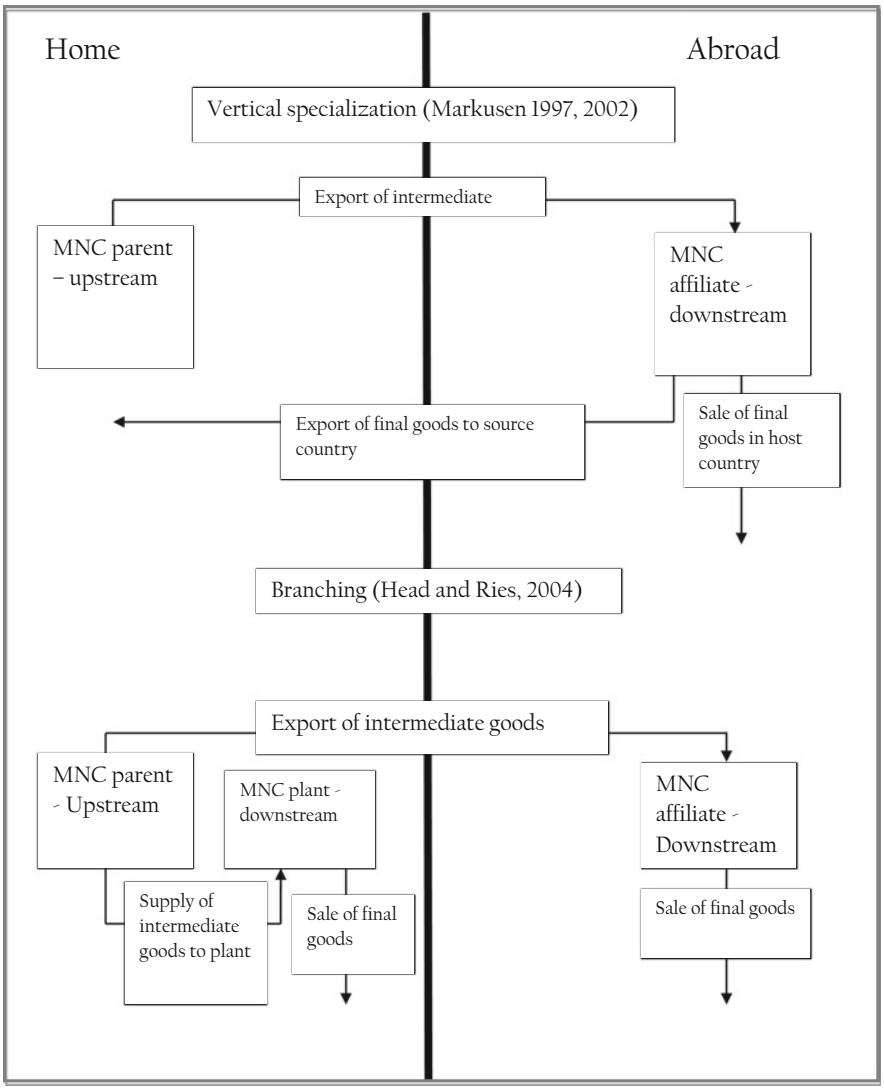


Fig. 4 Vertical FDI models—vertical specialization and branching

countries in addition to the aforementioned. The implication of the commodity wealth in the region is that unlike previous configurations where the upstream activity is based in the source country, proximity to natural resources will attract multinationals to engage in upstream production in the host country. Upstream production in the region will typically involve primary goods and extraction and mild processing. Thus the model is a "reverse" Markusen-type vertical FDI and trade association model, where the upstream production of a multinational is located in the natural resource-abundant host country, and it exports primary and

semi-processed goods for downstream production in the higher-skilled source country. The "commodity proximity" vertical FDI model therefore fits into the West African exports where multinationals engage the upstream production of commodities and export them to source countries.

Thus two scenarios are plausible: The first is the case where resource-seeking multinationals engage mainly in extraction of resources and export them to the source country where other stages of production take place. While resource extraction activities in the upstream are generally capital intensive, the labour component usually involve lower skill than the downstream which involve marketing, distribution and other skill-demanding activities. Thus multinationals engaged in the extractive primary industries will drive the exports of primary goods. A second scenario is the case where multinational presence in upstream production in the region can drive both extraction and subsequent processing into intermediate goods, which are then exported for further processing in the downstream of the source country. Unlike previous vertical FDI models in theoretical literature, where the intermediate goods exports is mostly parts and components, the intermediate goods exports by ECOWAS countries is largely dominated by semi-processed goods (Industrial supplies).

The nature of semi-processed goods inform the idea that the upstream production will be based in a lower skilled country. The raw form of these goods consists mainly of agricultural products and minerals such as coffee beans, rice, wheat, iron ore, and coal. While these raw materials are in abundance in the ECOWAS region, the demand for the finished goods that emanate from them are skewed towards higher income economies such as EU countries. The existence of multinationals in the upstream production of semi-processed goods in the ECOWAS region is likely to be driven by their deficiencies in technical capacity and infrastructure to meet the high demand and standards of EU countries, as well as the relative low cost of labour required for mild processing. Unlike parts and components where the unskilled labour requirement is higher at the final stages of the value chain, the production of semi-processed goods at the initial stages require more unskilled labour, and the final stages are largely automated and consist of knowledge driven activities such as product design, marketing and distribution. Thus the export of semi-processed goods also fits into the "reverse" Markusen-type vertical FDI and trade association model.

Figure 5 illustrates the "commodity proximity" model, where MNC affiliates in ECOWAS countries with huge natural resource endowment and unskilled labour dominated, engage upstream extraction and exportation of primary goods, as well as upstream mild processing and exportation of semi-processed goods to EU countries.

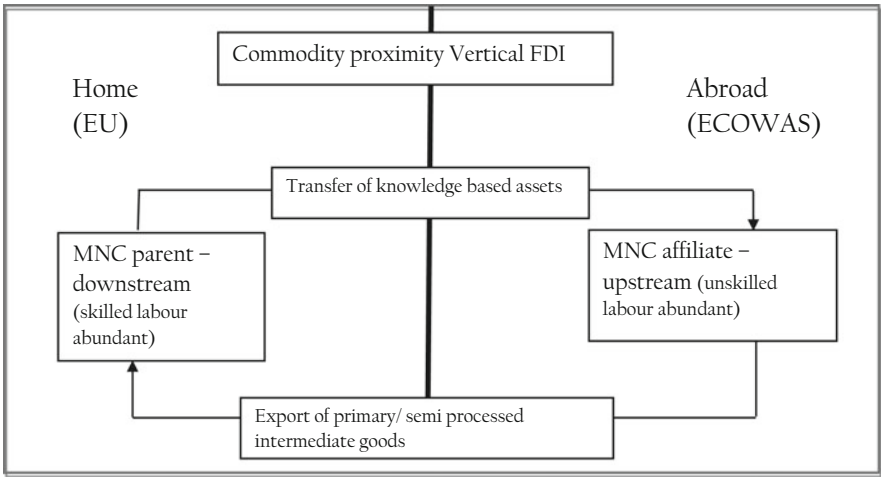


Fig. 5 "Commodity proximity" vertical FDI model

4 Empirical Evidence on FDI-Trade Relationship

The empirical evidence on the positive correlation of FDI and trade in the eighties prompted the revision of the existing trade theories and subsequent development of the "new" trade theories that allowed for their coexistence. It is therefore not surprising that most empirical studies on the effect of multinational activity on trade found complementary relationships. The general approach towards the investigation is to augment a measure of multinational activity into a gravity model. While there are considerable variations in specifications across literature, the main differences in empirical studies lie in the perspective (source/host country) of investigation, of aggregation of the models, nature of data, and proxies for multinational activity. Enquiries from a source country perspective, which investigated how exports of parent firms in a home country are affected by activities of their affiliates in the host countries, dominates the literature, especially the earlier studies. Thus the earlier studies were based on developed countries, particularly the US, as they dominated outward FDI at the time.

In the period when the debate of the FDI-Trade association was rather contentious, Lipsey and Weiss (1981, 1984) provided profound evidence of complementarily between the activities of US affiliates across a cross-section of countries and US exports at both industry and firm level, pointing to the export of parts and components to the host countries as the driver of the positive association. While the cross-sectional approach to their analyses can be considered limited in hindsight, they provided considerable insight with firm-level and industry-level data which set the tone for further enquiry in the area. In a similar vein, Grubert and Mutti (1991) found a complementary relationship between US affiliates activity in a cross-section of 33 countries and exports of parent firms. However, following concerns

of the potential simultaneity between increased FDI and exports, their work introduced tariffs and taxes as more exogenous measures of multinational activity.

With improvements in availability of data, the dimensions of research on the FDI-trade relationship expanded. A detailed and elaborate analysis involving two panel datasets was conducted by Clausing (2000). The study extended the dimension of previous studies at the time to include the effect of activities of affiliates in the US on imports from source countries. Using panel data techniques, the work found positive association of both export of parts and components from parent firms in the US with activities of their affiliates in 29 countries, and imports of the final goods from these countries and activities of affiliates in the US. Anderson and Van Wincoop (2003) extended the scope of the investigation to include a sample of both developed and developing countries. This allowed for the inclusion of conditionality into the argument. Thus their work found complementary relationship between FDI and trade when countries are different in size and factor endowments, and trade costs are high; while the opposite is the case when the conditions are reversed. In addition, their study contributed to the endogeneity argument reflected in Grubert and Mutti (1991) with the use of more comprehensive measures of costs/price of investment as more exogenous regressors.

Kneller et al. (2005) and Girma et al. (2005) extended the country-level study of Amiti and Wakelin (2003) to provide firm-level evidence based on UK multinationals. Unlike Amiti and Wakelin (2003), where complementarity of FDI and trade was dependent on the relative country characteristics and trade costs, Kneller et al. (2005) found robust evidence of complementarity across countries irrespective of their relative sizes and endowments. Girma et al. (2005), on the other hand, showed that complementarity was conditional upon the level of aggregation of data employed in the model; with the most disaggregated level resulting to substitution and vice versa. Elia (2007) found further evidence of complementarity between exports and vertical FDI among countries with different factor endowments using bilateral trade data of EU-15 exports to 11 CEECs.

Recent studies have increased the dimensions of the investigation, to include both home country and host country perspectives. From a host country perspective, Cieslik (2009) found a positive association between the stock of FDI from OECD countries in Poland and the volume of trade to and fro those countries. Anwar and Nguyen (2011) employed the multi-dimensional approach by examining the link between FDI and exports, imports, and net exports. Their results show that FDI in Vietnam from 19 OECD countries is positively correlated to exports, imports, and net exports to those countries. Similarly, Mullen and Williams (2011) found complementary relationship between inward FDI in Canada from 20 OECD countries and exports to those countries. However, outward FDI from Canada to a particular OECD country was not positively linked to exports to that county, implying that substation might have taken place.

In light of the ongoing debate of the association of FDI and trade, and conditions for complementarity, the present study approaches the enquiry from a host country perspective. As in the case of Cieslik (2009), but with an extended scope, the present study the impact of EU multinationals in ECOWAS region on exports from

the region to the EU. In particular, we investigate the impact of FDI in ECOWAS region on the export of primary and intermediates goods to EU countries. Thus does inward FDI in the ECOWAS region affect exports to the EU? And does the category of the exports to the EU affect the direction of the effect of FDI?

5 Methodology and Data

5.1 Empirical Model

The primary objective of this study is to investigate the relationship between inward FDI into ECOWAS countries and their bilateral trade relations with EU countries, using disaggregated data. For this purpose, the gravity model (henceforth referred to as GM) is the preferred empirical model. The GM has no doubt earned itself a near universal acceptance as it has been applied to a range of academic disciplines since it was first applied by Tinbergen (1962). The acceptance of the model stems from its high predictive power and the recent emergence of its theoretical supports after falling into disrepute in the 1970s and 1980s. Therefore, many authors on FDI-Trade relation utilized the approach (e.g. see Clausing 2000; Amiti and Wakelin 2003; Mullen and Williams 2011; Anwar and Nguyen 2011).

The conventional form of the GM can be expressed as below;

$$F_{ijt} = R_{ijt} \frac{M_i M_j}{D_{ij}} \tag{1}$$

Given the multiplicative form of Eq. (1), it can be re-specified in a log-linear form as below;

$$\ln F_{ijt} = \beta_1 \ln M_{it} + \beta_2 \ln M_{jt} + \beta_3 \ln D_{ijt} + \beta_4 \ln R_{ijt} + \varepsilon_{ijt} \tag{2}$$

where F_{ijt} is bilateral trade between countries i and j. M_i and M_j are the GDPs or economic size equivalents of countries i and j respectively. D_{ij} represents bilateral distance between the two trading partners, the proxy for bilateral trade costs and R_{ij} is the multilateral trade resistance term defined as barriers to trade that the country-pair faces relative to those faced with all its trading partners. ε_{ijt} is the error term.

Although authors have attempted to advance the GM (e.g. see Anderson and Van Wincoop 2003; Carrere 2006; Baldwin and Taglioni 2006, 2011; Baier and Bergstrand 2007), but many empirical studies still mis-specify the model. One major source of severe bias is the omission of the multilateral trade resistance term in the GM equation (see Baldwin and Taglioni 2006). Other causes include inappropriate deflation and wrong averaging of trade variables. Similarly, when trade is analysed in disaggregated form, estimating the conventional consumer good version of the GM leads to mis-specification of the economic mass variable

and thus biases the estimates (Baldwin and Taglioni 2011). In the present study, we augment the conventional GM to control for the above mentioned estimation problems. Particularly, our preferred specification is in line with Anderson and Van Wincoop (2003) and Balwin and Taglioni (2006, 2011). The augmented-GM is specified as;

$$\ln EXPORT_{ijt} = \alpha_0 + \alpha_1 ln\, GDP_{it} + \alpha_2 \ln GDP_{jt} + \alpha_3 \ln Dist_{ij} + \alpha_4 LANG_{ij} + \alpha_5 \ln DPCI_{ijt} + \alpha_6 \ln FDI_{it} + \rho_t + \gamma_{jt} + \varepsilon_{ijt} \quad (3)$$

Here $lnEXPORT_{ijt}$ is the log of total exports of goods from country i to country j at time t. $lnGDP_{i(j)t}$ are the logs of the source and partner countries nominal GDPs. The choice of nominal GDP is informed by the need to avoid measurement bias cause by inappropriate deflation of the variables as noted by Balwin and Taglioni (2006).[10] So, following Rose (2000), we allow the year dummies to capture this effect. lnD_{ijt} is the log of bilateral distance between the two partners measured as the distance between their major ports cities. $LANG_{ij}$ is a dummy variable used to capture the sharing of common official language while $lnDPCI_{ijt}$ is the log of differences in per capita income between the two trading partners which is a proxy for differences in relative factor endowment (see Amiti and Wakelin 2003). $\ln FDI_{it}$ is the log of foreign direct investment stock into the source country.

γ_{jt} are the nations dummies for all trade flows involving a particular nation and it is included to control for omitted multilateral trade resistance term. Preferences differ on how to control for these terms in panel analysis. While Baier and Bergstrand (2007) suggest the inclusion of year, country and country-pair dummies, Baldwin and Taglioni (2006) prefer the inclusion of both time-varying nation dummies and time-invariant country pair dummies. Applying either of these approaches will require very large number of observations which available data for the present study does not permit. Therefore, we minimize the bias by including nation dummies and year dummies in Eq. (3). The inclusion of the nation dummies removes the time invariant components of the resistance term (Baldwin and Taglioni 2006). The correlation matrix shows that no serious multicollinearity issues exist (See Fig. 7 in Appendix). However, since there are time series correlations between the resistance term and the included independent variables, it becomes imperative to control for the time-series components of the correlation. Thus, we also include year dummies ρ_t. Finally, since our focus is on disaggregated trade flows (i.e. primary, intermediate and final exports), fixed effects are used to control for economic mass in the preferred specification thereby addressing the mass-variable misspecification noted by Baldwin and Taglioni (2011).

In terms of a-priori expectations, we expect larger economic sizes of trading partners to promote trade between them so that α_1 and α_2 should be positive. The distance variable is a proxy for transportation cost and therefore the larger the distance between trading partners the higher the transportation cost and

[10]Baldwin and Taglioni (2006) refer to this bias as the bronze-medal error.

consequently a reduction in bilateral trade, so α_3 should be negative. α_4 should be positive since sharing common language facilitates bilateral trade especially in the case of ECOWAS countries where language is also an indicator of colonial ties. α_5 is expected to be positive since differences in factor endowment (especially natural resources differences) promotes north-south trade. α_6 is the main coefficient of interest: if there is a complementary relationship between FDI and a particular export category then it should be positive. On the other hand, if they are substitutes, α_6 should be negative. For all variables included in Eq. (1), if the relationship between them and trade flows are not strong, then we expect their coefficients to be statistically insignificant.

5.2 Data Sources

The data set include disaggregated bilateral trade flow from 10 ECOWAS members to seven EU countries for the period 2000–2010.[11] Conducting a more holistic analysis was hampered by dearth in disaggregated data on bilateral exports between members of ECOWAS and EU. This is mainly because many ECOWAS countries export only a few products to the major EU countries. Notwithstanding, bilateral exports based on Broad Economic Classifications (BEC) data were sourced from UN Comtrade Database. Following Gaulier et al. (2005) and Ueki (2011), the data were later re-grouped into three (i.e. primary, intermediate and final products) from the BEC five stage classification.[12] Data on bilateral distances and common language are available at CEPII Database while bilateral exchange rate is from IMF International Financial Statistics.[13] Nominal GDP and per capita income were from the World Bank World Development Indicators Database.

One major problem with research involving FDI is the dearth of disaggregated data by sectors especially for developing countries. Due to this problem, we limit our analysis to total FDI data which were sourced from UNCTAD Statistics Database. However, we conduct a sensitivity analysis for the regression by comparing the result for the EU with those of emerging countries including Brazil, India, China and South Africa (BICS).

In terms of the structure, the panel involves unidirectional flow of disaggregated exports from ten source countries to seven partners over 11 years yielding 770 observations. However, in few instances (less than 7 % of the total observation) there are zero observations but this does not pose a serious challenge to the accuracy of our results.

[11]The 10 ECOWAS countries are Benin Republic, Burkina Faso, CoteD'Ivoire, Gambia, Ghana, Mali, Niger, Nigeria, Senegal and Togo while the seven EU members are Belgium, France, Germany, Italy, Netherlands, Spain and UK.

[12]Table 4 in Appendix shows the re-categorization from BEC 5 Stage to 3 Stage product groups.

[13]Find CEPII data at: http://www.cepii.fr/anglaisgraph/bdd/distances.htm

6 Empirical Results

We conduct the empirical analysis using the least square dummy variable (LSDV) estimation technique. As reported in Table 2, Eq. (3) is estimated for three categories of exports namely primary, intermediate and final exports. For each of the three categories, three variants are estimated including one with the pooled regression, one with year effect only and the last one with both year and country effects. These yield Models 1–9 in the table. The last variants (Models 3, 6 and 9) are our preferred models and thus form the basis for comparing our variable of interest across export categories. We explore the behaviours of other independent variables included in the regression.

For all the equations estimated, both the source country's GDP and sharing of common language are statistically significant with the expected signs. This is a true reflection of the pattern of trade in ECOWAS as explained in Sect. 2. The region's exports (both intra-regional and extra-regional) are dominated by only a few relatively big economies such as Nigeria, CoteD'Ivoire, Ghana and Senegal. In fact, many of the coefficients of exporter country GDP are in line with those of previous studies on ECOWAS trade (e.g. see Agbodji 2008; Salisu and Ademuyiwa 2013). Similarly, given that ECOWAS countries are divided into anglophone (English-speaking) and francophone (French-speaking) countries whose trade relation with the EU reflects their strong colonial ties, it is not surprising that language is significant to trade with the EU.

The coefficient of both partner country GDP and distance are mostly insignificant. For the partner country GDP, this can be associated with the fact that apart from France and UK which dominate ECOWAS trade with the EU, there are no significant differences in individual ECOWAS members' trade with the other EU members included in the analysis. In the GM, distance is a proxy for transportation cost. Our result shows that although the coefficient of distance is correctly signed, trade between the ECOWAS members and the EU members are not significantly affected by transportation cost. One possible explanation for this is that transport infrastructure across the EU is well developed and thus transportation cost between EU members and ECOWAS members do not differ significantly. For example, the costs of shipping from Apapa Port (Nigeria) to the busiest ports in Italy and UK (i.e. Port of Gioia Tauro and Port of Felixstowe) are not significantly different even though UK is farther.[14] Furthermore, ECOWAS members major trading partners (France and UK) appear to be farther than many other EU members included in the analysis. For example, the UK is farther than Spain, Italy and Belgium. The coefficient of the differences in per capita income reveals that as the income gap between ECOWAS members and EU countries increases, the trade between them reduces. However, this relationship is found to be non-significant in the preferred model, implying that difference in resource endowment is not a major determinant of bilateral trade between the trading partners.

[14]See standard freight rates on http://worldfreightrates.com/

Table 2 Results for ECOWAS exports to the EU

	Primary exports equations			Intermediate exports equations			Final exports equations		
Independent variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
lnGDPit	1.249***	1.146***		0.657***	0.852***		0.429***	0.490***	
	0.160	0.162		0.251	0.252		0.115	0.118	
lnGDPjt	0.147	0.184		0.227	0.172		0.300**	0.276**	
	−0.147	−0.147		−0.247	−0.242		0.112	0.113	
lnDist	−0.660	−0.361	−0.725	−3.967***	−4.414***	−1.121	−0.836	−0.994	−1.498**
	−0.711	−0.711	−0.949	1.195	1.172	−1.587	−0.544	−0.549	0.699
LANG	0.559***	0.571***	0.592***	0.605***	0.580***	0.546***	0.839***	0.830***	0.800***
	0.099	0.098	0.094	0.172	0.168	0.162	0.078	0.078	0.071
lnDPCI	−1.318***	−0.676	−1.510	−4.833***	−5.588***	−1.320	−2.902***	−3.177***	−2.99***
	0.409	−0.441	−1.075	0.704	0.736	−1.863	0.312	0.337	0.818
lnFDI	0.392***	0.694***	0.586**	−0.383**	−0.786***	−1.431***	−0.043	−0.190	0.001
	0.109	0.134	0.229	0.189	0.231	0.390	−0.085	−0.107	−0.168
Constant	−9.584**	−9.437**	5.840	−11.688	−12.064**	0.751	−1.280	−1.458	−0.048
	3.833	3.814	−3.107	−6.208	6.048	−5.209	−2.816	−2.821	−2.277
Year effects	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Country effects	No	No	Yes	No	No	Yes	No	No	Yes
Adjusted R^2	0.53	0.53	0.60	0.20	0.25	0.35	0.44	0.44	0.57
F value	102.82***	44.03***	40.27***	29.27***	15.92***	17.39***	81.98***	34.34***	39.56***
No. of observation	649	649	649	770	770	770	718	718	lS

***, **, * indicate statistical significance at 1 %, 5 % and 10 % levels, respectively

The main coefficient of interest in this study is the FDI coefficient. We focus on models 3, 6 and 9 in Table 2 since they control for the methodological concerns raised earlier. Results of model 3 in the table show that the inflow of FDI into the ECOWAS region stimulates exports of primary goods to the EU. In fact the coefficient of the FDI variable is about 0.6 implying that a 10 % increase in the flow of FDI into the region will result in about 6 % increase in exports of primary goods. We find this complementary relationship not surprising but supportive of the widespread belief that investments into ECOWAS are resource-seeking. In fact, our investigation of the sparse FDI data available show that EU's investments are concentrated in primary sectors of resource-rich ECOWAS members like crude oil (Nigeria and Ghana), uranium (Niger) and cocoa and cotton (CoteD'Ivoire and Mali). Therefore, through FDI, natural resources are explored and exported to the rest of the world, including the EU.

The foregoing is supported by the results for model 9 which focuses on the effect of FDI inflows on ECOWAS exports of final products to the EU. We observe that apart from having very small coefficients, FDI is not a significant determinant of final goods exports. This can be associated with the targets of FDI in the region. Very small proportions of total FDI inflows are aimed at production and exportation of final goods. In few instances where such investments occur they are mostly targeted at exporting to the regional market rather than the international market due to low competitiveness.

As depicted under model 6 in Table 2, the exports of intermediate goods reduce as FDI flows into ECOWAS increases. At first glance this result appears contrary to what holds in the literature on trade and investment relation (e.g. see Markusen 2002; Head and Reis 2004), but there is a difference. In the conventional models the interest is on whether or not multinational investment activities in the recipient country increase the imports of intermediate goods by the recipient country from the source country. But in the present study, our interest is quite the reverse. We investigate whether or not multinational investment activities in the recipient countries (i.e. ECOWAS members) results in increase in the exports of different categories of goods from these recipient countries to the source countries (i.e. the EU). This is important because it reflects the purpose of multinational investments activities; do they invest in order to exploit primary resources or to process them into intermediate and final goods before exporting? In the case of exports of intermediate goods from ECOWAS to the EU, the significant and negative relationship with FDI probably imply that the inflow of investment is moving from intermediate sectors activities to other sectors of the economy.

In sum, our analysis shows that the effects of multinational investment activities on recipient country's exports vary across the different categories of exports.

6.1 Sensitivity Analysis

As discussed earlier, we conduct a similar analysis to investigate the trade and FDI relation between ECOWAS countries and selected emerging economies. Due to data limitations, we focus of just seven ECOWAS countries as the source countries while Brazil, India, China and South Africa are the partner countries.[15] The analysis is similar to those conducted earlier and the results are presented in Table 3.

The results are similar to those in Table 2. Models 3, 6 and 9 shows that multinational investments activities is positively correlated with an increase in ECOWAS exports of primary goods to the BICS and negatively correlated with the exports of intermediate goods. For final goods, no significant relationship can be established. Therefore, this sensitivity analysis reinforces the effect of the resource-seeking nature of investments flowing into ECOWAS on the structure of its trade with major trading partners.

7 Conclusion

Much of the investigation of the FDI-trade relationship in literature has been based on the effect of source country's outward FDI on its export of final or intermediate goods with little attention given to the effect of inward FDI on host country's exports performance. For developing countries where FDI remains a major source of bridging their saving-investment gap and promoting exports, the latter relation is more important. Therefore, this study presents a "commodity-proximity" model which conceptualizes this relation in resource-abundant countries in West Africa.

Empirically, the study uses disaggregated exports data to examine the trade and FDI relation between West African countries and the EU. Results from a theoretically augmented gravity model show that the effect of multinational investment activities on host country's exports differ across exports categories. Specifically, while increased inflow of FDI promotes the export of primary goods from ECOWAS to the EU, it is associated with a reduction in the exports of intermediate goods and has no significant effect on final goods exports. A similar result was found when the FDI-Trade relation between ECOWAS and the BICS was considered. One plausible explanation for this persistent observation is that FDI into the ECOWAS remain resource-seeking. These results suggest that the sectoral target of FDI inflow is important to the trade performance of recipient economy. Therefore, we recommend that in order to achieve export diversification and commodity based industrialization, ECOWAS members should align their investment promotion priorities with their industrialization policies. In other words, more FDI should be encouraged in sectors that are vital to their industrialization aspirations.

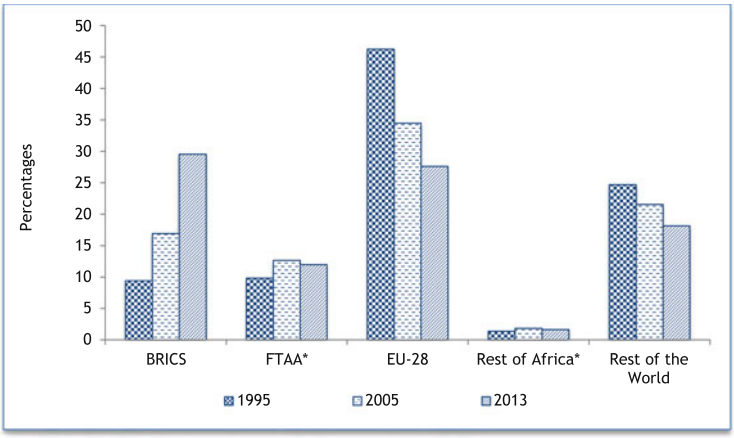
[15]In this analysis, we exclude Burkina Faso, Gambia and Niger Republic and Russia due to a high proportion of zero trade observations.

Table 3 Results for ECOWAS export to BICS

	Primary exports equations			Intermediate exports equations			Final exports equations		
Independent variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
lnGDPit	0.604	0.871		0.338	1.105**		0.435	1.144	
	−0.456	−0.477		−0.471	0.473		−0.431	0.431***	
lnGDPjt	2.06***	2.324***		1.454***	1.913***		0.925**	1.346***	
	0.432	0.438		0.436	0.425		0.403	0.391	
lnDist	−4.193***	−4.507***	−2.203	3.508***	3.678***	3.772***	2.84**	3.103***	3.504***
	1.326	1.316	−1.228	1.339	1.282	1.319	1.243	1.187	1.238
LANG	0.047	0.052	0.322	1.133***	1.164***	0.942***	0.078	0.165	0.294
	−0.33	−0.327	−0.309	0.347	0.332	0.350	−0.326	−0.311	−0.334
lnDPCI	−2.474***	−2.291***	−2.06***	0.269	−0.455	−0.272	−1.172***	−1.817***	−1.727***
	0.502	0.507	0.462	−0.517	−0.51	−0.521	0.478	0.471	0.488
lnFDI	0.959***	1.233***	0.86***	0.427	−0.388	−2.523***	0.217	−0.59**	−1.358
	0.291	0.323	0.290	−0.3	−0.322	0.725	−0.272	0.298	−0.716
Constant	2.813	2.793	−4.417	4.892	4.243	19.583***	1.043	0.259	12.57***
	−5.386	−5.362	−3.124	−5.652	−5.435	3.448	−5.145	−4.929	3.243
Year effects	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Country effects	No	No	Yes	No	No	Yes	No	No	Yes
Adjusted R^2	0.4	0.41	0.55	0.19	0.26	0.3	0.25	0.32	0.39
F value	29.53***	12.3***	16.11***	10.99***	6.64***	6.14***	14.71***	8.26***	6.83***
No. of observation	262	262	262	254	254	254	247	247	247

***, **, * indicate statistical significance at 1 %, 5 % and 10 % levels, respectively

Appendix



Source: Authors' Computations from UNCTAD Statistics Database, 2014

Fig. 6 Shares of economic groups in ECOWAS' imports, 1995–2013. *Source*: Authors' computations from UNCTAD Statistics Database, 2014

	$ln\, GDP_{jt}$	$ln\, GDP_{it}$	$ln\, Dist_{ij}$	$ln\, DPCI_{ijt}$	$ln\, FDI_{it}$
$ln\, GDP_{jt}$	1.0000				
$ln\, GDP_{it}$	0.9179	1.0000			
$ln\, Dist_{ij}$	0.0712	0.0695	1.0000		
$ln\, DPCI_{ijt}$	-0.7313	-0.6965	-0.1295	1.0000	
$ln\, FDI_{it}$	0.7746	0.7177	0.1797	-0.8086	1.0000

Fig. 7 Correlation matrix

Table 4 Broad economic categories of exports

5-Stage	3-Stage	BEC	Title in BEC
Primary exports	Primary goods	111	Food and beverage, primary, mainly for industry
		21	Industrial supply not elsewhere specified, primary
		31	Fuels and lubricants, primary
Intermediate exports	Semi-finished goods	121	Food and beverages, processed, mainly for industry
		22	Industrial supply not elsewhere specified, processed
		32	Fuels and lubricants, processed
	Parts and components	42	Capital goods (except transport equipment), parts and accessories
		53	Parts and accessories of transport equipment
Final exports	Capital goods	41	Capital goods (except transport equipment)
		521	Other industrial transport equipment, parts and accessories
	Consumption goods	112	Food and beverage, primary, mainly for household consumption
		122	Food and beverage, processed, mainly for household consumption
		51	Passenger motor cars
		522	Other non-industrial transport equipment, parts and accessories
		61	Durable consumer goods not elsewhere specified
		62	Semi-durable consumer goods not elsewhere specified
		63	Non-durable consumer goods not elsewhere specified

Source: Gaulier et al. (2005) and Ueki (2011)

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Part II
Trade and Competitiveness in Africa

Competiveness and Trade in West Africa

Toussaint Houeninvo and Khadidiatou Gassama

1 Introduction

Several measures have been put in place in West Africa to overcome the fragmentation of the ECOWAS zone to promote regional integration since the signing of the ECOWAS treaty in 1975. Despite, some progress made in the integration process in West Africa including progress in defining sector policies and multilateral surveillance, conflict resolution, less progress has been achieved in intra-regional trade which is still low. In fact, ECOWAS intra-regional trade (export and import in % of total trade) over 2008–2010 is estimated at 8.2 % against 91.2 % for the trade with the rest of the world. Therefore, there is a need for substantial effort to deepen Regional integration in West Africa.

Regarding monetary integration, countries out of WAEMU, with the exception of Cape Verde, have been working over a decade towards the creation of a second monetary zone which is set to merge later with WAEMU to subsequently form the single currency area of ECOWAS. The realization of the second Monetary Zone has been postponed several times since its initial target of 2003 due to the delay and the inability of the six WAMZ countries to comply with all required criteria simultaneously and on a sustainable basis. Initially those include four primary and six secondary convergence criteria. But recently, during the 45th ordinary session of the Heads of States of ECOWAS, held on July 10, 2014 in Accra decided

Paper presented at the Sixth Annual Conference on Regional Integration in Africa (ACRIA 6) on the theme: investment and competitiveness in Africa, Lagos, 1–3 July 2015. The opinions expresses in this paper are those of the authors and don't reflect the view of African Development bank nor those of its Board of Directors or the countries they represent

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D. Seck (ed.), *Investment and Competitiveness in Africa*, Advances in African Economic, Social and Political Development, DOI 10.1007/978-3-319-44787-2_7

to skip the step on the second monetary union and go directly to the unique currency scheduled for 2020[1]. They also decided de reduce total convergence criteria from ten (10) to six[2] (6).

In terms of funding for community development investments, they are two development Banks: ECOWAS Bank for Investment and Development (EBID) and West African Development Bank (WADB) for WAEMU member countries. These are specialized institutions that are responsible for financing infrastructure investments and to support productive investment in member countries.

The two Regional Economic Cooperation (REC) have elaborated for each zone a community development program mainly in the infrastructure sectors (transport, energy, telecommunications etc.) and productive sectors (agriculture, industry, handicrafts etc.). The resources come from taxes and levies which supply the budgets of the two REC and from the resources they mobilize from regional capital markets. These resources contribute to some specialized Funds such as the Fund of assistance to regional integration (FAIR), the Regional Development Fund for Agriculture (RDFA). For WAEMU, those Funds are managed by the Commission and the Regional Energy Fund managed by WADB. For both REC, the financing of regional investments program come mainly from specialized institutions such as West African Development Bank (WADB) and ECOWAS Bank for Investment and Development (EBID) which have non-regional shareholders. The region has certainly made some effort by providing strategic direction in key sectors such as agriculture, energy, transport, telecommunications within various sector policies, but in many cases the achievement is below what it could have been, mainly because of resource constraints. The problem of financing of the two RECs can be illustrated by the case of agriculture, a sector that the countries of West Africa consider as a basis for inclusive growth and development[3] but is still mainly trading raw material and struggling to develop value chain.

The remaining of the paper is as follows. Section 2 deals with the impact of the ECOWAS Free Trade Agreement (FTA) on Member Countries openness and change in their trade structures. Section 3 assesses country specialization and level of diversification and intra-regional trade performance based on the indicator of Revealed Comparative Advantage. Section 4 examines the impact of regional integration on economic growth and income per capita. Section 5 analyses some key factors that constrain investment and competitiveness in the ECOWAS and

[1]However, the recent turbulence in the Euro zone related to the Greek debt crisis and the level of preparedness of the WAMZ member countries to meet the criteria may lead to a new postponement of the Unique Currency date unless radical measures are taken in the meantime to that end.

[2]New 3 Primary criteria: (i) Average annual inflation rate $<= 10\,\%$ with a long term goal of $<= 5\,\%$ by 2019; (ii) Budget deficit (including grants)/GDP $<= 3\,\%$; (iii) Gross reserves $>= 3$ months of imports. New 3 Secondary criteria: (i) Public debt/ GDP $<= 70\,\%$; (ii) Central Bank financing of budget deficit $<= 10\,\%$ of previous year's tax revenue; (iii) Nominal exchange rate variation of + or $-10\,\%$.

[3]The sector account for more than 34 % on average to GDP ranging from 7.2 % for cape Verde up to 54.1 % for Sierra Leone.

therefore lead to low investment per capita as compared to other zones. Finally Sect. 6 concludes the paper with some policy recommendations.

2 Impact of ECOWAS Free Trade Area on Trade Structure

Since Balassa (1961), it is widely known that there are five steps in the integration process corresponding to various levels of regional integration. These are the Free Trade Area (FTA), the Customs Union (CU), the Common Market (CM), the Economic Union (EU), and the Political Integration. The FTA, which is the first step of the economic integration process, is an area in which tariffs and quotas are abolished for imports from member Countries but maintained by each country towards third countries (outside the zone). The customs union is a free trade area with a common external tariff towards third countries. The Common Market is a customs Union with the remove of non-tariff measures (facilitating the integration of product and services markets). The Economic Union is a common market with the coordination of national economic policies/harmonization of relevant national legislation. Finally, the political integration is an Economic integration in which all relevant economic policies are conducted at the supranational level, in compliance with the principle of subsidiarity. This implies that at this stage the authorities and supranational laws are in place and functioning. ECOWAS at the image of most African regions is mostly at the stage of the Free Trade Zone and recently created a Customs Union with the entry into force of an ECOWAS Common External Tariff (CET) since January 2015.

The ECOWAS treaty was signed in 1975 but the instruments needed for its implementation took time to be in place. In fact, the trade liberalization scheme of ECOWAS aims at eliminating customs duties on imports and exports of goods and the abolition of non-tariff barriers between Member States in order to create a Free Trade Area (FTA) began in 1979. It was limited to agricultural products, crafts and crude oil. It has been extended to industrial products in 1990 in other words 11 years after liberalization of crude products and 15 years after the creation of ECOWAS. As for the recognition of the right to free movement of people and labor force it did not begin until 2003. Regarding the visa-free movement of citizens within ECOWAS, it was not effective before 2006 meaning 31 years after the signing of ECOWAS treaty (Table 1).

The review of foreign trade data reveals a mixed development for the region. It appears that the most important change is in terms of structure, origin and destination of trade with the rest of the world and not in terms of overall development of openness of the economies in the region or intra-regional trade trends. Thus, in general, the opening of economies has not been so deepen during the mid-2000s (chart below). It appears that the countries that may be regarded as a locomotive for

Table 1 Key dates in the economic integration process of ECOWAS

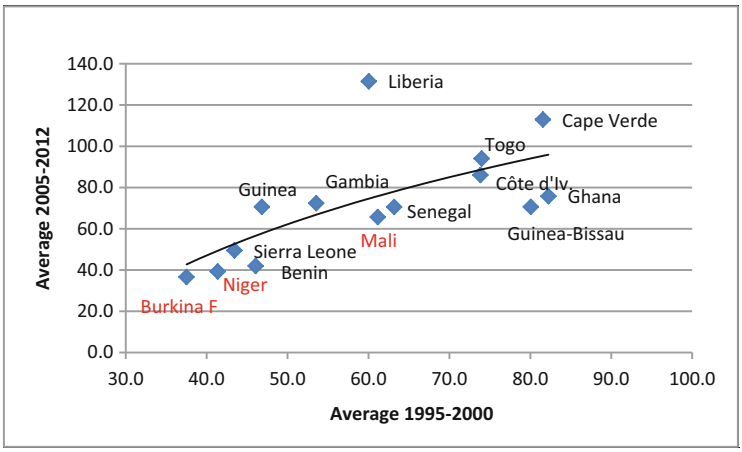
Key dates	Acts and events
1975	Creation of ECOWAS
1979 and 1990	Trade liberalization scheme for ECOWAS: elimination of customs duties on imports and exports between Member States and abolition of non-tariff barriers between Member States. In 1979 it was limited to agricultural products, crafts and crude oil. In 1990 it was extended to industrial products. Common External Tariff (CET) initially planned for 2008, then postponed and entered into force on January 2015
1993	Revision of the ECOWAS Treaty introducing articles concerning political cooperation, regional peace and security
2003	Recognition of the right to free movement of people and labor
2006	Effective free movement without visas within the area for citizens of ECOWAS (limited authorization to 90 days)
2007	Adoption of the constituent principles of vision 2020
2010	Negotiations for ECOWAS common external tariff (CET)
2015	Entry into force in 2015 of ECOWA CET S (1 January 2015)
2017	Monetary union for ECOWAS non-WAEMU countries (Planned)
2020	Single currency for ECOWAS (as planned)

Source: Compiled from ECOWAS data

the region (by population and by GDP) experienced a smaller change in terms of openness (under the trend line on the graph) than other countries (Graph 1).

In terms of trade of goods flows within the region, there are few changes and most of the trade is still with the rest of the world as shown in Table 2.

As indicated in Table 2, ECOWAS exports to high income countries represents 63.6 % of total ECOWAS exports over 2005–2011 which is still high even if there is a 9.59 points percentage decrease (relative value) from it 69.7 % level over 1995–2000. Regarding imports the region still imports 49 % from High income countries over 2005–2011 even if there is an important 39.18 % decrease (in relative value) as compared to it 68.2 % over 1995–2000. Unfortunately this decrease in imports from developed countries did not benefit ECOWAS intra trade but has been captured by trade with East Asia which gained 125.37 % (in relative value) rising from 6.7 % in 1995–2000 to 15.1 % over 2005–2011. At the same time ECOWAS exports to East Asia is still negligible around 1.1 % over 2005–2011 and experiences even a slight decrease as compared to its 1.8 % level over 1995–2000. One of the reasons is that most of the commodities are not processed in the zone and this limits leverage this could create in terms of trading among ECOWAS Countries. Mostly due to business climate and constraints related to infrastructure (energy, transport, logistics, technology) and some structural reforms, processing of those crude products in ECOWAS countries is not competitive (see Sect. 5 for details). Therefore crude products are exported mainly to non-African Countries where they are processed at a more competitive cost and then the processed products (manufactured) are imported in ECOWAS countries. As result and as



Graph 1 Openness of ECOWAS economies: comparison of 1995–2002 and 2005–2012. *Source*: Computed from TRADEMAP (Data retrieved early 2013)

shown in Table 3, trade between ECOWAS countries compared to their total external trade are limited.

It is below 10 % for both the beginning and the end of the decade of 2000. There is in fact a slightly decrease at the end of the decade in comparison to the beginning (9.8 % in 2001–2003, 8.2 % in 2008–2010). This indicates that the measures taken at institutional level in the zone did not translate yet into significant intra-regional trade increase relatively to total trade of the zone.

The evolution of tariffs, over the decade, however, shows a tariff reduction for the region (see Table 4) despite the obstacles that remain in the implementation of the liberalization scheme of ECOWAS. However, trade liberalization is more about primary products than manufactured goods. The decline was greater for non-WAEMU countries because they have higher levels of tariffs than WAEMU tariffs. This is also due to the fact that liberalization has been effective earlier within WAEMU with a 100 % reduction of customs duty on "qualified products[4]" and an average 9.7 % tariff in 2000 for any other product considered. The effectiveness of this liberalization came later among non WAEMU countries of ECOWAS with an average tariff of 19.3 % in 2000, which was the double of the WAEMU average tariff at the same period. This is one of the arguments for the choice of the period 1995–2000 as pre-integration period, the period 2000–2005 as the key period of the integration process and the period 2005–2011 as the post-integration period for the needs of the analysis in this paper.

[4]Products meeting preferential treatment of WAEMU liberalization scheme.

Table 2 Trade share (exports + imports) of different regions of the world in ECOWAS trade and its components

Exports from regions									
Regions and periods	Asia and pacific (%)	Europe and Central Asia (%)	Latin America and the Caribbean's (%)	Middle East and North Africa (%)	South Asia (%)	Sub Saharan Africa (%)	Arab countries (%)	High income economies (%)	Others (%)
Average 1995–2000									
WAEMU	1.1	1.2	4.4	1.8	4.7	21.6	2.3	54.5	8.4
Non WAEMU	2.0	0.5	4.5	0.7	9.0	8.5	0.7	73.8	0.4
ECOWAS	1.8	0.6	4.5	0.9	8.1	11.2	1.0	69.7	2.1
World	6.9	2.9	5.2	1.4	1.2	1.3	2.8	78.3	0.0
Average 2005–2011									
WAEMU	3.7	1.1	1.4	1.6	5.2	30.8	2.6	44.1	9.4
Non WAEMU	1.0	1.7	8.5	0.3	8.4	9.1	0.3	67.7	3.0
ECOWAS	1.1	1.6	7.2	0.5	7.8	12.9	0.7	63.6	4.5
World	10.4	4.7	4.9	2.0	2.2	1.7	3.7	70.5	0.0

Imports from regions									
Regions and Periods	Asie de l'Est et Pacifique	Europe & Asie Centrale	Amérique Latine et Caraïbes	Moyen Orient et Afrique du Nord	Asie du Sud	Afrique Sub Sahara	Monde Arabe	Economies à hauts revenus	Divers
Average 1995–2000									
WAEMU	5.8	1.9	2.2	1.3	2.4	19.5	2.9	59.3	4.7
Non WAEMU	7.3	2.1	4.2	0.4	3.0	8.5	1.2	73.2	0.0
ECOWAS	6.7	2.0	3.5	0.7	2.8	12.6	1.8	68.2	1.6
World	9.8	3.0	5.2	1.4	1.1	1.5	3.2	71.0	3.9
Average 2005–2011									
WAEMU	14.7	2.2	3.7	2.2	3.0	23.6	3.5	43.9	3.2
Non WAEMU	15.3	2.1	4.4	0.7	4.0	8.8	2.6	51.1	11.0
ECOWAS	15.1	2.1	4.2	1.1	3.7	13.2	2.8	49.0	8.7
World	15.4	5.0	5.8	2.3	1.6	2.0	5.4	62.6	0.0

Exports/Imports from regions (lines) to regions (in column)

Source: Computed by the Authors from World Development Indicators of the World Bank

Table 3 Trade share (exports + imports) of a given region with other regions and the rest of the world

Regions (% from data in current $)	2008–2010					2001–2003				
	World	WAEMU	Non WAEMU of ECOWA	ECOWAS	Rest of the world (out of ECOWAS)	World	WAEMU	Non WAEMU of ECOWAS	ECOWAS	Rest of the world (out of ECOWAS)
WAEMU	100.0	11.8	12.8	24.6	75.4	100.0	12.8	10.5	23.3	76.7
Non WAEMU of ECOWA	100.0	2.2	1.3	3.5	96.5	100.0	2.6	2.4	5.0	95.0
ECOWAS	100.0	4.4	3.8	8.2	91.8	100.0	5.3	4.5	9.8	90.2
Rest of the world (out of ECOWAS)	100.0	0.1	0.5	0.6	99.4	100.0	0.1	0.3	0.4	99.6
World	100.0	0.1	0.5	0.6	99.4	100.0	0.1	0.3	0.4	99.6

Source: Computed by the authors from Trademap data (online early 2013)

Table 4 Evolution of tariff in the ECOWAS from 2000 to 2010

Indicators and sub-region	Average customs tariff all goods (%)		Average customs tariff manufactured goods (%)		Average customs tariff primary goods (%)	
Years	2000	2010	2000	2010	2000	2010
WAEMU	9.7	9.3	10.5	10.3	9.0	8.1
ECOWAS non WAEMU	19.3	10.4	17.1	10.6	24.9	9.3
ECOWAS (whole)	16.6	10.2	15.2	10.6	20.3	9.0

Source: Compiled from Word Development Indicators, World Bank

3 Regional Specialization and Intra-Regional Performance

Conventionally, assessment of regional integration refers to the period "before" and "after" integration.

Analysis of specialization and performance of ECOWAS intra-regional trade will be done here through the revealed comparative advantage indicator. This indicator developed by Bela (1965) reveals the specialization in a given product. It is equivalent to the share of exports of a 'Good' **j** compared to all exports of a given country **i** divided by the share of exports of this 'Good' in total exports of a reference area (ECOWAS). If we name RCA, the revealed comparative advantage indicator, it is computed with the following formula:

$$RCA = \frac{\left(\frac{E_{ij}}{E_{it}}\right)}{\left(\frac{E_{nj}}{E_{nt}}\right)}$$

Where:

E stands for Exports; i for Country index; j for 'Good' index; n for set of countries (ECOWAS); t for set of 'Good'.

If the indicator is greater than 1, the country is considered to be specialized in that 'good' meaning relatively exporter than the reference area which is here ECOWAS. More the indicator will have a higher value than 1, more the specialization will be considered as greater. In contrary, if the indicator has a value less than 1 for a given 'good', the country is considered to have a comparative disadvantage. The disadvantage will be considered greater if the indicator has a value close to zero. On this basis the potential strategic positioning of each ECOWAS country vis-à-vis the region is estimated (see Table 3).

Therefore and as regards competition between ECOWAS countries, taking into account the total number of commodities under consideration, we can say that there is more complementary among ECOWAs member trading pattern than direct

competition. In fact, there are only 19 products from a total of 97 products considered for which there are five or more countries with an RCA[5] (Table 5).

Note also that countries that have the most products with an RCA, are Senegal, The Gambia and Togo (with more than 20 products with RCA over a total of 97 commodities). They appear to be the most diversified countries of ECOWAS. At the other extreme, countries such as Liberia, Cape Verde and Nigeria[6] have respectively 6 and 4 commodities with RCA for the period 2008–2011.

4 Regional Integration Economic Growth and Income Per Capita

Economic growth and improvement in the conditions of life are some of the expected effects of regional integration although those results cannot be solely attributed to regional integration given their complexity. Improvement in conditions of life is approximately measured by income per capita in this section.

The GDP of the region has experienced a higher growth rate than the world average and slightly lower than that of sub-Saharan Africa over the period. The WAEMU countries have a lower growth than the rest of the Zone. In terms of GDP per capita, given the high population growth in the region, nearly 2.6 % on average, the performance is lower than for the world. The standard of living in the region is therefore much improved, despite the weight of demography. However, given that the WAEMU countries have not benefited as much growth and living standards improvement, while integration is more advanced than the non WAEMU zone, one can hardly conclude that this improvement is attributable to the integration process, although it probably contributed (Table 6).

According to the comparison of the growth in GDP per capita during the 2000s and it level of the beginning of the period (Chart 2 below), the best performing countries—Economic growth rate significantly higher than trend—are Cape Verde,

[5]These are products for which there is therefore competition. We see from this figure that there are few products (according to a detailed classification) where countries are competing. This finding contradicts the widespread idea that there is more competition than complementarity between the countries of the region. This common misconception is probably based on comparisons of products according to aggregated classifications.

[6]For Nigeria, the high share of oil in exports leaves little room for specialization for other products and therefore diversification. This result is consistent with a recent study carried out by Nigeria Country Office of African Development Bank entitled "Structural transformation of the Nigerian Economy: a Policy Paper", September 2013, (p. 7 and 25) which shows that the Nigerian economy was more diversified in the 1960s and before the oil boom of the early 1970s than today where it is dominated by the oil economy and its Dutch disease effect on other sectors. Indeed, the non-oil exports, which accounted for 78 % of GDP in the 1960s decreased drastically to 3 % in the 2000. Petroleum products are the main exports of Nigeria to the ECOWAS countries representing more than 85 % since 1997. Such a situation has not encouraged the development of other products (diversification). Maybe the recent drop in oil price will give incentive for more diversification.

Table 5 Positioning of countries of the region in terms of revealed comparative advantage (RCA)

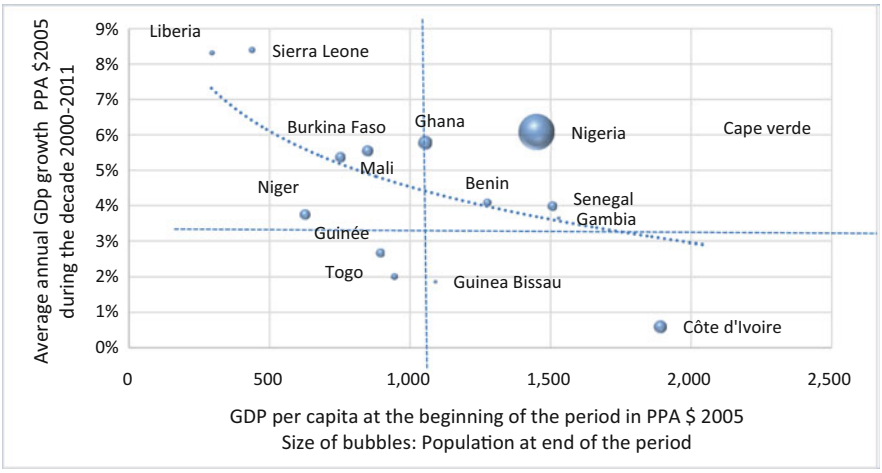
Total number of products considered (97)	Senegal	Gambia	Togo	Côte d'ivoire	Benin	Ghana	Sierra Leone	Guinea	Guinea Bissau	Mali	Burkina Faso	Niger	Liberia	Cape Verde	Nigeria
Number of products with RCA	27	23	23	18	17	15	13	12	10	10	9	9	6	6	4
Presence with RCA (%)	27.8	23.7	23.7	18.6	17.5	15.5	13.4	12.4	10.3	10.3	9.3	9.3	6.2	6.2	4.1

Source: Computation based on data from the Trademap (classification 6)

Table 6 Economic growth in the ECOWAS over the decade, 2000–2011

ECOWAS and world	GDP growth 2000–2011 (PPA, dollar 2005) (%)	GDP per capita growth 2000–2011 (PPA, dollar 2005) (%)
WAEMU	3.3	0.6
Non WAEMU ECOWAS	4.6	2.1
ECOWAS (whole)	4.3	1.7
World	3.5	2.3
Sub-Saharan Africa (developing countries only)	4.9	2.4

Source: Computed from Word Development Indicators (World Bank)



Graph 2 GDP growth and initial level of GDP per capita and population per country, 2000–2011. *Source*: Computed from Word Development Indicators (World Bank)

Nigeria, Liberia, Sierra Leone, Senegal and Ghana. These results support the view that regional integration has probably some minor impacts on the GDP of countries that have more trade with the region. However, countries that could be used to lead the locomotive to transmit growth through trade in the region are more anchored to the rest of the world in their trade than within ECOWAS (Nigeria, Ghana) or have little weight in terms of GDP per capita (Mali, Burkina Faso). Senegal is an exception. It benefited from integration, especially given the relative increase in net trade within the Region. It also has a significant weight in the region in terms of GDP per capita and population (Graph 2).

The effect on the region would have greater if countries that are considered as locomotives in the integration process had higher economic growth rate and moreover GDP per capita growth rate.

Table 7 Some keys factors of competiveness in the ECOWAS countries

Country	State of competitiveness	
	Relatively favourable factors	Impeding factors
Benin	Macro, health, primary education, labor market effectiveness	Narrow market, infrastructure, higher education and training
Burkina Faso	Macro, labor market efficiency, goods market efficiency, institutions	Infrastructure, primary education and higher education, technological readiness preparation
Côte d'Ivoire	Macro, labor market efficiency, goods market efficiency, institutions	Narrow market, infrastructure, primary education and higher, technological readiness
Gambia	Institutions, innovation, education, training	Narrow market
Ghana	Financial market, education, extensive market, higher education	Infrastructure, technological readiness
Liberia	Macro, institutions	Narrow market
Mali	Macro	Higher education and training, infrastructure
Niger	Macro, extensive market	Infrastructure, primary education
Nigeria	Extensive, macro	Infrastructure, technological readiness
Senegal	Macro, technological readiness	Market size, infrastructure, higher education and training
Sierra Leone	Institutions	Narrow market, education
Guinea	Labour market	Infrastructure, narrow market

Source: World Economic Forum, World Development Indicators, World Bank

5 Key Competitiveness Factors and Impediment to Competitiveness in ECOWAS

As mentioned earlier most of the constraint to commodity processing and creating value chain that can give leverage to niches for intra-regional trade, growth, employment and quality of life of people in ECOWAS, are Business environment factors. Generally ECOWAS Countries make progress in terms of macroeconomic policies at some institutional levels but the progress regarding structural reforms are weak. Table 7 summarizes some of those factors.

6 Conclusion and Policy Recommendations

Peace and political stability are key factors for regional integration. The instability that has prevailed in several West African countries for many years and its socio-economic consequences (destruction of socio-economic infrastructure, destruction of human capacities, loss of qualified professionals, etc.) have adversely impacted investment, competitiveness and integration within the region.

The progress of trade and the impact on economic growth are still timid. Countries that are seen as the powerhouses of the region are either little involved in trade within ECOWAS (Nigeria, Ghana and Cape Verde) or have a moderate economic growth rate (Senegal).

The region's foreign trade has enough potential in terms of diversification of comparative advantages. Out of the 97 listed products traded considered within ECOWAS, countries have been ranked in terms of comparative advantages and diversification/number of products with comparative advantage. Based on that indicator Senegal appeared to be the most diversified economy of ECOWAS.

Among the factors that impeding the Regional to exploit it potential in terms of competitiveness, investment and improvement of conditions of life are the following:

- The lack of interconnection among the existing country specific stock exchanges is also a constraint to investment and trade performance at regional level
- Poor intraregional transport facilities (road, railways, Air and Maritime) are among the major constraints to competitiveness and regional enterprise investment. Similarly alarming West Africa's energy low consumption per capita, low electrification rate, predominance of biomass, high cost of production in most countries, mediocre performance and quality of services, have been identified as impediment to competitiveness in the region
- Institutional weakness in enforcing the Free Trade Agreement protocol as well as other related protocols.

Based of those findings the main policy recommendations include:

- Eliminate effectively non-tariff measures in all ECOWAS member countries by strengthening regional solidarity and compensation
- Empower the ECOWAS institution to effectively implement the protocol on FTA
- Speed up regional reforms aimed at putting in place a regional investment market: regional investment code and the protocol on the regulation of regional investment
- Pursue structural reform that will facilitate at national as well as regional level raising national and regional saving rate to facilitate the financing of private investment
- Accelerate regional initiative in promoting affordable access to energy both in the production and the distribution
- Accelerate the implementation of ECOWAS Community Development Program
- Pursue institutional reforms in the electricity sector in member countries including accelerating the implementation of the WAPP Master Plan projects
- Upgrade of corridors, by putting in place regional initiatives in the form of incentives for the development of economic activities along the corridors and in surrounding areas.

These recommendations are expected to foster goods processing and generate new niches for trade and investment opportunities to boost the competitiveness of the region.

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Financial Development, Trade Costs and Bilateral Trade Flows: Connecting the Nexus in ECOWAS

Evans S. Osabuohien, John T. Odebiyi, Uchenna R. Efobi, and Oluyemi O. Fayomi

1 Introduction

The surge in the number of regional trade agreements (RTAs) notified to the World Trade Organisation (WTO) shows increasing attention on trading among countries within a given region. For example, the reported RTAs across the globe have grown more than threefolds between 1990 and 2011 (WTO 2011; Osabouhien et al. 2014). Estevadeordal et al. (2013) observe that the *impasse* of multilateral trade talks, have given an opportunity to RTAs to take the centre stage. Almost all countries of the world are members to at least one RTA, and most countries belong to two or more. One possible reason adduced for it is that multilateral negotiations are complex and cumbersome. A related argument lies in the fact that RTAs can be viewed as a means to an end, while multilateral trade negotiations can be likened as ends in themselves (Evenett 2014; Osabouhien et al. 2014).

The proliferation of RTAs has also raised some concerns amongst economists. For example, Bhagwati (2008) described RTAs as '*termites in the global trading system*' because, in his opinion, RTAs undermine free trade and promotes preferential trading. Krueger (1997, 1999) shares a similar view, claiming that the formation of RTAs significantly affects the willingness of member countries to

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D. Seck (ed.), *Investment and Competitiveness in Africa*, Advances in African Economic, Social and Political Development, DOI 10.1007/978-3-319-44787-2_8

participate in further multilateral negotiations. The WTO (2003) holds contrary view noting that RTAs and Multilateral trade negotiations can co-exist.

The case of the European Union (EU) as a regional bloc has caused several other regions across the world (including Africa) to form, reform, and revive their RTAs. A critical assessment of regional blocs in the developed countries of Europe and America reveals some elements of success. While those in developing economies—like Africa, though making some elements of progress, still leaves much to be desired. Amongst the notable trading blocs (also called regional economic communities-RECs) in Africa include: Arab Maghreb Union (AMU); Community of Sahel-Saharan States (CEN-SAD); Common Market for Eastern and Southern Africa (COMESA); East African Community (EAC); Economic Community of Central African States (ECCAS); Economic Community of West African States (ECOWAS); Intergovernmental Authority on Development (IGAD); and Southern African Development Community (SADC). Five of them have established free trade area-FTA (namely: COMESA, ECCAS, ECOWAS, EAC and SADC) (African Union Commission-AUC 2011; Osabuohien and Efobi 2011).

One of the notable desires from the RTAs is the need to improve the financial sector in the member countries in order to enhance bilateral trade flow. A number of studies (e.g. Kletzer and Pranab 1987; Do and Levchenko 2004) have shown that financial development (hereafter FD) could be a source of comparative advantage for trading economies or trade partners. Hence, FD can be seen as an important determining factor of trade flows, which appears to be logical, considering the importance of finance in any economic activities. In effect, FD in both exporting and importing countries would be required to fund production and consumption, respectively. Thus, it could determine the extent to which trade finance is available for financing exports and imports among member countries.

In view of the foregoing, this study provides empirical evidence on the interplay between FD, trade flow and trade cost within the context of ECOWAS as a regional economic community (REC). Attention is given to ECOWAS because of some reasons: such as low level of intra-regional trade, some renewed efforts of ECOWAS countries to integrate and deepen their financial sector as witnessed by the growth of indigenous banks having branches in other member countries, and so on. In this study, it is argued that an improvement in FD in the member countries will provide a salient structure to enhance trade flow. To the best of the researchers' knowledge, this has not received considerable attention in the empirical literature. Extant literature that deals with the improvement of ECOWAS intra-regional trade has emphasised on infrastructural development (Deen-Swarray et al. 2012), institutional framework (Efobi and Osabuohien 2016), cost of trade (Ackah et al. 2012), among others. Thus, this study differs by examining the role of the financial sector development of member countries, which is germane as ECOWAS treaty on common market has witnessed an increase in the 'flow' of national banks into other member countries.

The study is structured in sections. Following this introduction is Sect. 2 that provides a brief review of the literature. Section 3 discusses the methodological approach including the model, technique of estimation and data sources. The

presentation and discussion of empirical results, and the conclusion are encapsulated in Sects. 4 and 5, respectively.

2 Brief Insights from the Literature

From the literature, financial development (FD) is seen as a source of comparative advantage for trading economies (or trade partners), and an important determining factor for trade flows (Kletzer and Pranab 1987; Do and Levchenko 2004). First, FD entails a set of policies and drivers of such policies, intermingling together within, and in the global community to foster economic growth and development. It denotes the ability of the financial sector to actively play its intermediating role to enhance economic growth and development (Olayiwola et al. 2012). FD in the exporting and importing countries are essential in funding productive activities and consumption, respectively. In addition, FD will influence the availability of trade finance in an economy.

Given the challenges of adverse selection and moral hazard that characterise economic relationship; it is essential that the financial sector is guided and guarded by meaningful regulations. This is to avoid decrease in economic growth through increased economic fragility that is caused by higher chances of severe crises or financial instability (Ductor and Grechyna 2015). Another negative consequence that regulations will help to prevent is resource misallocation. There are instances of sub-optimal resource allocation, where the growth of the financial sector attracts and absorbs skilled workers from other sectors, thereby causing a *skill-lacuna* in the other sectors.

The way to prevent the possible adverse effects (notably moral hazard and adverse selection) that may be associated with financial transactions is to strengthen regulation (Griffith-Jones et al. 2014). Some studies have been able to establish a linkage between these two variables; however, without a direct implication for ECOWAS countries. Some of the earliest studies in this category include Pramesti (2010), who examined the extent to which financial development in an economy has an effect on the degree of bilateral trade flows. Specifically, financial development in Pramesti (2010) was measured by the access to external financing (in form of loans) and some other measures of international financial indicators. Access to loans (external financing) was found to have a strong positive relationship with bilateral trade. Another important connection between these two variables is tied to the linkage that is provided by banks between economic agents, to aid in the transfer of fund for transactions. Sending and receiving of fund between economic agents that are located in different member countries will be made easier with the development of the financial sector. More so, the time and economic resources that is attributable to indulging in the transfer of fund through the services of Money Transfer Organisations (MTO) would be reduced with the development of the financial sector (Efobi et al. 2014). This will make intra-regional trade transactions cheaper, swifter and even more efficient.

Studies that have considered the factors that can improve intra-regional trade within ECOWAS countries have focused on infrastructural development (Limao and Venables 2001; Deen-Swarray et al. 2012; Efobi and Osabuohien 2016); depreciation of exchange rates and trade openness; improvement of the institutional infrastructure among member countries (Osabuohien and Efobi 2011); improvement of complementary national production, ease of movement of people and goods among member countries, and the improvement of efficient financial sector development to aid payment (Seck 2013). The issue of financial sector development has not received attention as a determinant of intra-regional trade performance, at least for ECOWAS member countries. Thus, this study makes its contribution by filling this observed gap.

3 Methodological Approach

3.1 Methods of Analysis

The study, with a view to achieving its objectives, uses two main methods of analysis. They include descriptive and econometric techniques. The former employs Tables and Graphs to assess the trade flow and the level of financial development in ECOWAS. While the econometric analysis starts by formulating an augmented gravity model, which is estimated with Panel Ordinary Least Squares (POLS), Poisson Pseudo-Maximum Likelihood (PPML) and Generalised Methods of Moments (GMM) techniques. This is in order to examine the relationship between financial development, trade cost and trade flow.

3.2 The Empirical Model and Estimation Technique

The study employs the augmented gravity model of trade.[1] The gravity model of trade considers trade flows between two countries as a function of the economic mass of both countries and the distance between them. It supposes that the trade flow between two countries is positively related to their economic mass or size (usually proxied by gross domestic products-GDP), and inversely related to the distance between them. This is mathematically represented by the following expression:

[1]The choice of gravity model is mainly due to the need to capture bilateral trade flows within ECOWAS member countries in the light of their financial development. Hence, other econometric modeling approach will be applicable when examining trade flows among ECOWAS and the rest of the world, which can be taken up in further studies.

$$X_{ij} = \frac{Y_i Y_j}{D_{ij}} \tag{1}$$

In multiplicative form, Eq. (1) is re-written as:

$$X_{ij} = {Y_i}^{\beta} {Y_j}^{\gamma} {D_{ij}}^{-\delta} \tag{2}$$

Where X_{ij} represents the flow of trade (exports) from country i to country j, Y_i and Y_j are country i's and country j's GDP, while D_{ij} is the distance between the countries.

The above expression is linearised by logarithmic transformation as:

$$Ln\left(X_{ij}\right) = \alpha + \beta ln(Y_i) + \gamma ln\left(Y_j\right) + \delta ln\left(D_{ij}\right) \tag{3}$$

The formulation specifies distance as a kind of trade barrier. In empirical trade literature, however, the barriers to trade extend beyond physical distance. Therefore, D_{ij} represents a vector of trade barriers, and thus in several works, it has been represented by various measures depending on the key issue of interest. In this study, an augmented gravity model of trade is applied to empirically examine the effect of financial development on bilateral trade flows. The augmented gravity model for this study is such that:

$$\begin{aligned} lnX_{ijt} = {} & \beta_0 + \beta_1 lnY_i + \beta_2 lnY_j + \beta_3 lnD_{ij} + \beta_4 lnZ_{ij} + \beta_5 lnFD_i + \beta_6 lnFD_j \\ & + \beta_7 (CT) + \mu_{ijt} \end{aligned} \tag{4}$$

Where X_{ijt} is the exports of country "i" to country "j" at time "t"; Y_i is the GDP of the exporting country "i", while Y_j is the GDP of the importing country "j". The distance between the importing and exporting country is represented as D_{ij}. Trade cost that shows the costs of trading for each country pair using bilateral trade and gross national output for all sectors, is represented by Z_{ij}, as one of the major trade barriers that distort bilateral trade flow among ECOWAS countries is included in the model as it has possible influence on bilateral trade flow (Limao and Venables 2001; Deen-Swarray et al. 2012). Some additional control variables (CT) that will likely affect the estimates of the gravity model are included in Eq. (4). These CT are included in order to reduce the tendency of omitting some important variables that affect bilateral trade among ECOWAS countries. Some of them include: common coloniser, common language and contiguity. These variables can exert some influence on the volume of intra-regional trade (Dada and Adeleke 2015).

The main variable of interest is the extent of financial development in the ECOWAS exporting and importing countries represented as FD_i and FD_j, respectively. It is measured using credit to the private sector as percentage of GDP. This approach has been favoured for capturing financial development, and more so, its relevance can be seen from its ability to capture the extent of reach-out of the financial sector to the private sector (Beck 2002). μ_{ijt} represents the error term, which takes into account other variables that are not captured in the model.

Three estimation techniques were applied in the estimations of the gravity model. They include POLS, Poisson Pseudo-maximum likelihood (PPML) and GMM estimates. As baseline estimation, the POLS was applied to understand the relationship between the variables in order to ensure that they conform to classical hypotheses of the Gravity model: that is, trade flow is inversely related with distant and positively related with income (size).

We are mindful of some of the shortcomings of the POLS technique, which include the tendency of the technique to violate some of the assumptions of the classical linear regression model (CLRM). Furthermore, applying the POLS technique on panel data, fixed or random effects,[2] cannot account for the possibility of endogeneity in the model. Finally, economic relationships are perceived to be dynamic and not static, so the inclusion of the lagged dependent variable in the model specified makes it a dynamic model as shown in Eq. (5) below:

$$lnX_{ijt} = \beta_0 + \beta_1 lnY_i + \beta_2 lnY_j + \beta_3 lnD_{ij} + \beta_4 lnZ_{ij} + \beta_5 lnFD_i + \beta_6 lnFD_j + \beta_7(CT) + \beta_8 lnX_{ijt-1} + \mu_{ijt} \quad (5)$$

This inclusion of the lagged dependent variable could lead to the problem of autocorrelation. To this end, the Generalised Method of Moments (GMM) was utilised, due to its ability to address the issue of endogeneity and reverse causality.[3]

The study further utilised the Poisson Pseudo-maximum likelihood (PPML) technique of estimation as proposed by Santos Silva and Tenreyro (2006). This was necessitated by the tendency of log-linearised gravity models to be misleading in the presence of heteroscedasticity because of the Jensen's inequality. The Jensen's inequality simply states that:

$$E(\ln Y) \neq \ln E(Y)$$

Given any variable say (Y), the expected value of the logged variable given as $[E(\ln Y)]$ is not equal to the log of the expected value of the same variable $[\ln E(Y)]$.

[2]The fixed effect (FE) model considers the relationship between the predictor and outcome variables within an entity, where each sample has its own individual characteristics that may or may not be caused by the predictor. The FE model expunges all time invariant features in order to observe the net effect of the predictor on the outcome variable. In essence, the FE model controls for all time-invariant differences between the individuals. An important assumption of the FE model is that the time invariant feature of the model is unique to the individuals and independent of themselves. The random effect model (RE) does not control for time invariant features of the samples. The main assumption of the RE model is that the error terms of the samples are not correlated with the predictors and this allows for the allowance of time-invariant variables as explanatory variables.

[3]Endogeneity and reverse causality are the two fundamental issues that confront panel data analysis. Endogeneity problems occur when the explanatory variables are deterministic. This can be said as the explanatory variables are correlated with the error term. In such a case, the estimates of the regression analysis will be biased in some form. Reverse causality imply that the dependent explained variable also plays the role of an explanatory variable in the same model.

By implication, Santos Silva and Tenreyro (2006) showed theoretically how the problem of heteroscedasticity might cause biased results when estimating log-linearized gravity models and interpreting the elasticities. They posited that results could be misleading, and recommended PPML, although, according to them, a few authors in the empirical literature have addressed the problem with some other methods. In addition to solving the problem of heteroscedasticity, the PPML estimator also addresses the problem that X_{itj} sometimes takes the value of zero, in which case lnX_{ijt} is not defined.[4]

3.3 Sources of Data and Variable Definitions

The 15 members of the Economic Community of West African States (ECOWAS) are covered namely: Benin, Burkina Faso, Cape Verde, Cote d'Ivoire, Gambia, Ghana, Guinea, Guinea Bissau, Liberia, Mali, Niger, Nigeria, Senegal, Sierra Leone, and Togo. The scope of the study is the period 2006 to 2013, which is informed by data availability and to circumvent the problem of having highly unbalanced panel.[5] The variables identifier, the definition, the indicators, and a summary statistics and the source of data are presented in Table 1.

A glance at the summary statistics in the last but one column of Table 1 shows that, on the average, the total export value of an ECOWAS country was about USD 485.25 million, while the average income (GDP) stood at about USD 15, 912.50 million. The values in the Table also indicate that average distance between ECOWAS countries as trading partners is about 1313.00 km, while the level of their financial development 18.72 %. This appears low as the level of credit to private sector in their economies is lower than 20 %, which reveals that financial sector influence on their economies is less than one-fifth.

4 Empirical Results and Discussions

4.1 Trade Patterns of ECOWAS Countries

The major trade products and direction of trade of ECOWAS countries are presented in Table 2. The table indicates the top five countries that constitute the major export destination of ECOWAS countries, the top five countries where

[4]The variables (except those that are dummies, namely: *common coloniser*, *comlang_off* and *contiguity*) are presented in their logarithmic form to bring them in a more comparable unit of measurement and also to reduce the issue of heteroscedasticity (Olokoyo et al. 2009).

[5]However, the descriptive analysis spans 2000–2013; since a number of them dealt with average values.

Table 1 Variables definition, mean and source of data

Identifier	Definition	Measurement	Mean (S.D.)	Source
Exporter $_{ij}$	Exports of country *i* to country *j*	Total merchandise export at constant 2005 USD	485.26 (397.61)	World Bank, WDI
Exporter_GDP	Income (GDP) of exporting country	Real GDP at constant 2005 USD	15912.5 (3726.67)	World Bank, WDI
Importer_GDP	Income (GDP) of importing country	Real GDP at constant 2005 USD	15912.5 (3726.67)	World Bank, WDI
Distance	Distance between the exporting and importing country	Distance between the capital cities of the exporting and importing countries	1313.00 (721.80)	Index by Mayer and Zignago (2011)
Bilateral Trade Costs	Bilateral trade cost	Measures as the trade costs for each country pair using bilateral trade and gross national output for all sectors	111.05 (99.87)	World Bank UNESCAP Trade costs Database
Exporter_FD	Financial development of exporting country	Credit to the private sector as percentage of GDP	18.72 (12.65)	World Bank, WDI
Importer_FD	Financial development of exporting country	Credit to the private sector as percentage of GDP	18.72 (12.65)	World Bank, WDI
Common coloniser	Binary variable indicating whether or not both partners share the same colonial heritage	Dummy variable. Yes = 1, 0 otherwise	0.33 (0.47)	Hopkins (2006), Posner (2004)
Comlang_off	Binary variable indicating whether or not both partners have the same official language	Dummy variable. Yes = 1, 0 otherwise	0.37 (0.48)	Hopkins (2006), Posner (2004)
Contiguity	Binary variable indicating whether or not both partners share the same border.	Dummy variable. Yes = 1, 0 otherwise	0.24 (0.43)	Hopkins (2006), Posner (2004)

Source: The Authors'

ECOWAS imports originate as well as the top five export and import products. This is aimed at assessing the trade patterns of countries within ECOWAS as a regional bloc.

It is discernible from Table 2 that the product traded (especially from the *export angle*) by countries in ECOWAS have low value-added. In essence, the products being exported are either in their raw state or semi-processed. Most of the ECOWAS countries do not process their products. As a result of this, they are not able to create opportunities for further production of goods as well as processing such goods for both local and international markets. This reduces the length of the value-chain within the country, which reduces the economic activities and the

Table 2 Major trade partners and top five trade products of ECOWAS countries

Country	Export destination	Import origin	Export products	Import products
Benin	India (24), China (23), Lebanon (19), Mali (16), Viet Nam (3.9)	China (40), United States (7.7), India (7), Malaysia (5.6), France (5.5)	Gold (19), coconuts, Brazil nuts, and cashews (17), raw cotton (17), refined petroleum (16), rough wood (9.8)	Light pure woven cotton (11), cars (10), rice (7.7), palm oil (5.5), poultry meat (5.3)
Burkina Faso	Turkey (30), China (29), Belgium-Luxembourg (6.2), Côte d'Ivoire (4.4), and Mali (4.2)	Côte d'Ivoire (17), Ghana (16), France (14), Togo (6.6), and Mali (4.1)	Raw cotton (43), gold (36), other oily seeds (2.9), refined petroleum (2.4), and other pure vegetable oils (1.8)	Beauty products (5.8), packaged medicines (5.2), refined petroleum (4.9), cement (4.8), and mixed mineral or chemical fertilizers (3.8)
Cape Verde	Spain (64), Portugal (11), United States (4.3), El Salvador (4.1), and India (3.2)	Portugal (38), Netherlands (12), United States (8.8), Spain (8.4), and China (4.8)	Non-filet frozen fish (34), processed fish (27), crude petroleum (8.3), footwear parts (5.3), and water (3.6)	Refined petroleum (12), planes, helicopters, and/or spacecraft (7.2), cement (2.5), rice (2.4), and cars (2.2)
Côte d'Ivoire	Germany (9.2), United States (8.9), Netherlands (7.6), Nigeria (7.2), and France (6.2)	Nigeria (24), France (13), China (8.1), India (4.2), and Thailand (3.0)	Cocoa beans (22), refined petroleum (15), crude petroleum (10), rubber (7.8), and cocoa paste (6.6)	Crude petroleum (24), rice (7.1), special-purpose ships (4.1), non-filet frozen fish (3.2), and packaged medicines (2.6)
The Gambia	China (52), India (19), Mali (6.9), France (4.4), and United Kingdom (3.6)	China (29), Senegal (10), Brazil (8.5), United Kingdom (6.7), and India (6.3)	Rough wood (48), coconuts, Brazil nuts, and cashews (18), refined petroleum (6.8), ground nut oil (4.3), and titanium ore (4.0)	Light pure woven cotton (15), refined petroleum (5.6), raw sugar (5.3), rice (5.1), and palm oil (4.9)
Ghana	South Africa (27), United Arab Emirates (9.9), Switzerland (7.9), France (7.3), and Italy (6.7)	China (20), United States (9.6), Belgium-Luxembourg (5.2), United Kingdom (5.0), and Netherlands (5.0)	Gold (44), crude petroleum (18), cocoa beans (15), cocoa paste (2.3), and manganese ore (1.3)	Cars (5.5), delivery trucks (4.5), refined petroleum (3.8), large construction vehicles (2.4), and rice (2.2)
Guinea	India (13), Spain (12), Chile (12), United States (8.5), and Germany (8.2)	China (24), Netherlands (15), India (6.1), France (5.8), and United Kingdom (5.0)	Aluminium ore (51), petroleum gas (12), crude petroleum (11),	Refined petroleum (19), rice (4.7), rubber footwear (3.1), motorcycles (3.0), and

(continued)

Table 2 (continued)

Country	Export destination	Import origin	Export products	Import products
			aluminium oxide (4.6), and gold (3.8)	packaged medicines (2.3)
Mali	South Africa (47), China (17), Switzerland (10), Burkina Faso (3.2), and Côte d'Ivoire (2.5)	Senegal (20), France (12), China (11), Côte d'Ivoire (8.2), and Benin (4.4)	Gold (59), raw cotton (14), prepared cotton (8.5), mixed mineral or chemical fertilizers (3.7), and bovine meat (2.9)	Refined petroleum (22), cement (4.7), packaged medicines (3.7), telephones (3.4), and rice (2.3)
Niger	France (40), Mali (7.4), United States (7.0), China (6.9), and India (5.6)	China (19), France (12), United States (6.1), Japan (5.0), and Togo (4.9)	Radioactive chemicals (41), refined petroleum (16), uranium and thorium ore (12), used clothing (5.1), and petroleum gas (5.0)	Rice (7.5), excavation machinery (4.0), cars (4.0), delivery trucks (3.9), and packaged medicines (3.5)
Nigeria	United States (17), India (11), Spain (7.3), Brazil (6.7), and South Africa (5.1)	China (19), United States (11), India (6.4), Netherlands (6.1), and United Kingdom (4.9)	Crude petroleum (72), petroleum gas (14), refined petroleum (5.3), rubber (2.2), and cocoa beans (1.4)	Refined petroleum (14.43), cars (6.54), rice (3.16), wheat (3.10), and telephones (2.80)
Senegal	Mali (22), India (11), Switzerland (10), Guinea (3.7) and Italy (3.1)	France (13), Nigeria (12), United Kingdom (7.0), China (6.4), and India (6.0)	Refined petroleum (19), gold (11), phosphoric acid (8.8), cement (6.9), and non-filet frozen fish (6.4)	Refined petroleum (16), crude petroleum (10), rice (6.2), packaged medicines (2.4), and petroleum gas (2.2)
Togo	Cameroon (10), India (9.5), Burkina Faso (8.5), Lebanon (8.2), and Ghana (7.7)	China (26), Netherlands (16), Belgium-Luxembourg (6.2), France (5.4), and Ghana (4.6)	Refined petroleum (12), cement (12), calcium phosphates (11), gold (11), and crude petroleum (3.8)	Refined petroleum (39), palm oil (2.3), petroleum gas (2.2), synthetic filament yarn woven fabric (2.1), and motorcycles (1.9)

Note: The values reported show the top five for each category and represent averages for 2012. The values in parentheses are the percentage share of each product in the total export/import basket of the country

Source: Authors' compilations based on Hausmann et al. (2011) and Simoes and Hidalgo (2011)

expected benefits in terms of job creation, service provision and the general multiplier effects (Table 2).

There are some reasons that could account for the above pattern. First, the cost of processing these products could require large initial investments that are not readily

available in some of the ECOWAS countries. In this case, the investment could be tied to the sophisticated technology necessary for value addition (Morrissey and Mold 2006). Second, most of the producers of the export products like cocoa and coffee are *atomistic* smallholders or are dominated by small number of large firms, who are involved in the production of raw value of these products and are at the bottom of the value chain, as well as, and suffer from the non-competitive behaviour of other agents along the chain (Depetris-Chauvin and Porto 2014). Third, the transaction costs to create value from these products could be high. High transaction costs include the cost of licensing, cost of transportation, cost of protecting property rights, etc., are regular features in the business environment of many ECOWAS countries, with Nigeria being at the forefront (Osabuohien and Efobi 2011; Asongu 2013, 2014; Efobi et al. 2014; Efobi 2015; Efobi and Osabuohien 2016).

In some of the member countries, there is a higher demand and taste for imported products than the locally produced substitute. For instance, Nigeria (like many other ECOWAS countries) has the capacity to be involved in rice production and export due to its fertile land and rich agro-climatic conditions. However, the country's local rice still accounts for less than 50 % of its local consumption. Instead, the country imports rice from Thailand, India and Brazil as urban consumers (who constitute a huge percentage of domestic consumers) prefer the imported rice to the locally grown rice (Depetris-Chauvin and Porto 2014).

Another relevant point to highlight from Table 2 is that there are a lot of similarities in the main export products of ECOWAS countries. For instance, most of these countries export agricultural products like cotton, tobacco, cocoa, sesamon, coffee, bovine animals, among others. Some others export natural resources like crude oil, gold, uranium, ore concentrates, among others. The main explanation for the similarity of exports can be traced to the inability of the ECOWAS countries to drive value addition by ensuring that some of the major export products are processed within the country and more sophisticated products are created from such a process (Efobi and Osabuohien 2016). This would not only increase trade diversity, but also increase the competitiveness of products from these countries in the global market. This is tied to the arguments of the contributors to the New Trade Theory that a country tend to witness economics of scale as it specialises in the value addition processes. Processing of the products would equally increase their shelf-lives and overcome the challenge of losing a large quantity of perishable agricultural products. This has remained a major problem in some ECOWAS member countries (Olayemi et al. 2012).

Taking a look at the top five export destination of ECOWAS countries, it is evident from Table 2 that most of ECOWAS exports are directed towards developed countries in Europe and America, and emerging countries in Asia. Countries like China, France, Germany, India, Indonesia, Netherlands, Spain, Switzerland, United Kingdom, and USA dominate the export destination of most of the ECOWAS countries. On a related note, it will be difficult to raise demand for ECOWAS export in the face of their production of similar primary products. The implications from the foregoing include: primary products and commodities remain

the major exporting products of ECOWAS countries. Processing these products could create diversity and then enhance specialisation, which will boost intra-regional tradability. This essential step will require a resilient and reliable financial sector to support such activities, which makes financial development a relevant factor of trade flows.

4.2 Analytical Framework: Financial Development and Trade

Beck (2002) provides a theoretical explanation on the possible linkage between financial sector development and trade by focusing on the role of financial institutions in facilitating high-return manufacturing projects. The main intuition from the author's model is that countries with a better-developed financial system have a higher export share and trade balance in manufactured goods. Pramesti (2010) tested this linkage by focusing on the bilateral trade relationship between United States, Japan and Germany, and 47 partner countries for the period 2003 to 2007. The author concurred with Beck's finding that financial development matters for trade. Thus, this study argues that value addition that will enhance intra-regional trade flow will require viable financial sector, which will provide capital to the firms for value adding activities.

With respect to trade, the financial sector plays important role to two key beneficiaries. It provides finance to facilitate the activities of the consumers as well as those of the producers. The major activity of the consumers, in relation to intra-regional trade is to import the produced goods from member countries and make it available for the local market (see Left hand side-LHS of Fig. 1). The producers, on the other hand, require the financial sector to fund their productive activities in both the primary sector as well as in value addition. This facilitates the volume of goods made available for export (see the right hand side-RHS of Fig. 1). Importantly, the financial sector provides finance in the form of trade credits and loans as an alternative source of funds to agents involved in international trade.

The value addition to enhance intra-regional trade flow will require a viable and resilient financial sector, which will provide capital to the households and firms for value adding activities. In essence, the development of the financial sector in ECOWAS member countries will provide support for firms to realise their potential of participating in international trade; for example by capturing markets within the regional bloc. This can be achieved by increasing the production of value-added commodities to reduce the extent of product similarity that can hinder trade among member countries. The common market structure of the ECOWAS commission makes it possible for the financial sector of member countries to play their intermediation role within the entire region. This implies that the financial sector of one member country can freely provide services in other member countries, thereby

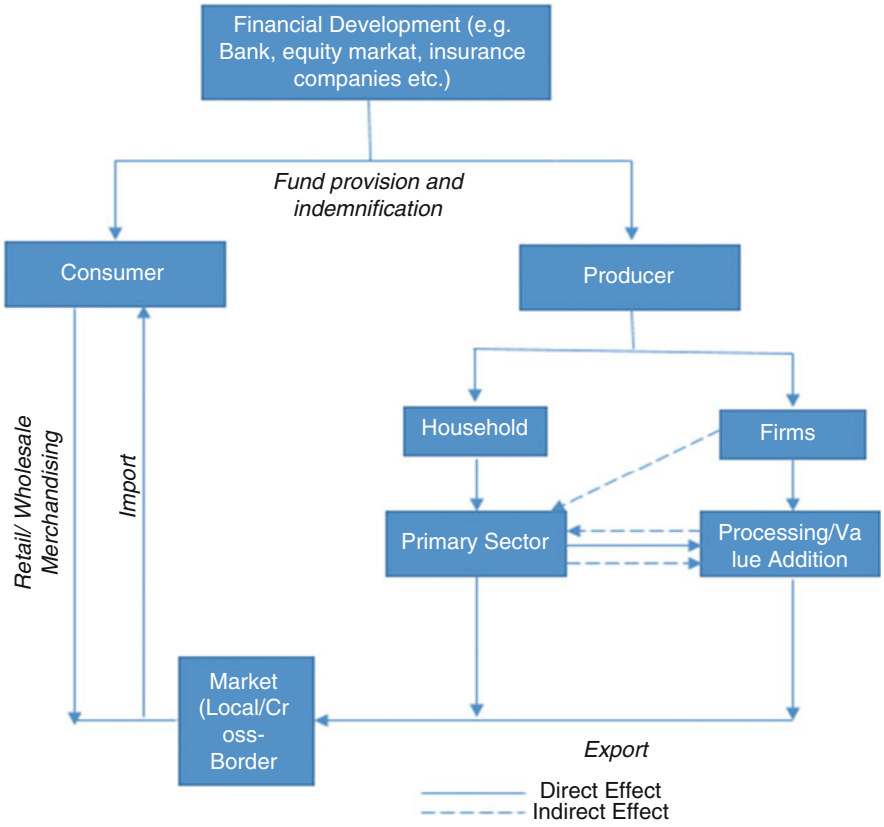

Fig. 1 Analytical linkage between financial development and trade flows. *Source:* Authors'

creating a broader network of financing opportunities for the development of industries.

An example of the participation of the financial sector is seen in the across border activities of some players in the Nigerian financial sector. Table 3 provides evidence on how the development of the financial sector in Nigeria has spanned across the ECOWAS sub-region. Most importantly, the presence of these banks in other countries in Africa will provide a wider span of development of the banking sector in the respective countries. This arises as a result of competition in the sector, thereby making other players to improve on their service delivery in order to maintain their market share. Another important outcome from this form of cross-border financial sector development is that it will create a uniform financial sector development trajectory for the member countries. For instance, the financial sector in ECOWAS member countries can portray uniform indices of development since other players (banks) can learn from the presence of these regional banks.

In assessing the relevance of financial sector development to the economies of ECOWAS countries, some indicators like broad money supply, domestic credit

Table 3 Cross border branches of selected Nigerian banks

Banks	Cross-border branches
Access Bank	Cote d'Ivoire, The Gambia, Ghana and Sierra Leone
United Bank for Africa (UBA)	Benin, Burkina Faso, Cote d'Ivoire, Ghana, Guinea, Liberia and Sierra Leone
Guaranty Trust Bank (GTBank)	The Gambia, Ghana, Liberia and Sierra Leone
Zenith Bank	Ghana, Sierra Leone and The Gambia
Keystone Bank Limited	The Gambia, Ghana, Liberia and Sierra Leone

Source: Dada and Adeleke (2015: 102)

provided by the banking sector, and domestic credit to private sector all as a percentage of GDP are presented in Fig. 2a–c. Most of the countries experienced a slow but rising trend in their broad money supply to GDP; this is apart from Ghana that experienced marked fluctuations between the periods presented. Ghana's trend experienced a drastic reduction from 2009, which may be related to the global financial crisis.

The extent of domestic credit by the banking sector to the private sector as a percentage of GDP in Fig. 2b reveals that the banking sector contributes marginally to the economy. In effect, they have not been able to maximally support the real economy in terms of adequate provision of credit. Most of the banks engage in short term loans, which do not support much for business development with long gestation period such as agricultural and the manufacturing sectors. Most of the countries presented have the values below 35 % in terms of credit to the private sector for the period 2002–2010. Afterwards, some countries like Togo and Ghana witnessed slight increase.

Likewise, Fig. 2c presents the trend in domestic credit to private sector as a percentage of GDP for ECOWAS countries. A cursory look at the figure shows that most of the countries had values lower than 20 % for the period 2002–2010. Just a very few of the countries had values above this threshold. The value of the total domestic credit to the private sector in Nigeria between 2006 and 2009 witnessed sharp decline. The consolidation in the domestic banking sector in 2005, along with abundant capital in the wake of rising oil prices, can be associated with the rise of credit creation with significant flows to the private sectors. This boom ended in a burst with a systematic banking crisis in 2009: this accounts for the drastic reduction of the trend to almost 10 % for the remaining periods after 2009.

The reason for the low contribution of the financial sector to the economy of most countries in ECOWAS region can be traceable to a number of factors. Some of which include the size and structure of the players: many of the large banks in this region are relatively smaller when compared to mid-sized banks in high-income countries. The inaccessibility of capital seekers to funding from the financial sector players is another important drawback. In some of these countries, large segments of small firms, and even those in the agricultural sector, have limited access to formal financial services, thus resort to informal financials services (Osabuohien

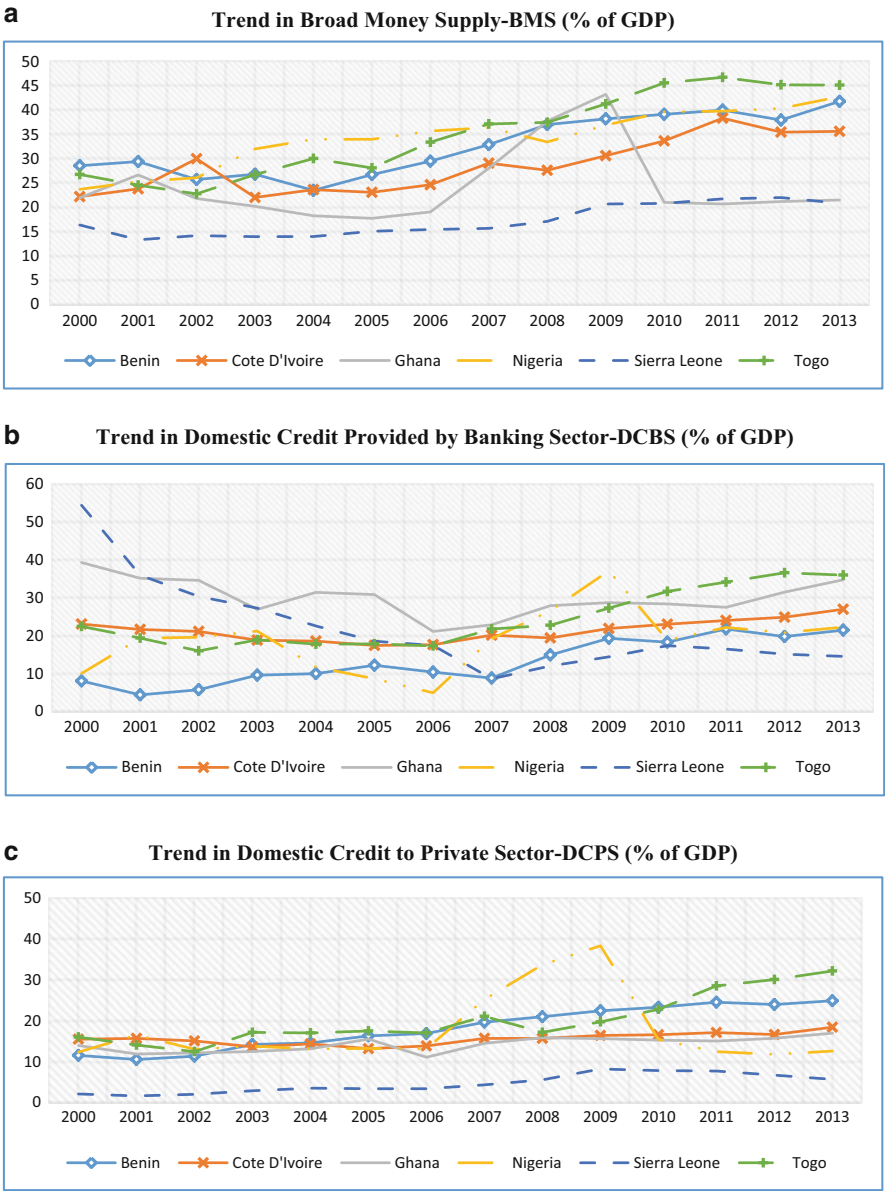

Fig. 2 (**a**) Trend in broad money supply-BMS (% of GDP). (**b**) Trend in domestic credit provided by banking sector-DCBS (% of GDP). (**c**) Trend in domestic credit to private sector-DCPS (% of GDP). *Note:* The countries plotted in the graphs are those with complete data within the period considered. BMS includes the sum of all money in circulation as a percentage of GDP; DCBS measures banking sector depth and financial sector development in terms of size. DCPS measures the amount of credit transmitted to the private sector for production, consumption and capital formation. *Source:* Authors' computation using data from World Development Indicators

and Duruji 2007; Griffith-Jones et al. 2014). The bottlenecks confronted in enjoying the services of banks accounts for a major explainer of the reasons for the limited access to financial services. Some of the criteria for accessing fund from the banks, in terms of collateral and documentations, are so high (Beck and Cull 2013); this discourages small firms. This leaves these firms disadvantaged—in terms of capital base—compared to competitors. As a consequence, most of these firms depend on internal cash flow as a major source of investment finance. This is probably why most of them have not been able to engage in huge capitalisation to break into the export market.

Noting the trend in the extent of development of the financial sector and the performance of intra-regional trade flow among ECOWAS countries, we test, using the gravity model, our intuition on the performance of the financial sector having a contributory effect on the extent of intraregional trade flow.

5 Results from Econometric Estimations

The regression results for the augmented gravity model are presented in Table 4. The Table comprise estimates from the Panel Ordinary Least Squares (POLS), the fixed and random effects, the Poisson Pseudo-Maximum Likelihood (PPML), as well as the Generalised Method of Moments (GMM) estimation techniques. The POLS results constitute the benchmark analysis, in which it is observed whether the variables included in the model significantly explains the level of bilateral trade flows before proceeding to the PPML and GMM results.

As a check, the overall significance of the POLS model is examined. Columns 1–3 of Table 4 present the Wald statistics at the lower segment. It reveals that the overall model is significant, implying that the independent variables jointly have explanatory power in explaining the dependent variable. Specifically, the POLS results show the following: the income levels of both the exporter and importer countries are important in determining bilateral trade flows in ECOWAS countries. A 1 % increase in exporter GDP explains a 0.26 % increase in trade, while a 1 % increase in importer GDP explains a 0.18 % increase in trade. The results from the POLS are treated with some elements of caution given the weaknesses of POLS; hence, the results from the PPML and GMM are discussed herein.

The PPML and the GMM are alternative estimation techniques that attenuate the weaknesses of the POLS. As a result, more reliable estimates from the PPML and GMM estimation compared to the POLS are presented in Columns 5 and 6 in Table 4. Compared to the POLS results, the coefficients obtained from PPML point to the same direction but are considerable smaller. From the table, income of the exporter and importer countries, distance, bilateral trade cost, common language and common coloniser are important determining factors that explain bilateral trade flow in ECOWAS sub-region.

Focusing on the financial development of the exporting country, the variable is significant using both the PPML and the GMM estimators (i.e. Columns 5 and 6).

Table 4 Econometric results on the determinants of trade flows

Dependent variable: bilateral trade flow						
	(1)	(2)	(3)	(4)	(5)	(6)
	POLS	Random effects	Random effects (robust)	Fixed effects	GMM (system)	PPML
Exporter_GDP	0.260***	0.253***	0.253***	0.813	0.812	0.0465***
	(0.041)	(0.057)	(0.068)	(0.951)	(0.574)	(0.008)
Importer_GDP	0.183***	0.180***	0.180***	1.647*	0.789	0.034***
	(0.039)	(0.055)	(0.057)	(0.929)	(0.594)	(0.007)
Exporter_FD	−0.254*	−0.077	−0.077	−0.0418	1.329**	0.047**
	(0.131)	(0.159)	(0.159)	(0.261)	(0.518)	(0.020)
Importer_FD	−0.171	−0.084	−0.084	−0.140	1.546***	0.0333**
	(0.111)	(0.139)	(0.217)	(0.248)	(0.507)	(0.029)
Bilateral trade costs	0.178***	0.126***	0.126***	0.129***	0.035*	0.033***
	(0.024)	(0.023)	(0.033)	(0.0276)	(0.057)	(0.005)
Distance	−0.400***	−0.375**	−0.375**		−18.620***	−0.073***
	(0.111)	(0.157)	(0.186)	–	(6.519)	(0.021)
Common coloniser	−0.273	−0.342	−0.342		−31.390***	−0.046*
	(0.265)	(0.375)	(0.222)	–	(8.743)	(0.027)
comlang_off	0.936***	0.992***	0.992***		22.480***	0.165***
	(0.261)	(0.368)	(0.256)	–	(4.577)	(0.032)
Contiguity	0.029	0.007	0.007		58.99***	0.007
	(0.151)	(0.214)	(0.216)	–	(20.300)	(0.023)
Btrade_1					−0.134	
	–	–	–	–	(0.124)	–
Constant	4.940***	4.321***	4.321**	−15.47**	−132.2***	1.606***
	(1.015)	(1.402)	(1.740)	(6.009)	(42.34)	(0.187)
Observations	805	805	805	805	671	805

(continued)

Table 4 (continued)

Dependent variable: bilateral trade flow						
	(1)	(2)	(3)	(4)	(5)	(6)
	POLS	Random effects	Random effects (robust)	Fixed effects	GMM (system)	PPML
R-squared	0.189	–	–	0.037	–	0.170
F-test (Wald tests)	20.63	90.43	35.05	5.14	98.56	–
F-test (p-values)	0.0000	0.0000	0.0001	0.0001	0.000	–
Hansen	–	–	–	–	0.515	–
AR (1)	–	–	–	–	0.002	–
AR (2)	–	–	–	–	0.780	–
AR (3)	–	–	–	–	0.624	–
Number of Instruments	–	–	–	–	17	–

Some robustness checks were carried out such as the inclusion of the variable *remoteness*. There was no much change in the pattern of the result; hence, not reported for space

Note: Btrade_1 is the bilateral trade flow of the previous years. The variables are in their logged values. Standard errors are in parentheses. ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$

Source: Authors'

This suggests that an improvement in the exporter's financial sector is an important factor in accounting for the variation in bilateral trade flow of ECOWAS countries. Since we are relying on the PPML and SGMM estimation techniques for inference, the results from Table 4 confirm the importance of the financial development in ECOWAS countries can exert influence on the bilateral trade flows in ECOWAS sub-region.

The mechanisms through which financial sector development affects trade flows are twofold: First, the financial sector plays an intermediary role by receiving funds from the surplus unit of the society and making it available to the deficit unit for investment and production. In the case of ECOWAS countries, the financial sector can enhance intra-regional trade by providing finance to business activities especially those that are involved in trade, leading to the expansion and production prospects. Thus, allowing businesses to develop the capacity to supply neighbouring countries with their products. When business activities are supported, in terms of making capital easily accessible and less costly, they can expand, and neighbouring countries can benefit from the supply of this unique product. This result supports the UNCTAD (2015) report that the support of the private sector, especially through creation of cheaper and easily accessible credit, will bring about the realisation of regional integration.

Second, the improvement of the financial sector will reduce the transaction cost associated with banking services for intra-regional trade. Most cross-border transactions may not require the transfer of physical cash because of its diverse risks (e.g. theft and other security issues) and costs (e.g. time and economic resources). Policies geared towards improving transparency and efficiency in banking operations as well as curtailing money laundering will build public confidence in the financial sector of both the exporting and importing countries in ECOWAS. This is relevant because in countries where the financial sector is not developed, the transfer of funds between suppliers and customers slows down the execution of the business. Through these channels, financial sector development can influence intra-regional trade.

In furtherance, apart from the significance of the variable of interest, it is also important to comment on the elasticity of the variables. This is because as a double logged model, we interpret the estimates in terms of their elasticity. While the PPML reports that the significant relationship between the financial development and trade flows is inelastic (implying that changes in the independent variable would lead to less than proportionate change in the dependent variables), the GMM result shows that the parameter estimates are elastic. This implies that small changes in the independent variable would result in more than proportionate change in bilateral trade flow.

Since we are relying on the PPML and SGMM estimation techniques for inference, the results from Table 4 confirm the importance of the financial development sector in improving bilateral trade among ECOWAS countries. The mechanism through which the financial sector development affects trade flow can be explained in two facets: first, the financial sector plays an intermediary role by receiving fund from the surplus unit of the society and making it available to the

deficit unit for investment and production. In the case of ECOWAS countries, the financial sector can enhance intra-regional trade by providing finance to business outfits and small businesses, leading to the expansion and production prospects. This will make businesses to develop the capacity to supply neighbouring countries with their products. A relevant example is the textile industry in Nigeria. Some of the players in the industry are small-scale businesses that engage in *tie* and *dye* for small number of customers. When these businesses are supported, in terms of making capital easily accessed and less costly, they can expand their production and neighbouring countries can benefit from the supply of this unique product. For the importing country, the financial sector can provide upfront capital, guarantee loans and other source of relevant finance to facilitate the import of products from the neighbouring countries. The overall effect is that the value of the consumers in both the importing and exporting country will be enhanced.

Second, the improvement of the financial sector will reduce the transaction cost associated with banking services for intra-regional trade. Most cross-border transactions may not require the transfer of physical cash because of the diverse risks (e.g. theft and other security issues) and costs (e.g. time and economic resources) of this form of cross-border transaction. The above suggests that policies geared towards improving transparency and efficiency in the banking operations as well as curtailing money laundry will help in building public confidence in the financial sector of both the exporting and importing countries in ECOWAS. All of these will have influence on intra-regional trade.

6 Summary and Conclusion

This study, which is motivated, among others, by the debate on the role of financial development (FD) as a determinant of bilateral trade performance, provides an empirical investigation on the effects of FD and trade cost on bilateral trade flows in Economic Community of West African States (ECOWAS) for the period 2006 to 2013. This is deemed crucial based on the fact that low level of intra-regional trade is witnessed in ECOWAS and a number of countries within the ECOWAS sub-region have shown some efforts to integrate the financial sector. It argues that an improvement in FD in the member countries will provide one of the required structures that will increase bilateral trade flows.

To achieve its objective, the study engages both descriptive and econometric analyses. The econometric aspect utilises the augmented gravity model of trade to explain the effects of FD on bilateral trade flows, which is estimated using Panel Ordinary Least Squares, Poisson Pseudo-maximum Likelihood and Generalised Methods of Moments techniques. A number of findings are made and the major ones are summarised herein.

Most of the exported products by ECOWAS countries are of low value added composition: they are mainly in their raw state or in few cases semi-processed. The implication of this is that most ECOWAS countries do not process their products,

which reduces the value-chain and limits the associated potential to trade among themselves. Thus, efforts and policies such as increased investments in the processing of products in ECOWAS countries will be laudable in enhancing the intra-regional tradability as it will help to reduce the effects of too many similarities in the main line of export products. This will increase trade diversity and intensify the penetration as well as competitiveness of their products.

Evidences also show that the monetary assets available in many economies of the ECOWAS sub-region are quite low with minimal contribution of the banking sector to their economies. This might have resulted from a number of challenges such as low level of infrastructural provision faced by the banking sector in ECOWAS member countries, which limits their provision of broad-based financial services. This denotes that for the financial development to witness satisfactory improvement there is the need to boost the services from the banking sector, which will eventually enhance trade flows.

It is established that FD of both exporting and importing countries are significant determinants of bilateral trade flows in ECOWAS. This connotes that when there is increased credit availability to the private sector, there will be marked improvement in the level of bilateral trade flows. Thus, it is recommended that policies such as more transparent and efficient banking operations and curbing illicit money laundry be pursued with resilience with a view to enhancing the development and public confidence in the financial sectors of both the exporting and importing countries in ECOWAS. This will help to boost the flow of credit to firms that are involved in trading activities within the ECOWAS sub-region. The role of the ECOWAS Commission as a regional focal point in encouraging member countries to actively position their financial sector in this wise is essential.

As a suggestion for further research, it will be expedient to complement this study using other components of financial development that covers access, efficiency and stability. It is also recommended that further studies examine the role of financial development in influencing bilateral trade flows in other regional economic communities in Africa such as COMESA, ECCAS, EAC and SADC, with a view to comparing their experiences with that of ECOWAS.

Acknowledgements This paper draws from the research project supported by United Nations Conference on Trade and Development Virtual Institute (UNCTAD Vi) on 'Localization of Teaching Material on Regional Trade Agreements for ECOWAS'. The comments and suggestions from Julia Seiermann, Vlasta Macku and Alessandro Nicita of UNCTAD, are appreciated. The initial draft of this paper was presented at the Sixth Annual Conference on Regional Integration in Africa (ACRIA 6), 1st–3rd July, 2015 at West African Institute for Financial and Economic Management (WAIFEM), Lagos, Nigeria. The full support from the organisers to participate, helpful comments from the discussant (Prof. Oladele Omosegbon of Indiana Wesleyan University, USA), and other participants, are acknowledged. Evans Osabuohien also acknowledges the supports from the Alexander von Humboldt Foundation (AvH) under its 'Return Fellowship Award' during which period the paper was written. The views expressed are authors'.

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Upgrading in Value Chain: The Case of Sub-Saharan African Countries

Manfred Kouty and Patrice Bonaventure Ongono

1 Introduction

Global trade has grown exponentially over the last decade. The volume of global trade in goods and services has increased by 10 % on average between 2000 and 2010 (WTO 2012). One of the striking features of the evolution of global trade is that traded commodities are increasingly composed of intermediate goods (United Nations 2013)[1]. About 60 % of global trade consists of trade in intermediate goods. The trade in intermediate goods represents more than half of the goods imported by economies in the Organization for Economic Co-operation and Development (OECD) and about three-quarters of the imports of large developing economies, such as China and Brazil (WEF 2012)[2]. These intermediate goods are incorporated at various stages in the production process of final goods. The increasing importance of intermediate inputs in global trade is reflected in the rising fragmentation of production processes in the world and has led the emergence of the concept of Global Value Chain (GVC). The GVC includes the full range of activities that firms undertake to bring a product or service from its conception to its end-use by final consumers (Porter 1985; Kaplinsky and Morris 2001). These activities include design, production, marketing, distribution and support to the final consumer.

[1]United Nations (2013). *World Investment Report 2013: Global Value Chains: Investment and Trade for Development,* Switzerland.

[2]World Economic Forum (2012). *The Global Enabling Trade Report 2012: Reducing Supply Chain Barriers*, Switzerland.

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D. Seck (ed.), *Investment and Competitiveness in Africa*, Advances in African Economic, Social and Political Development, DOI 10.1007/978-3-319-44787-2_9

GVCs have become an important factor of link between trade openness and growth. It enhances the possibilities for countries to overtop their traditional comparative advantages and access new types of production. It also provides opportunities that developing country enterprises or firms can exploit to upgrade their activities. Upgrading is acquiring technological, institutional and market capabilities that allow firms to improve their competitiveness and move into higher-value activities (Gereffi and Memedovic 2003). Following Kaplinsky (2000), it is the capacity to upgrade into rent-rich activities that underpins sustainable income growth, export generation and job creation.

Since the year 2000, the share of global value added trade captured by developing economies is increasing rapidly. It grew from about 30 % in 2000, to over 40 % in 2010 (United Nations 2013). Among the developing regions in the world, Africa is one where regional value chains are relatively less developed. Many African countries are still struggling to gain access to GVC beyond natural resource exports (Downstream component).

The low position of Africa in GVC raises the interrogation about the determinants of upgrading in GVC in these countries. This interrogation is important because it gives us a tool to understand why some countries are unlikely to benefit from trade and provides a key starting point in understanding the dynamics of industrial organization in African perspective. Understanding the determinants of upgrading in sub-Saharan African countries would give us a series of practical strategies to empower firms upgrading in GVC.

Despite the abundant literature (Humphrey and Schmitz 2000; Gereffi and Memedovic 2003) on the GVC, little is known about the determinants of upgrading in African countries at the firm level. Apart from the study of Kaplinsky and Wamae (2010) in the cases of Kenya and Madagascar countries, there are no studies which address the issue of African countries using the econometric approach.

The objective of this study is to analyse and evaluate the factors which influence firms upgrading sub-Saharan African countries: Cameroon, Cote d'Ivoire and Mauritius. We focus on these three sub-Saharan African countries economies for three reasons. First, the availability of data. Second, Cameroon, Cote d'Ivoire and Mauritius are central, western and southern African countries respectively. Second, as will be shown below, these countries represent each one an important part of the economy of their regional communities[3]. Understanding the strategies used by the firms of these countries to upgrade can help to learn lesson about the sub-Saharan region in general.

The rest of the paper proceeds as follows. The next section presents the African countries in GVC. This is followed by a brief review of the literature. Section 4 outlines the results and Sect. 5 concludes with a discussion of policy implications.

[3]These communities are respectively: the Economic Community of Central African States (ECCAS); the Economic Community of West African States (ECOWAS); the Common Market for Eastern and Southern Africa (COMESA).

2 Africa in the GVC

Figure 1 presents the participation of some regions into GVC. Two indicators are generally used in the literature to measure the integration of countries in GVC: the backward integration and the forward integration (AFDB, OECD, UNDP 2014). The backward integration is measured by the share of foreign value added embedded in a country's exports while the forward integration is measured by the share of a country's exported value added that is further exported by the importing country. As the Fig. 3 shows, Africa's participation in global value chains is fairly high (about 55 %) compared to other developing regions. However, the forward integration dominates the participation of Africa in GVC. This imply that Africa's region is a source of raw materials for many global value chains. The backward integration is low (about 20 %) implying that the foreign intermediate products represent a small part of Africa's exports.

Many factors can justify the low participation of Africa in GVC: the Africa trade pattern, the insufficient infrastructure (transport, communication. . .), the lack of institutional support, the lack of enterprises capacities and entrepreneurial capabilities.

The African trade pattern shows that the continent has diversify its trade partners (Fig. 2). Although the European Union attracted about the thirds of African exports and sourced more than thirds of African imports, their influence decline steadily by the emerging partners, especially China and India. However, the diversification of Africa's trade partners doesn't induce the diversion of exportation. Africa's exports remain dominated by the primary products such as hydrocarbons, cocoa and coffee and, it imports by final consumer goods. This trade pattern causes the poor marginalization of Africa in manufacturing GVC. For example, in 2011, more than half

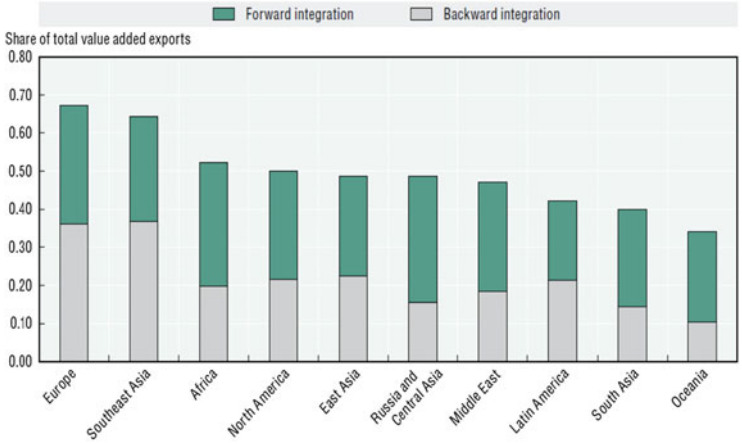

Fig. 1 Integration of world regions into GVC (2011). *Source*: African Economic Outlook 2014

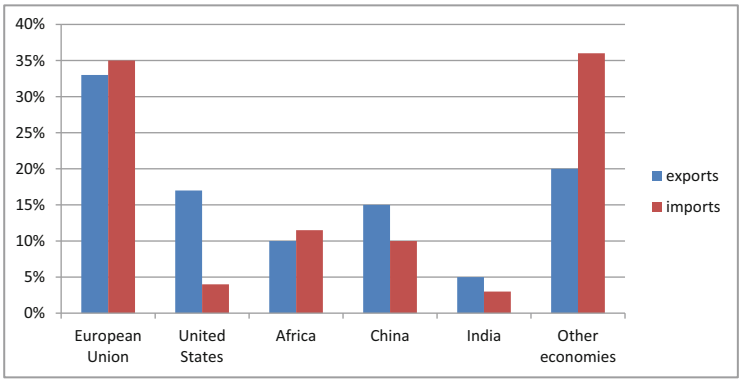

Fig. 2 Africa's main export destination and origin of imports in 2011 (%). *Source*: Author based on UNCTADSTAT data base available at www.unctad.org

of the 54 African countries have the export product concentration index[4] equal to or higher than 0.40, and one quarter of them have an index equal to or higher than 0.60 (United Nation 2013).

For Cameroon, Cote d'Ivoire and Mauritius, the index is respectively 0.38, 0.38, 0.25. Likewise, all African countries have a diversification index[5] of 0.5 or higher, meaning they have lower diversification levels than the world average. The diversification index is 0.71, 0.70 and 0.71 for Cameroon, Cote d'Ivoire and Mauritius respectively.

The poor diversification of African economies reflects the weakness of Africa's industrial sector. While the Middle East and North Africa, and the East Asia and Pacific countries experience the contribution of industry value added to GDP, the SSA countries record one of the lower performances among developing countries since 2001 (Fig. 3). The rapid transformation of Asia's developing economies to higher-technology and knowledge-intensive sectors explains the good industrial performance of these countries. This Africa's underdeveloped industrial sector explains why many African countries are still at the bottom of GVC.

Other reasons explain the failure of Africa to participate more effectively in GVC. They range from inadequate transport, energy and telecommunications infrastructure to cumbersome border procedures and poor business environments. These factors are locational determinants that act as precondition for countries access to GVC (WEF 2012). For example, the high costs of transport and energy,

[4]For the export product concentration index, values closer to 1 indicate an economy more dependent on exports of one product.

[5]The export diversification index ranges from 1 (largest difference from world average) to 0 (alignment with world average).

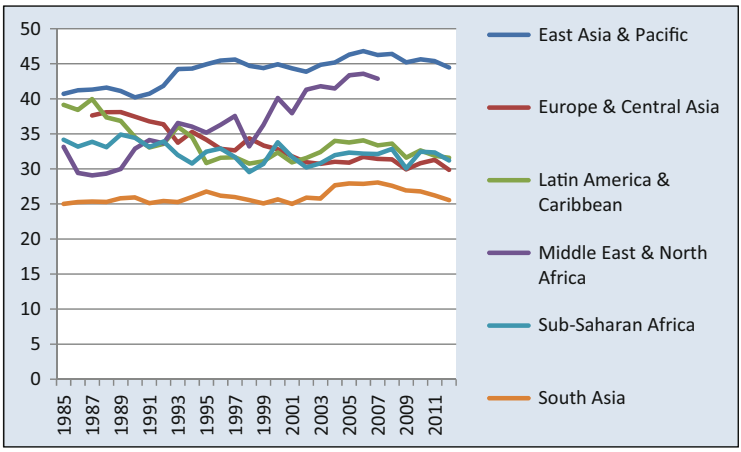

Fig. 3 The evolution of the industry value added (% of GDP). *Source*: Author base on World Bank database available at www.worldbank.org

and poorly trained workforce affect the productive capacities and the integrations of firms into GVC. The poor business environment also affect the participation of Africa countries to GVC through its negative effects on Foreign Direct Investment (FDI). In 2012, Africa have received only 3.7 % of FDI compare to 24.1 and 18.1 % for Asia and Latin America respectively (United Nations 2013).

3 Literature Review

Extensive literature reviews can be found in Gibbon (2008), Kaplinsky and Wamae (2010), WEF (2012), Johnson and Noguera (2012), and United Nations (2013). We summarize briefly the typology of upgrading strategies and discuss the empirical studies.

3.1 How Can Firm Upgrade?

The literature (Porter 1985; Humphrey and Schmitz 2000; Kaplinsky and Morris 2001; Gereffi and Memedovic 2003) distinguishes four typology of upgrading strategies. The first is the process upgrading which include improvement in process efficiency, new embodied technologies, and new forms of organization within the firm and throughout the chain. The second is product upgrading and consists of the improvement of the product/service quality, the introduction of new products/services, and product/service variety. The third is the functional which involves

Table 1 Upgrading strategies

Upgrading	Process	Product	Functional	Chain
Typology	Improving the efficiency of internal processes	Introducing new Products/services, or improving old products/services	Increasing value added by changing the mix of activities conducted within the firm or moving to different links in the value chain	Moving to a new value chain
Examples	Improving quality control processes in the plant	A beverage company introducing a new flavoured drink	Moving from manufacturing to design	Moving from manufacturing mobile phones to smart phones

Source: Adapted from Kaplinsky and Morris (2001)

the capacity of individual producers to change their functional position in the chain (moving into higher-rent activities such as branding, marketing etc.). The fourth is the chain upgrading or the capacity to move into wholly new chains (Table 1).

The firms can also adopt horizontal coordination (development of relationships among firms at the same level of the value chain) and vertical coordination (developing relationships among firms at different levels of the value chain) to upgrade. Another important factor which is exogenous to the firm is related to the Country-specific operating conditions (Upgrading of the enabling environment) include the changes to the external governance of the value chain.

3.2 Previous Research

Bair and Gereffi (2001) find that US buyers have contributed in an important way to process and product upgrading in the blue jeans cluster of Torreón in Mexico. Bazan and Navas-Aleman (2003) find that in the Sinos valley (southern Brazilian), local suppliers were discouraged from functional upgrading by their main US buyers who did not want to share their core competencies in design, marketing and sale with them. The authors also show that firms operating in quasi-hierarchical value chains experience extensive product and process upgrading but very little functional upgrading. In contrast, functional upgrading for firms operating in market-based chains is high and process and product upgrading moderate. Functional upgrading capabilities are acquired in the national market and transferred to exporting activities. Schmitz (2004) on his study proves that upgrading prospects of local enterprises differ according to the type of global value chain they feed into. Giuliani et al. (2005) analyse the manufacturing natural resources complex products software in Latin America and find sectoral specificities matter and influence the mode and the extent of upgrading in clusters integrated in global value chains.

Wang and Cheng (2010) explore the critical challenges encountered in the transformation process of Hong Kong from a freight transport hub city to a

knowledge-based global supply chain management center (GSCMC). The exploration involves an examination of the structural issues of the logistics industry in Hong Kong within the framework of global value chains (GVC). The result suggests the upgrading of Hong Kong from a port city to a supply chain management center.

In the African context, Kaplinsky and Wamae (2010) study the cases of Kenya and Madagascar countries and find that firms selling into multiple markets are more likely to upgrade than those selling into single markets. They also find that the large sales volumes of low-price products into the United State in particular tend to foster a dependence on buyers for upgrading, and this invariably only addresses process efficiency, rather than product and functional upgrading.

4 Upgrading: What Does Firm Level Evidence Show?

In this section we present in firstly, the detailed findings, organized in terms of each of the two types of upgrading (process and product) and the firm characteristics. Secondly time, we regress the characteristics of value chain structure on upgrading variable. All the analysis is based on enterprise surveys[6] database of World Bank. Our database contents 1287 firms for three sub-Saharan African countries (Cameroon, Côte d'Ivoire and Mauritius) for the year 2009. The choice of this year can be justified by the availability of the data for all these three countries (Table 2).

Figure 4 gives a first impression of the probability of upgrading according to major firm characteristics. The data show that Asian-owned firms are more likely to introduce new process and products than the European-owned and African-owned one (Fig. 4a).

Table 2 Distribution of firms by countries (2009)

Countries	Cameroon	Cote d'Ivoire	Mauritius
Firm size[a]			
Micro firms	125	328	151
Small firms	145	141	156
Medium firms	72	48	72
Large firms	21	9	19
Total	363	526	398

Source: Author base on enterprise surveys

[a]The firm size is function of number of permanent workers. *Micro firms* with employees < 11; *Small firms* with 11–50 employees; *Medium firms* with 51–250 employees; *Large firms* with employees >250

[6]Data are available at: https://www.enterprisesurveys.org/

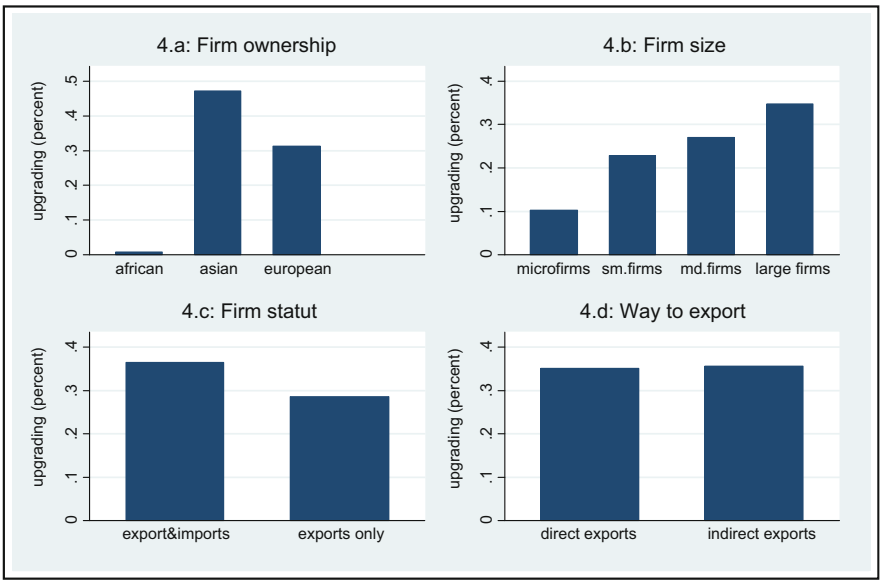

Fig. 4 Share of upgrading firms according to the firm characteristics (2009). *Source*: Author base on enterprise surveys

The data also shows that the large firms upgrade more than all other category of firms (Fig. 4b). Finally, the firms that export and import inputs abroad upgrade more than firms that export only.

Another characteristic of GVC structure that affects upgrading is the degree of integration between firms. Vertical and horizontal linkages are an important source of information, learning and technical assistance for process and product upgrading. Figure 5 shows that firms that subcontract a part of their production are more likely to upgrade than the one that don't subcontract a part of their production.

Last but not the least, host country context also affects the capacity of firm to upgrade. When making an upgrading strategy, the firms are motivated or limited by the business environment in which they operate. In Fig. 6 we focus on the business environment in which the Cameroonian, Ivoirian and Mauritian firms operate. The data suggest the relative unfavorable operating environment in these three countries.

In Cameroon, the competition of informal sector, the justice (partial and corrupted court system), the deficit of energy supply and financial constraint constitute the severe obstacle on firm's operation. For instance, more than 60 % considered informal competition as an obstacle to their business. In Cote d'Ivoire, more than 80 % of the firms complain about the instability of the country. Lacking access to finance access, justice and the energy deficit supply are also the important constraints of the firms in this country. Mauritian firms also complained about the energy supply, the transport infrastructures and financial constraints. But firms in

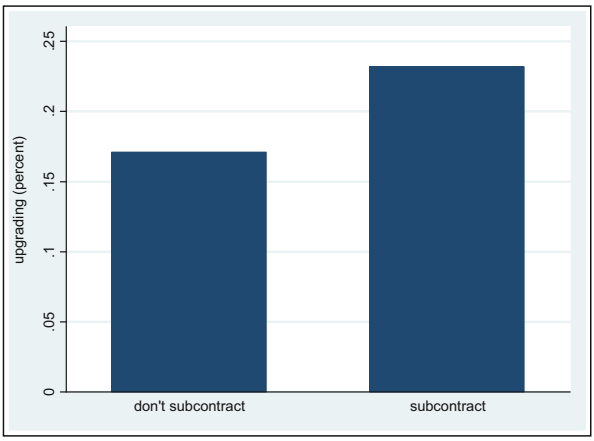

Fig. 5 Integration between firms (2009). *Source*: Author bases on enterprise surveys

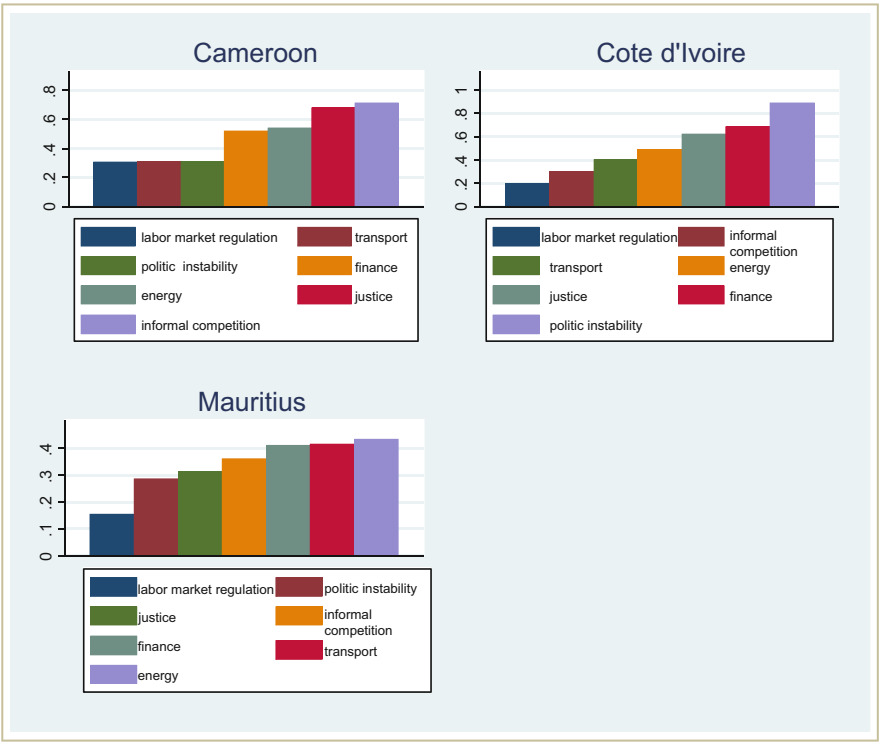

Fig. 6 Country business environment (2009). *Source*: Author bases on enterprise surveys

Mauritius operate in favorable operating environment relatively to their homologues in Cote d'Ivoire and Cameroon because less than 40 % of the firms is constraint.

However, with the basic analyses conducted so far, it is impossible to determine the main characteristics which influence firm-level upgrading. To address this issue, we conduct a regression analysis that allows us to assess how changing one factor influences the probability of a firm to upgrade. We apply a simple probit model:

$$pr(upgrading = 1) = \left(\begin{array}{l} \beta_o + \beta_1 price + \sum_{i=2}^{4} \beta_i firmsize\_i + \sum_{i=5}^{7} \beta_i ownership\_i + \\ \beta_8 subcontract + \sum_{i=9}^{11} \beta_i busenv\_i \end{array} \right) + \varepsilon_i$$

where the dependent variable is set equal to 1 whenever the firm upgrade (the firm indicates that it has introduced a new production processes or a new product) and 0 otherwise. As we mentioned above, the factors we consider to be relevant for the likelihood of a firm upgrading are follow: first, we add the selling price (equal 1 if the price increase and 0 otherwise) by the firm. The rational is that, firm owners decide to upgrade if the profits they expect to receive from upgrading are high. Second, we take into account the firm sizes (four dummy variables), ranging from micro firms to large firms third, we introduce the nationality of largest owner (ownership) of the firm (dummies variables which take 1 if larges firm's owner is African or European or Asian, and 0 otherwise). Fourth, we introduce the variable subcontract in order to capture the effect of the integration between firms (it takes 1 if the firm subcontract any part of its production to other firms and 0 otherwise). Finally, we add four variables of business environment (finance, justice, informal competition and energy). These variables capture how much of an obstacle is: access to finance, access to justice, access to electricity and the competition of informal sector for firms upgrading.

Detailed results are presented in Table 3. All the estimations are corrected for the heteroskedasticity. The results show that the rise of selling price increases the likelihood of firm to upgrade (Column 1). This result confirms the analysis of Dunn et al. (2006) who prove that upgrading activities require investment. As firms owners decide to respond to upgrading opportunities, they may consider several relevant criteria. Price is the important one because it indicates the level of profits expected from upgrading.

When we introduce the firms size (Column 2), the explanatory power of our model (as captured by the pseudo R^2) increases, underscoring their importance in determining the capacity of firm upgrading. The result reveals that large firms have a higher probability of upgrading than the micro (the reference group), small and medium firms. Another important results concern the effect of ownership, firm integration level and business environment (Column 3). The introduction of these variables also increases explanatory power of the model. As indicated in the statistical analysis, the African-owned firms (the reference group) are less likely to introduce new process and products than the European-owned and Asian-owned one. African owned firms face many constraints for upgrading than foreign owned

Table 3 Estimation results

Variables	(1)	(2)	(3)
Price	0.346	0.274	0.204
	(0.110)***	(0.114)**	(0.090)**
Small firms		0.505	0.495
		(0.096)***	(0.062)***
Medium firms		0.644	0.005
		(0.120)***	(0.270)
Large firms		0.837	−0.031
		(0.198)***	(0.386)
European ownership			2.286
			(0.380)***
Asian ownership			1.892
			(0.036)***
Subcontract			0.458
			(0.094)***
Finance			−0.631
			(0.177)***
Justice			−0.511
			(0.173)***
Informal competition			−0.410
			(0.164)**
Energy			0.047
			(0.064)
Constant	−0.969	−1.300	−1.909
	(0.045)***	(0.070)***	(0.421)***
Pseudo R^2	0.008	0.047	0.462
Observations	1287.00	1287.00	1026.00

Note: The notations * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$ denote significance at 10, 5 and 1 % levels, respectively. Standard error in parenthesis are clustering on country

ones. This result is consistent with the one find by Kaplinsky and Wamae (2010) that countries with a higher presence of FDI tend to have a high level of participation in GVCs.

Our results also show that firms which subcontract a part of their production to other firms have a high probability to upgrade than the one that don't subcontract a part of their production. This result confirms the fact that cooperation between firms has a large impact on linkage development. For example (Gereffi 1999) also find that US retailers and marketers encouraged their suppliers to upgrade to "fullpackage" production, while branded manufactures only required basic assembly from their suppliers.

Finally, the business environment constraints such as lack of finance, partial and corrupted justice, and the competition of informal sector affect negatively the firm upgrading probability. These results come straight from our analyze of Fig. 6 and prove that when making an upgrading strategy, the firms are motivated or limited by the business environment in which they operate. In fact, many studies highlight that

access to finance is one of the binding constraints for Africa development. In number of African countries, the financial sector is characterized by the low level of savings, the high cost of fund and the collateral. Justice is the another influential business environment variable which constraint firms to respond to upgrading opportunities in Africa. As the partial and corrupted commercial court system reduces the likelihood of firms to upgrade, the well-established good practice that protect industrial property and promote quality and efficiency in commercial court system encourage firms to invest and upgrade. Other influential variable of the business environment is the unfair competition of the informal sector on formal firms. This variable affect negatively the probability of firms to introduce a new product of process.

5 Conclusion

The aim of this paper was to analyze and evaluate the factors which influence firms upgrading in three sub-Saharan African countries (Cameroon, Cote d'Ivoire and Mauritius). We have analyzed four categories of upgrading: the process upgrading (process efficiency), the product upgrading (improvement of the product/service quality), the functional (moving into higher-rent activities) and the chain upgrading (Moving to a new value Chain). Our analysis reveals that the selling price as firms profit indicator, the firms size, the ownership, the level of firms integration, the access to finance, the informal competition and the justice system influence firm's upgrading decisions. From these results, several lessons about facilitating firm upgrading have emerged for policy makers. The policy actions suggested are:

(i) the implementation of policies which improve the profitability of the firm (price of input for example) and attract foreign participation in local firms;
(ii) the promotion of the effective collaboration (vertical and horizontal integration) between firms. The vertical and horizontal integration reduce transaction costs and provide a platform for sharing information and demonstrating new products, processes or technologies.
(iii) providing the access to finance through a reduction of the cost of fund and collaterals. Making finance more accessible could therefore have large effects on innovation and investment. It also important to develop financial market because process and product upgrading often require long-term investments;
(iv) providing the fair and functioning trade dispute settlement because firms are more likely to upgrade in the environment ensuring that clear rights to property exist (protection of formal ownership and innovation);
(v) proving legal regulatory framework to fight against unfair competition. In the absence of regulation institutions, unfair competition could drive the formal firms out of the market.

Annex

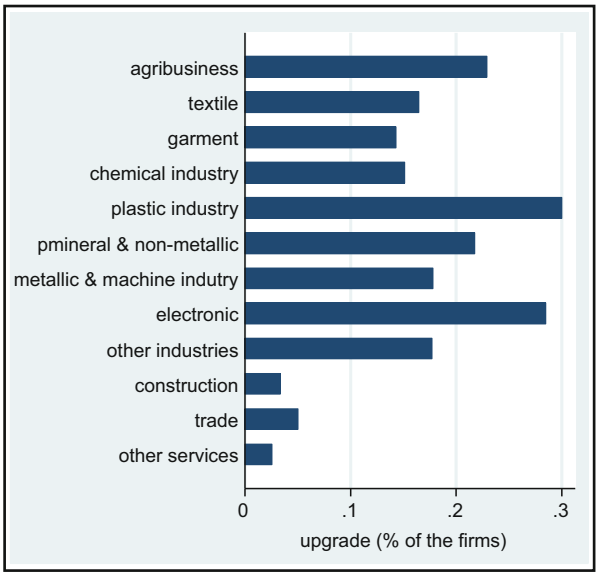

Fig. 7 Upgrading by industries (% of firms). *Source*: Author bases on enterprise surveys

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Regional Disparities in the WAMZ: Integrating the Role of Market Potential and Structural Change

Douglason G. Omotor and Jimoh O. Saka

1 Introduction

The economics of regional integration perceive no less than three means of amalgams—economic and trade integration, political integration and physical integration. These processes respectively relate to phases like free trade area, customs union, monetary union etc.; coordination and harmonization of actions by authorities and; integration of projects (infrastructure and services). However, WAMZ members' structural weaknesses that have impeded the integration process and cause regional imbalances are paid lip services without deliberate concern as to what policy reforms may be required to ease this fragility. Economic structural changes, economic integration at different scale and governance integrity in the face of economic policy formulation have been recognized as possible factors that could be used to engender their effects. In the case of the EU, some studies have shown that half of the income inequalities which exist among EU member states are attributable to regional inequalities within individual countries (Dall' Erba 2003; Caraveli et al. 2008; Martin 1999, 2004; Petrakos et al. 2003; Puga 2002; Caraveli and Tsionas 2012). In Galbraith (2011) opinion, globalization rather than internal structural change plays the dominant role in determining the movements of inequality both between and within countries. Some other studies on EU economic cycles also show that regional disparities tend to rise in periods of severe recessions and fall in periods of economic growth (Petrakos and Psycharis 2004; Petrakos 2009 referred to in Caraveli and Tsionas 2012). Contrasting opinions canvassed elsewhere in the literature claim that during periods of economic crisis, a reversal of concentration trends with a tendency towards regional convergence; sectors (mainly in technology and in finance) which earn the highest income enjoy their

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D. Seck (ed.), *Investment and Competitiveness in Africa*, Advances in African Economic, Social and Political Development, DOI 10.1007/978-3-319-44787-2_10

greatest income growth in boom times, whether driven by domestic investment or by exports, and thus income and inequality rise together (Petrakos and Saratsis 2000; Petrakos and Artelaris 2008; Petrakos 2009; referred to in Caraveli and Tsionas 2012).

A scan at the relevant literature relays the empirical validity of the facts that bulk of the differences in the pattern of structural change between regional members' productivity is due to the mismatch of labour mobility from high-to-low productive sectors. Some factors so far identified for these spurious movements are; (i) Structural change not being growth inclusive and sustainable in countries with relatively large export share of natural resources. The high growth rates occasioned by high primary commodities export prices are unable to absorb the surplus labour from agriculture; and (ii) development partners (DPs) in aid dependent member countries devote much more resources on impact regulatory reforms and diminutive resources to critical areas like productive investment, infrastructure and innovation. These factors no doubt underscore the zone's sectoral disparities that have affected the politics and crisis of confidence in advancing the integration space.

The paper contributes to the literature through evaluating these disparities in relation to WAMZ member countries by identifying the regional inequalities (measured by per capita GDP) and other economic fundamentals between 1980–2013 for the complete sample. These have been varying and imploding over time. The scheme is to see how the polarized structures can be leveled and regional macroeconomic policy measures implemented to strengthen poor infrastructure framework, weak institutional capacity and individual member states competitiveness.

Closely following the introductory section is Sect. 2 which provides the statistical documentation of the WAMZ member countries' disparities, within the context of general structural imbalances and competitiveness of the economies with reference to general disparities in macroeconomic policy performance over past decades. Section 3 provides brief theoretical issue while in Sect. 4; we develop the model and data. Empirical analysis and conclusion take place in Sect. 5.

2 Macroeconomic Performance Disparities in the WAMZ

The ECOWAS zeal to adopt the common currency policy is to enhance free mobility of capital, labour, goods and services within its members. The effort to integrate the economies of its members is becoming stronger and thus requires modification of its approach towards greater monetary integration and regional exchange rate stability through establishing the West Africa Monetary Zone (WAMZ). By following the path of European Union, the convergence process in the region is much enhanced.

The WAMZ came into existence during the ECOWAS Treaty of 1993 and by 2000; it was already an economic and monetary union with six members which include Gambia, Ghana, Guinea, Liberia, Nigeria and Sierra Leone. Liberia having

faced with social and political unrest was not able to sign to be members of the WAMZ. The zone somehow relies on very few export goods despite claims of openness to the world economy.

The performance of the economies in the WAMZ in terms of GDP growth, population, trade openness, stock market indices and capital flows, gross value added by sectors of production, fiscal balance and rate of inflation and inter-regional trade openness provide some insights of the regional disparities in the sub region. In what follows, we discuss a few macroeconomic fundamentals pinpointing to the disparities within WAMZ.

2.1 Real GDP Growth

Nigeria is seen as dominant among WAMZ economies, with more than 76.5 % of the population and 85.6 % of the entire zone's GDP. Nigeria is oil-based with contribution of about 20 % of GDP, 80 % of total revenue and about 90 % of foreign exchange earnings. Nigeria's real GDP growth rate has been fluctuating across the period with highest positive growth rate of about 21.3 % in 2002 up from 14.2 % in 1971. However, the aftermath effect of the global crisis may be attributed partly to the fall to an average of 6.9 % between 2007 and 2010. By 2013, the real GDP was already 6.6 %. Ghana is next largest economy recording about 9.2 % of the zone's GDP. Ghana's highest real GDP growth was 15 % in 2011 up from 8 %, 4 % and 8.4 % in 2010, 2009 and 2008 respectively. The economy also experienced a drop due to the global financial crisis. In Nigeria, the decade growth was driven mainly by non-oil sectors, such as agriculture, trade, ICT, entertainment industry, and other services. The oil sector, which accounts for 37 % of GDP and about a fifth of government revenues, is currently a drag on growth and suffers from theft, pipeline vandalism and weak investment.

Liberia and Gambia remain the two smallest economies with 0.4 % and 0.6 % of the GDP respectively. However, Liberia faced some periods of acute social unrest which accounted for negative GDP growth. Surprisingly, the real GDP growth was not less than an average of 7 % during the global financial crisis. The real GDP growth of Gambia was highest in 1981 with about 18 % and thereafter dropped consistently to as low as −4.6 % in 2011. The rate however increased to 7.1 % in 2013.

Obviously, Guinea had impressive real GDP growth rates for most of the period compared to Sierra Leone. By 2000, a sudden change occurred where real GDP growth in Sierra Leone began to increase with 3.8 % and 2.9 % respectively for the same year. By 2013, Sierra Leone had recorded 12.6 % while Guinea, 4.2 %. It should be pointed out that the growth rates were generally robust for the zone during the period under study. Generally the Ebola scourge of 2014 affected the West African countries in which Liberia and Sierra Leone are the worse hit with growth rate of 0.5 and 6.0 % to the extent that the recorded gains experienced by the two member countries have since been eroded. Sierra Leone's growth is mainly

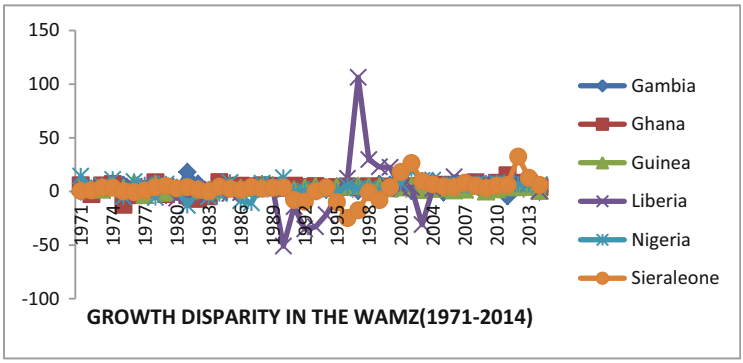


Fig. 1 Growth disparity in the WAMZ. *Source:* UNCTAD and WEO Data base (2015)

driven by iron and ore exports, although other sectors, agriculture and construction in particular, also contributed. The real Growth rates for the zone are displayed in Fig. 1.

The WAMZ region's growth were projected to marginally pick up in 2015 but for the slow global recovery and decline in mineral and commodity export prices especially crude oil.

2.1.1 Domestic Investment

Total investment-GDP ratio defined as the sum of fixed capital formation and changes in inventories varies across the WAMZ. Nigeria's total investment—GDP ratio was highest in 2002 reaching about 23.1 % and thereafter dropped partly attributable to instability in the macroeconomic environment. By 2013, the ratio reached 14.7 %. Ghana's total investment—GDP ratio was about 3.7 % in 1980 and fluctuated thereafter until it reached 27.8 % in 2012, the highest before falling to 20.8 % in 2013. From the statistics available, Guinea appeared nest to Nigeria in terms of the investment-GDP ratio starting with 14.4 % and all through maintained double digit ratio except in 2010 only (9.4 %). However, these ratios were higher than those of Nigeria in 2012 and 2013 owning partly to instability. Statistics for Liberia was unavailable during the period of the analysis (Fig. 2).

2.1.2 Foreign Direct Investment

On the foreign investment development, Nigeria received the greatest inward FDI during the 1980–2013 period with 81977 m$ in 2013 up from 76370 m$ in 2012. The lowest FDI inflow was 2457.3 m$ in 1980. Basically, the stock of inward FDI shows an increasing trend over the period. The slow growth rate during late 2000s may be attributed however to the global economic crisis and peculiar social and economic instabilities in Nigeria. Liberia appears with greater FDI inflows

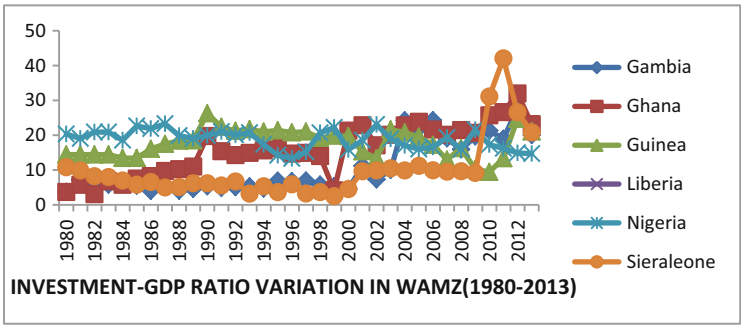


Fig. 2 Investment-GDP ratio in the WAMZ. *Source*: WEO Data base (2015)

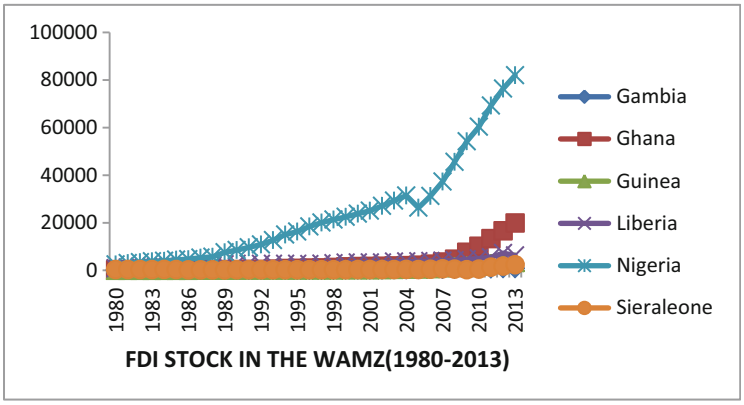


Fig. 3 FDI stock in the WAMZ (1980–2013). *Source*: UNCTAD Data base (2015)

compared to other WAMZ economies except Nigeria. The highest inflow was 7220.6 m$ in 2012 with 868.2 m$ as lowest in 1980. These are compared to Ghana's highest and lowest flows of 19848.1 m$ and 232.9 m$ in 2013 and 1980 respectively.

Compared to Guinea, Sierra Leone experienced an increasing trend in inward FDI flows. However, in 2013, inward FDI of Guinea was 3303 m$ much higher than 2319.5 m$ of Sierra Leone. Inward FDI was 1.2 m$ for Guinea in 1980 compared to 323.6 m$ for Sierra Leone. This is demonstrated in Fig. 3.

2.1.3 International Openness

ECOWAS seems to have been promoting the process of trade liberalization through its trade liberalization scheme since the 1990. However, this has not significantly contributed to trade diversification for the countries of WAMZ as expected. A low

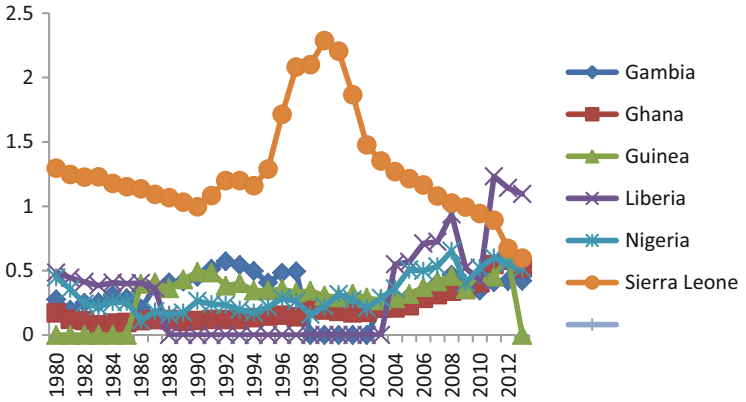


Fig. 4 International openness in WAMZ (1980–2013). *Source*: Computed from UNCTAD Data base (2015)

intra-WAMZ trade does exist except between Ghana and Nigeria and this mostly results in trade biases towards non-members of the WAMZ in ECOWAS and other regions. Trade pattern within ECOWAS indicates that WAMZ member countries exports to ECOWAS have been comparable to those of the WAEMU.

With regard to inter-regional trade openness to GDP ratio, The Gambia's average trade openness in the WAMZ was 0.28, Ghana's was 0.17, Guinea's 0.17, Nigeria's 0.44, Liberia's 0.48 and Sierra Leone's 1.30 during the 1980. By implication, Liberia could be perceived to be more open to the rest of the world followed by Nigeria during this period. This openness continued for Liberia till 1987 and thereafter no record was available. This is attributed to the instability resulting from the civil unrest. In 2011, Nigeria's openness moved to 0.60 and was next to Sierra Leone of 0.89. The latter began to be more exposed since 2009 compared to other WAMZ countries. Openness indices were high for Liberia since 2006 and later dropped drastically from 2010. By 2013, Sierra Leone openness was about 0.60 while that of Nigeria was 0.52 according to computation obtained from UNCTAD statistics (Fig. 4).

3 Theoretical Issue

There has been a presumption that poor countries should grow faster than rich countries. They are characterized with peculiar advantages of economic backwardness—low capital-labour ratios which tends to increase return to investment, reliance on global market to supplement domestic saving and as well as having access to global markets for the expansion of output in these tradable goods in which they have comparative advantage.

Growth theory has distinguished between unconditional and conditional convergence. Growth in developing nations is retarded by a variety of country-specific

obstacles which range from weak institution to poor institutions, from lousy policies to poverty traps. All of these in great dimension may results in disparities across nations and subsequently, developing nations tend to converge to rich—country income levels only conditioned upon over coming these disadvantages over time.

Given a conditional convergence equation:

$$\widehat{y_j} = \beta\left(\ln y^*(\theta_j) - \ln y_j\right) + \varepsilon_j \tag{1}$$

Where $\widehat{y_j}$ is defined as the growth rate of per capita GDP, y_j, in country j, θ_j defines a vector of country-specific circumstances determining the long run income level, β is the rate of (conditional) convergence and ε_j is a random term. Growth fundamentals are embedded in θ_j can be described as the set of factors that conditions long-run income level, although many of the plausible members of the set are also endogenous in the long run. Conditioning variables used in growth regressions such as investment levels, human capital and the quality of policies might all be viewed as being ultimately determined for example, by a country's quality of institutions. Quality of institution has received a great attention in the literature. High quality institutions make a huge difference to long-run income levels, and hence pattern of convergence. According to Acemoglu et al. (2014a), the differences in institutional quality account for as much as 75 % of the variation in income levels around the world. The empirical relationship between institutions or its changes and growth rates seem not to be that strong, compared to what the long run relationship in levels suggest.

Within numerous empirical literatures, the growth effects of democracy still remain in question. Acemoglu et al. (2014b) provide the strongest recent statement about the growth promoting effects of democracy. They find that full democratization produces approximately a 20 % increase in GDP per capita over 30 years translating to about 0.6 growth effects per year. While this is not insignificant, it is temporary and phased out with time and cannot account for on a broader note to income differences across the world.

The growth Eq. (1) does not describe growth miracles as expected at least with the fundamentals θ. The tradition of the dual-economy models has provided a complementary perspective that has long been important to development economics. However, this tradition tend to be over shadowed by the modern growth economics but apparently, the heterogeneity in productive structures which the dual-economy models capture have continued to demonstrate some relevance to low income economies like those within the sub-Saharan Africa.

A known feature of developing countries is the disparities in productivity across economic activities in the likes of modern versus traditional, formal versus informal, traded versus non-traded, cash crops versus subsistence crops and even within individual sectors as observed from recent studies. In Rodrick (2013), it is shown that modern, organized manufacturing industries are quite heterogeneous as they do follow unconditional convergence, compared to the rest of the economy based on estimated beta coefficient of about 3 %.

Applying the conditional convergence frame work for the African economy, we assume the economy is divisible into two parts-the modern part taking the subscript M_s, and the traditional part taking the subscript T_s. Assume also that only the M-sector exhibits unconditional convergence while the T-sector is subject to conditional convergence. Now decomposing the growth rate of the economy into three channels, the following equations emerge:

$$\begin{aligned}\hat{y} &= \beta\left(\ln y^{*}(\theta) - \ln y\right) \\ &+\alpha_{M_s}\pi_{M_s}\beta_{M_s}\left(\ln y_{M_s}{}^{*} - \ln y_{M_s}\right) \\ &+(\pi_{M_s} - \pi_{T_s})d\alpha_{M_s}\end{aligned} \tag{2}$$

The first part of the above Equation depends on the cumulative accumulation of fundamental capabilities as observed in Eq. (1). The second channel is the convergence within modern industries and its magnitudes depends on the distance from the productive frontier, the coefficient of convergence (β_{M_s}), the productivity in M_s relative to the economy (π_{M_s}), and the employment share of M_s (α_{M_s}). The third channel defines the structural change term, and captures the growth effect of the reallocation of labour from low productivity sector (T_s) to high productivity sectors (M_s). The two new sectors can boost significantly the growth and this seems to have played a key role in Asia growth miracles. Their quantitative magnitudes are dependent on the size of the modern sector and its expansion rate (α_{M_s}, $d\alpha_{M_s}$), the pace of industrialization. Fast growth into middle-to-upper income status is enhanced by rapid industrialization. In the latter strategies of growth, as industrial convergence runs out of stream, then economic progress begins to rely disproportionately on the fundamentals and growth tends to slow down.

As shown in Table 1, long-term convergence would require both structural change fundamentals. Rapid industrialization without the accumulation of fundamental capabilities (institutions and human capital) suddenly increases growth which tends to run out of steam eventually. However, investment in fundamentals on its own produces moderate growth given that rapid structural change is absent.

4 The Model and Data

Considering the driving forces behind the evolution of regional disparities particularly in income, the neoclassical growth models traditionally predict convergence in the long run through the assumption of diminishing returns to scale in labour and

Table 1 Structural transformation, industrialization. A typology of growth (processes/outcomes)

		Slow	Rapid
Investment in fundamentals (human capital, institutions)	Slow	No growth	Episode growth
	Rapid	Slow growth	Rapid, sustained growth

Source: Rodrik (2014)

capital implicitly defined in the neoclassical production function. This assumption is considered as the transmission mechanism. The beginning of the 1990s has however brought a tremendous change within the frame work of spatial economics known as the New Economic Geography (NEG). The New Economic Geography (Krugman 1991) has emphasized the role which second nature geography plays in the form of access to consumer market and to inputs suppliers as potential driving force behind the agglomeration of economic activities within space and disparities in income. Given this frame work, the reduction in transport costs followed by increasing returns to scale in manufacturing activities and market size interact cumulatively leading to the spatial concentration of economic activities. Literature on NEG has come up with various contributions of activities of the economy on the pattern and workings of these models since the end of the nineties. These models pinpoint on the relationship between market potentials and income levels for different scenarios such as a sample of world countries (Redding and Venables 2004), countries within US (Hanson 2005), EU regions (Breinlich 2006), and Poland regions, Jesu's and Malgorzata (2014).

Based on the foregoing framework, the impact of market potentials on the growth of GDP using the standard growth regression and incorporating the market potential measure is estimated. We follow Jesu's and Malgorzata (2014) as an extension of the theoretical framework emanating from the New Economy Geography Model of Ottaviano and Pinelli (2006) by estimating two major variants of growth regressions—The one based on incorporating initial conditions in both GDP and market potential and the other relating to the initial conditions in GDP and the changes in the regional market potentials during the period. On this basis, the model for the relationship between GDP and the initial GDP and market potentials is specified in logarithmic form as follows:

$$\log\left(\frac{\Delta y_t}{y_{t-1}}\right) = \alpha_0 + \alpha_1 \log(y_{t-1}) + \alpha_2 \log(MAC_{t-1}) + \alpha_i \sum_{i}^{n} (\log X_i) \tag{3}$$

$$\log\left(\frac{\Delta y_t}{y_{t-1}}\right) = \beta_0 + \beta_1 \log(y_{t-1}) + \beta_2 \log(\Delta MAC) + \beta_i \sum_{i}^{n} (\log X_i) \tag{4}$$

Where $\frac{\Delta y_t}{y_{t-1}}$ is the Per capita GDP growth and hence forth, PGR, y_{t-1} is the initial per capita GDP (PGR(−1)), *MAC* is the market potential which describes the market access and X_i is a measure of other controlled variables which are also fundamental determinants of income disparity in the zone. In this case, we incorporate foreign direct investment (FDI), domestic investment (DI), the interactive term (FDIDI), consumer price index (CPI), population growth rate (POPG) and trade complementary index (TCMR); *i* ranges from 1 to *n*. The intuition for the inclusion of the controlled variables is to reduce omitted variable bias in the model. All variables are essentially in logarithmic forms except those in rates to reduce trend and heteroscedasticity in variables. We take into account the impact structural change would have on the growth disparities in the WAMZ. In the context of development economics and in economic history, structural change is mostly identified as "the

different arrangements of productive activity in the economy and the way productive factors, occupations, geographic regions, product types, etc. (Machlup 1991:76 in Silva and Teixeira 2008:275) are distributed among various sectors of the economy. On the basis of this definition, it is expected that the impact of such changes on growth across the region would be a reflection of the changes in its determinants. The dynamics of the determinants of growth resulting from structural changes are passed on to the growth process. In our study, the dynamics of the determinants of growth represent the structural changes.

Data was collected mainly from the United Nations Conference on Trade and Development (UNCTAD) Data base (2015). The investment-GDP ratio and part of real GDP growth rates were obtained the World Economic Outlook data base (WEO 2015).

However, due to inherent and acute data insufficiency, we part away with a standard measure of market access which is the tariff rates. To the best of our knowledge, in most cases it is either these are completely missing across times or are not sufficient for analytical purposes. Obviously if analysis is made with such inadequacy, result could be misleading. Evidence from past empirical works has shown that better market access conditions increase the probability of survival of a trade relationship. Over time, bilateral trade agreements have been significantly affecting market access. Trade agreements generally provide trading partners with lower tariffs, hence different tariff rates are applied to same product based on its origin. Given that lower tariff can effectively increase trade agreement among partners, then by implication each partner country is more open to the rest and vice versa. Openness measure is therefore use to proxy market access in this study.

5 Results and Discussion

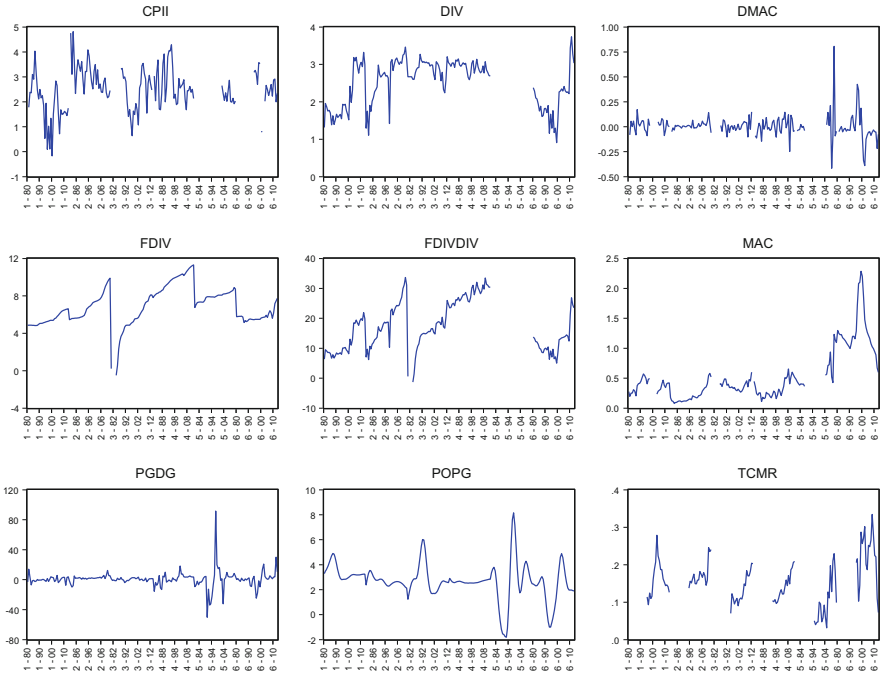
Table 2 presents description of the variables in terms their statistical characteristics. The CPI comes with the highest mean (17.07), median (11.69) and standard deviation (17.54) and skewness (3.18) in the distribution. The high standard deviation value demonstrates the high volatility of the CPI variable over time

Table 2 Descriptive statistics

Variables	Mean	Median	Std. Dev.	Skewness	Kurtosis	J-B Prob.
CPI	17.07	11.69	17.54	3.18	16.70	0.00
DI	2.51	2.71	0.62	−0.63	2.26	0.00
FDI	6.84	6.56	1.97	−0.16	3.96	0.01
TCMR	0.16	0.15	0.06	0.39	2.93	0.24
PGR	0.65	1.26	10.39	2.29	34.68	0.00
POPG	2.71	2.67	1.43	−0.22	6.32	0.00
MAC	0.53	0.40	0.44	1.78	6.12	0.00

Source: Authors' computation using E-views

compared to others. While the kurtosis coefficients are positive for all, the PGR appears with highest kurtosis value. A look at the statistics indicates that mean and median values are approximately equal for the TCMR and thus is normally distributed. The J-Prob. values further confirm this.



Graph 1 Graphical illustration of variables in table 2

The panel unit root results as displayed in Table 3 using Levin, Lin & Chu test statistic shows that CPI, PGR and POPG are stationary in their levels and so they are I(0) variables while MAC, DI, FDI and TCMR are stationary only in their first differences, I(1). We undertake the unit root test based on intercept only as the test equation. As indicated by variable plots, all the variables seem to appear with trend.

The panel least square regression is as presented in Table 4. Equations (1) and (2) respectively represents the period of no structural change while Eqs. (3) and (4) presents results for period of structural change. Equations (1) and (3) contain the initial MAC and the change in MAC among other regressors for the full sample size while Eqs. (2) and (4) observe the effect of TCMR and other regressors within a small sample range.

For Eq. (1) which excludes the effect of structural change, the initial per capita GDP growth rate exerts a positive and significant impact (0.28). The positive sign is an indication of lack of convergence in the region. The initial per capita GDP maintains positive and significant relationship across other Equations but its effect seems to be more robust (0.28, 0.17) in Eqs. (1) and (2) where trade

Table 3 Panel unit root

Variable	Test statistic	probability	Order of integration
CPI	Levin, Lin & Chu	0.00	I(0)
MAC	Levin, Lin & Chu	0.00	I(0)
DI	Levin, Lin & Chu	0.00	I(1)
FDI	Levin, Lin & Chu	0.00	I(1)
TCMR	Levin, Lin & Chu	0.00	I(1)
PGR	Levin, Lin & Chu	0.00	I(0)
POPG	Levin, Lin & Chu	0.00	I(0)

Source: Authors' computation using E-views

Table 4 Panel least square regression statistics

Variable	No. structural change	No. structural change	Structural change	Structural change
Variable	Eq. (1)	Eq. (2)	Eq. (3)	Eq. (4)
Constant	−3.04(−0.81)	−10.40(−1.91)	−11.24(−2.92)**	−9.72(−1.67)
PGR(−1)	0.28(3.64)**	0.17(1.79)*	0.07(0.75)	0.12(1.03)
MAC(−1)	−0.12(−0.10)	0.67(0.46)	0.81(2.77)**	3.18(2.07)**
ΔMAC	−20.27(−3.74)**	−30.20(−5.11)**	−8.90 (−1.60)	−15.11(−2.43)**
CPI	−0.69(−1.38)	−0.17(−0.26)	−0.38 (−0.74)	−0.87(−1.26)
FDI	0.41(1.49)	0.73(2.46)**	0.81(2.77)**	0.86(2.65)**
DI	0.97(0.91)	2.95(1.86)*	0.93 (0.86)	1.83(1.09)
FDIDI	0.68(0.66)	−0.09(−0.08)	3.28 (3.10)**	3.47(3.26)**
POPG	−0.03(−0.06)	−0.34(−0.42)	1.13 (2.27)**	−0.15 (−0.17)
TCMR	–	−1.95(−0.14)	–	9.06 (0.61)
R-Squared	0.34	0.57	0.28	0.46
F-statistic	8.05	10.37	6.11	6.45
AIC	6.14	5.88	6.18	5.97
SC	6.33	6.18	6.38	6.27
HQC	6.22	6.00	6.26	6.09
Durbin-Wats	1.77	2.14	1.34	2.07

Source: Authors' computation using E-views

complementarity index entered as part of the regressors. Obviously, the period of exclusion of structural change and the one with structural change demonstrate positive contributions of the initial per capita growth.

However, the initial market access variable indicates a negative (−0.12) and insignificant impact on the per capita GDP growth only for Eq. (1) without structural change effect. This may not be surprising following the existence of some poorer member countries within the region and so trade capacity often retarded most integration plans. However, the period of structural provides a

positive influence of the changes in the market access. This result is indicative of the fact that changes in market access do not support the process of convergence within the regions and is in line with the findings of Jesus and Malgorzata (2014). The increases in market access may be realized in the economic core member countries of WAMZ.

On the controlled variables, the foreign direct investment and domestic investment have shown expected positive impacts on per capita GDP growth across all the Equations though the foreign directed investment is significant for the period of structural change where the trade complementarity index is included. The investment variable is significant in only Eq. (2) where structural change is effective. This result is often supported in growth literature that both foreign direct investment and domestic investment are fundamental determinants of growth. However, foreign direct investment appears more robust with significant positive coefficients in most equations compared to the domestic investment variable. The coefficient of interaction between foreign direct investment and domestic investment in all the Equations indicates that each of these variables could serve as substitute in facilitating growth and this is true for both period with and without structural change. This is essentially true where one does not crowd-out the other. Growth however increases most for the interaction coefficient of 3.47 in Eq. (1).

Population growth, a proxy for labour force, comes with unexpected positive though significant coefficient (1.13) for Eq. (3) with no structural change. Although it is expected that a growing 'unskilled' population essentially retards growth and moreover in this context a growing labour force with job opportunities is expected to contribute significantly to growth. The trade complementarity index each comes with a positive coefficient (−1.95 and 9.06) in Eqs. (2) and (4) showing that member region differ in trade.

The coefficient of determination is generally low and is highest for Eq. (2) with structural change. In this regard some other potential determinants of growth may provide a more robust explanation of its variation. The F-statistic provides evidence for the model adequacy.

6 Conclusion

This paper examined the disparities in terms of income of the WAMZ six member country over the period 1980–2013. We estimated growth regressions with the inclusion of the initial per capita GDP growth, changing market access variable and other controlled variable including the interaction between foreign direct investment and domestic investment. The period of structural changes and exclusion of these changes are considered.

The major findings obtained from our estimations were the positive and significant relationship between initial per capita GDP and GDP growth for both periods of structural and no structural changes. This did not seem to support convergence in the region and could be attributed to the growing pattern of some member countries

of the sub-region. However, the changing market access variable showed negative but significant impact mostly for the period of no structural changes. Hence with the declining pattern of market access, the richer countries in the WAMZ may not benefit from such a declining trend and if this persists, it may lead to gradual decline in income (though not immediately) and poorer countries may tend to catch up. Therefore, there may be the tendency to have a less pronounced income disparity following similar trend[1].

A major policy implication here is to have greater access to market enhanced by affordable tariff rates and/or costs to foster better trade relations within the region and other global trade players. Effective trade relation is needed across all member countries with minimum bias to further strengthen integration plans. State of the economy need be monitored following some structural changes.

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Is Regional Integration Beneficial for Agricultural Productivity in Sub-Saharan Africa? The Case of CEMAC and WAEMU

Juliet U. Elu and Gregory N. Price

1 Introduction

The decline in the real value of output per capita in Sub-Saharan Africa relative to its population growth between 1961–2011 (Alston and Pardey 2014) poses significant threats to individual welfare, as it could compromise food and human security (Rajaonarison 2014) for individuals in Sub-Saharan Africa. The decrease in the share of agricultural value added in Africa lead to a significant increase in urbanization with a negative average effect on GDP per capita growth (Markus 2012). Given the apparent critical role that agriculture has in reducing poverty (Collier and Dercon 2014; Dethier and Effenberger 2012), particularly for the poorest of the poor (Christiaensen et al. 2011), institutional and/or policy arrangements that induce increases in agricultural productivity in Sub-Saharan Africa can engender pro-poor economic development (Dorward et al. 2004; Kydd et al. 2004). According to the executive report from African Development Bank (2014), regional integration that allow for greater access to capital markets, including foreign direct investment, but can also enable countries to pool resources for large game—changing projects which would have implications for growth, emergency of a manufacturing sector and economic diversification with implications for regional employment. Regional integration can also serve as catalyst for African countries to foster broad and inclusive growth. With the small and fragmented African markets, the recent inclusive growth strategy embarked by many developing countries, particularly Africa can only foster sustainable growth and development with the revitalization of the agricultural sector.

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D. Seck (ed.), *Investment and Competitiveness in Africa*, Advances in African Economic, Social and Political Development, DOI 10.1007/978-3-319-44787-2_11

In this paper, we consider whether a particular institutional arrangement—a regional currency union—can be beneficial for agricultural productivity in Sub-Saharan Africa. Even though agricultural productivity has remained low in SSA countries due to reduced earnings, increase in agricultural total productivity can promote robust growth especially when there are effective and efficient links between the rural and urban sectors. We extend the analysis of Elu and Price (2008, 2014), and consider whether membership in the euro-currency integration in the Franc Zone has beneficial and favorable treatment effects in the agricultural sector. Our results, while limited, will inform the extent to which institutional arrangements such as regional currency unions can enhance economic development in Sub-Saharan Africa through the agricultural sector.

The remainder of the paper is organized as follows. In Sect. 2 the data and empirical methodology are discussed. Our econometric strategy for identifying the treatment effects of regional currency integration is a potential outcomes approach, and utilizes a propensity-score matching estimator to determine the effects of regional currency union membership on total agricultural value. We report parameter estimates in Sect. 3, and the last section concludes.

2 Data and Empirical Methodology

To estimate the treatment effect of currency union membership in Sub-Saharan Africa, we use World Development Indicators (2013) data SSA.[1] Our measure of belonging to a regional euro currency zone is dichotomous, and based on a country's membership in the euro-currency integration—Central African Franc Zone as identified by Elu and Price (2008, 2014). We create dummy variables for a country's membership in the: (1) Central African Franc Zone (CFAZ), (2) West African Economic and Monetary Union (WAEMU), and (3) Economic and Monetary Union of Central Africa (CEMAC).

The treatment effect of currency union membership for a country is parameterized within the potential outcomes framework (Imbens 2004; Price et al. 2011) of the Rubin causal model (Imbens and Rubin 2010). For country observations indexed by $i = 1 \ldots, N$, each observation is characterized by a pair of potential outcomes, $Y_i(0)$ for the outcome under the control treatment, and $Y_i(1)$ for the outcome under the treatment of currency union membership. Each unit is exposed to a single treatment W such that:

[1] *World Development Indicators* data are available at http://data.worldbank.org/data-catalog/world-development-indicators

$$\begin{aligned} Y_i &= Y_i(W_i) = Y_i(0) \quad \text{if} \quad W_i = 0_i \\ &= Y_i\,(1) \quad \text{if} \quad W = 1 \end{aligned}$$

We utilize a propensity score matching scheme which selects control observations on the basis of the difference in propensity scores between treated and control observations.[2] and for the heterogeneity that can emerge in panel data. In particular, we estimate country-year-specific propensity scores similar to the panel-specific propensity score matching approaches Millard-Ball (2012) and Nielsen and Sheffield (2009). In general, our propensity score matching scheme ensures that for matches in the sample, Sub-Saharan African countries who are members of CEMAC and WAEMU are compared only with those were most likely to have joined, but did not, as a function of panel-level observables, that may vary across panels as a govern selection into the treatment. We implement this minimum distance algorithm with the Stata enabled matching with replacement program of Abadie et al. (2001).

As in Imbens (2004) and Price et al. (2011), for a sample characterized by (Y_i, X_i, W_i) where X_i is a covariate measuring a characteristic, our matching estimator can identify three relevant sample treatment effect parameters (Abadie et al. 2001):

$$\tau_M^{sm} = \frac{1}{N} \sum_{i=1}^{N} \left[\hat{Y}_i(1) - \hat{Y}_i(0)\right]$$

$$\tau_M^{sm,t} = \frac{1}{N_1} \sum_{i:W_i=1} \left[\hat{Y}_i(1) - \hat{Y}_i(0)\right]$$

$$\tau_M^{sm,c} = \frac{1}{N_0} \sum_{i:W_i=0} \left[\hat{Y}_i(1) - \hat{Y}_i(0)\right]$$

Where τ_M^{sm} is the sample average treatment effect—the treatment effect for an assigned country in the sample. This treatment effect could not be policy relevant if there is selection into membership on the basis of eligibility requirements—of which not all countries can satisfy, or some who did satisfy, did not participate. In this context, $\tau_M^{sm,t}$ and $\tau_M^{sm,c}$, the sample average treatment effect on the treated and control observations respectively, can inform the impact of regional currency union membership on countries that actually joined currency unions, and those who were capable of joining a regional currency union but did not. This implies that membership in the euro currency zone is a consequence of political history or national decision which can be considered endogenous in the model.

If we assume that assignment to the treatment is independent of the outcomes, then conditional on observables in X_i, as long as the conditional probability of receiving the treatment is between zero and unity, τ_M^{sm} and $\tau_M^{sm,t}$, and $\tau_M^{sm,c}$ are identified. These two assumptions correspond to the ignorable treatment or selection on observables assumption of Rosenbaum and Rubin (1983). The practical

[2]See Augurzky and Kluve (2007) for a consideration of propensity score distance matching.

import of these assumption is that they permit viewing data as if though it were generated from a randomized experiment, however; countries can decide if they want to be part of the euro-currency zone. In this context, differences in the outcomes between treated and control observations are causally related to exposure to some treatment.

The treatment effect of interest in this paper measures the causal effect of a country's decision to joining a currency union with the Rubin Causal Model (RCM) framework (Holland 1986). In the RCM framework, a treatment effect is viewed as an endogenous function of observables, and defined for each country in terms of two potential outcomes. Endogenizing the currency union membership recognizes that currency union membership is not randomly assigned and the RCM approach enables an approximation of the nonrandom assignment mechanism. Each country has one outcome that would manifest if were exposed to the treatment and another outcome if were exposed to the control. The treatment effect is the difference between these two potential outcomes. Nonetheless, this country-level treatment effect is unobservable because countries can only receive the treatment or the control, but not both. Matching on the propensity score—the probability that a country joins a currency union—controls for the nonrandom endogenous treatment assignment, and ensures that countries assigned to the treatment and controls are identical. As such, the treatment outcomes among the treated countries serve as a counterfactual for outcome among the control countries—who did not join a currency union.

As we match treatment and controls on the propensity score, our matching estimator also has the advantage that it is not susceptible to misspecification bias, as a matching estimator does not require knowing the true functional form determining the outcomes of interest (Todd 2010). As such, our estimates of the treatment effects enable identification of a currency union's causal effects as long as selection into the treatment is based upon those observables governing selection into the treatment—which is consistent with a wide variety of ways in which individuals form expectations about the gains from treatments. In particular, Imbens (2004) shows that in the case where optimizing agents are exposed to a treatment with an associated stochastic pay-off with unobservable costs, if the unobserved costs are orthogonal to the stochastic error in agents pay-off forecasts or expectations, then the effect of the treatment is identified when selection into the treatment is on unobservable. In the case of the decision for a country to join a currency union, such a characterization seems likely, as it seems plausible that there is a large stochastic component associated with the benefits of joining a currency union that are orthogonal to the unobservable costs associated with it.

3 Results

We consider two binary treatments over the 1960–2013 time period, each associated with a Sub-Saharan African country joining euro-currency integration which consists of two separate regional currency and economic unions in Sub-Saharan Africa: 1. West African Economic and Monetary Union (WAEMU) and 2. Central African Economic and Monetary Community (CEMAC). CEMAC includes the countries of Cameron, Central African Republic, Chad, Congo Republic of, Equatorial Guinea, and Gabon. WAEMU includes the countries of Benin, Burkina Faso, Cote d' Ivoire, Mali, Niger, Senegal and Togo. We report results on the effects of these treatments on the percent change in total agricultural value added from World Development Indicators (2013). It is defined as the net output of a country's formal agricultural sector after adding up all outputs and subtracting intermediate inputs. The propensity score, upon which the matching is based, is estimated as a function of a country's minimum gross domestic product over the 1960–2013 time period.[3] To allow for panel-specific heterogeneity across time (Millard-Ball 2012; Nielsen and Sheffield 2009) the propensity score is estimated with a random country-year intercept. The propensity score matching estimates compares each treated observation with controls on the basis of four matches with replacement on a total of 1530 observations for which data on gross domestic product and total agricultural value-added were available in the data over the 1960–2013 time period.

Table 1 reports estimates of the treatment effects. In every instance, for both CEMAC and WAEMU, the treatment effect is positive and significant. That $\tau_M^{sm,c}$ is always positive and significant suggests that expansion of, or replication of euro-currency integration type regional currency unions could raise agricultural value-added for other Sub-Saharan African countries who are not currently members of a regional currency union. As for practical significance, on average the three treatment effects constitute an effect that is approximately 42 % higher than average total agricultural productivity of all countries in the sample.

4 Conclusion

This paper considered the effects of regional euro-currency integration on agricultural productivity in Sub-Saharan Africa. We utilized a propensity score matching estimator to estimate the treatment effect of Sub-Saharan African countries joining the euro-currency integration on agricultural value-added. Our parameter estimates reveal that euro-currency integration membership has positive effects on agricultural value-added. This suggests that as an institutional arrangement, regional currency union membership can improve agricultural productivity in Sub-Saharan

[3]This satisfies the requirement that a propensity score—the function determining the probability of selection into the treatment—is a function of covariates that cannot be altered by the treatment.

Table 1 Propensity score matching estimates of currency union treatment effect

Outcome	Annual growth in agriculture Value-added: CEMAC	Annual growth in agriculture Value-added: WAEMU
Treatment effect		
τ_M^{sm}	6.52	9.48
	(1.06)[a]	(0.547)[a]
$\tau_M^{sm,t}$	9.18	5.49
	(1.07)[a]	(0.572)[a]
$\tau_M^{sm,c}$	6.01	10.21
	(1.21)[a]	(0.602)[a]
Number of observations	1530	1530
Number of matches	4	4

Standard errors in parentheses
[a]Significant at the 0.01 level

Africa, which is an important component of achieving economic growth that is effective in reducing poverty.

As for limitations, our results are based on only one measure of agricultural productivity. There are other measures of agricultural productivity which are potentially more important for economic development in Sub-Saharan Africa. For example, Diao et al. (2010), find that agriculture's share of GDP is an important determinant of pro-poor growth in Sub-Saharan Africa, and Djurfeldt (2013) finds that agriculture's share of new firm formation has a similar effect. In future work, our aim is to consider these other measures and the extent to which regional currency unions in Sub-Saharan Africa favorably impact them.

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