

FINANCIAL LIBERALIZATION AND THE DEVELOPMENT OF STOCK MARKETS IN SUB-SAHARAN AFRICA

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Abstract

This study sought to investigate the relationship between financial liberalization and stock market development in four Sub-Saharan African stock markets using quarterly data for the period 1975 - 2014. The analysis focused on three dimensions of liberalization in isolation, which are capital account liberalization, stock market liberalization and financial sector liberalization. Hence, the empirical analysis uses three Bayesian VAR models for each market studied. The results from the investigation show a positive correlation between stock market development and the liberalization of stock markets and the financial sector in all four countries, which advocates for the opening of financial markets to international investors, as well as the deepening of the sector. Additionally, a positive long-run response of stock market development to all three forms of liberalization in all the markets considered suggested that greater focus should therefore be put on increasing financial openness by removing the restrictions in the financial sectors of the respective economies, as this will promote the effectiveness of the deliverance of credit to the private sector, efficient credit evaluation and public sector surveillance, which is provided through the stock market. Finally, the analysis uncovered negative correlation between stock market development and inflation in all four markets, suggesting that policy makers in these countries should pay special attention to inflation targeting policies in order to positively contribute to enhancing these markets.

Keywords: Financial liberalization, capital account liberalization, stock market liberalization, stock market development, Bayesian Vector Autoregressive model.

JEL Classification: G18, G28, G38.

1 Introduction

After the financial crises of the 1980s, major reforms were implemented as part of broader programs of financial sector reforms funded by loans from the World Bank or other multilateral agencies. Reforms

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regarding the bank regulations and supervision were high on the list of conditions of the World Bank financial sector adjustment loans, bearing higher probability of inclusion than interest rate deregulation, bank privatization or directed credit reforms (Brownbridge and Kirkpatrick, 2000). However, a number of developing economies faced banking crises during the mid to late 1990s, many years after the prudential reforms started to be implemented (Brownbridge and Kirkpatrick, 2000). These crises were attributed to an incorrect sequencing of financial sector reforms, with liberalization preceding prudential reforms. It is of convention that emerging economies should only liberalize their financial sectors after sound prudential systems have been put in place, or at least gradually, while systems are being strengthened (Brownbridge and Kirkpatrick, 2000). Nevertheless, multilateral organizations such as the IMF and the World Bank, still support the traditional free market neoclassical view arguing that financial repression is the cause of the slow growth and the alarming rate of persistent poverty in Africa. Actually, the proponents of this view maintain that restrictions such as interest rate control or considerable reserve requirements constitute the main sources of the low growth and poor driven allocation of financial resources on the continent (Yusuf, Malarvizhi and Jayashree, 2014).

In spite of the banking crises plaguing the financial markets worldwide in the 1980s - 1990s, that period saw a mushrooming of stock markets in Sub-Saharan Africa. Besides a few early risers such as the Egypt Exchange, the Johannesburg Stock Exchange, the Casablanca Stock Exchange and the Zimbabwe Stock Exchange, established in 1883, 1887, 1929 and 1948, respectively; 13 of the 29 exchanges housed on the continent were established between 1988 and 1999. Before the 2008 financial crisis, the equity market sector improved and expanded rapidly. In fact, market capitalization in most African exchanges doubled between 1992 and 2002, increasing from US\$113.4 billion to US\$244.6 billion (Yartey and Adjasi, 2007). Although these markets remain small in size and relatively illiquid, many have yielded high returns to investors over time. Since 1995, at least one African stock market has been ranked in the world's top-10 best performing markets every year. However, the global financial crisis, creating gloomy growth prospects worldwide, tighter credit conditions as well as an increase in risk aversion, affected foreign investors' interest in African markets' investment opportunities. Thus, in 2008 there was fall in foreign direct investment and portfolio equity flows, as well as sharp fall in equity prices. Moreover, the decrease in private sector credit growth in some countries and the stiffening of domestic banking lending conditions in others impacted negatively the development of the banking sector which is considered as playing a complementary role for stock market development in Africa.

In light of the preceding discussion, it is relevant to pose the following research questions: Does the liberalization of the financial sector impact the performance of stock markets in Sub-Saharan Africa? Could financial liberalization induce the development of stock markets? Hence, the objectives of this paper are to evaluate the degree of financial liberalization in selected Sub-Saharan Africa countries; and to examine the effects of liberalization on the stock markets' performance.

Analyzing the impact of liberalization in the financial sector on the stock markets could contribute to

form policy makers' understanding of the right instruments to employ in order to promote the development of security exchanges. Despite, the considerable number of already available studies on the effect of financial liberalization on the development of financial markets in general, there is limited existing literature on the effect of liberalization on the stock market development specifically. Therefore, this paper aims at contributing to the existing literature by focusing on the development of securities exchanges in the Sub-Saharan African region. More precisely, this analysis will focus on four stock markets in the region, namely, the Nigerian stock exchange, the Nairobi stock market, the Johannesburg stock exchange and the West African stock market¹ (i.e the Bourse Regionale des Valeurs Mobilieres). These four markets, with a total market capitalization of US\$1 174 trillion constitute more than 80 percent of the total market capitalization in the Sub-Saharan African region.

The rest of the paper is organized as follows. Section two will describe the evolution of financial liberalization in the region up to date. Section three provides a brief review of the theoretical and empirical literature. Section four discusses the methodology used to conduct the analysis and provides a detailed description of the data. Section five presents the empirical analysis and findings; while the last section provides a conclusion to the paper.

2 Evolution of financial liberalization in Sub-Saharan Africa

The financial liberalization process was not uniform around the continent. In fact, countries such as South Africa, Mauritius and Senegal were quite early in their embrace of the reforms (as early as 1980), while others such as Sierra Leone, Uganda, Zambia and Zimbabwe were quite late in joining the movement, with liberalization starting in 1991 in Zambia and Zimbabwe, and in 1992 in Sierra Leone and Uganda (Fowowe, 2008). Moreover, some countries followed a gradual approach to liberalization by executing different measures in different years. This was the case in Zambia, Malawi, Kenya and Botswana. However, other countries chose to rather implement multiple liberalization reforms in the same year. This was the case in Zimbabwe, Uganda, Mali, Gambia and Cote d'Ivoire (Fowowe, 2008).

The following subsections will give an overview of the evolution of financial liberalization in the four markets considered in this study, focusing on three specific forms of liberalization undertaken as part of the broader liberalization process, namely capital account liberalization, stock market liberalization and financial sector liberalization. The last subsection will provide a conclusion to the discussion.

2.1 Capital account liberalization

Authorities in emerging and developing economies have taken considerable steps towards liberalization in the last 40 years. This led to a record increase in the flows of capital to these markets. The 1993

¹The BRVM is a regional stock market serving the eight West African countries comprising the West African Monetary Union and the BCEAO. These countries are: Benin, Burkina Faso, Guinea Bissau, Cote d'Ivoire, Mali, Niger, Senegal and Togo.

World Development Report reported an amount of US\$850 billion of gross capital flows to the main developing countries between 1990 and 1993. This amount was a substantial increase compared to the US\$100 billion recorded between 1980 and 1985 (Tswamuno, Pardee, and Wunnava, 2007).

According to Bicaba, Brixiová and Ncube (2015), as of 2012, capital accounts were liberalized in 18 African economies, most of which are frontier markets². A general trend towards capital accounts liberalization can thus be identified in Africa, although this was delayed compared to the other regions. The capital account liberalization process in most African economies kicked off through the removal of restrictions on long term transactions, particularly FDI inflows (Bicaba, *et al.*, 2015). The most common controls remaining untouched were the restrictions on all types of capital outflows (i.e. financial, direct investment and equity). As mentioned before, the process of liberalization was not uniform across countries and the speed differed considerably. For instance, full capital accounts liberalization could already be recorded in Mauritius and Zambia in the early 1990s; while Angola and Tanzania still had tight restrictions in place from 1995 to 2005 (Bicaba, *et al.*, 2015).

The capital account liberalization was not a uniform process in the Sub-Saharan African region. In addition to the different starting dates among countries, diverse measures and different degrees of liberalization were adopted. While Kenya adopted the IMF's SAP in 1992 and had already abolished all exchange controls by the end of 1995; the WAEMU countries only engaged in capital account liberalization in 1999, lifted capital controls restrictions on only inward FDI and foreign borrowing by residents, and still has its currency anchored to the Euro. Moreover, South Africa lifted and reinstated certain restrictions between 1983 and 1992, from which year the liberalization process really took off. This process is still ongoing, as controls on current transactions were only relaxed in 2016. Finally, Nigeria which kicked off its liberalization process as early as 1986, gradually implemented a series of measures over the year, reaching full liberalization of foreign exchange controls in 1995. However, the country returned to tighter regulations on residents' accounts and the acquisition of foreign currency domestically for investment in foreign securities in 2016, to restraint flight of capital and the pressure on the naira created by adverse economic conditions.

Additionally, the trends in the balance of net financial account, net FDI inflows and net portfolio investment flows depicted for the 3 countries and the WAEMU zone between 1970 and 2015 (cf. Figure 4 in Appendix), did not attest of a considerable and immediate impact of the liberalization measures undertaken by the respective authorities on the capital/financial account. An exception was observed, however, in South Africa where the financial account balance came out of a decreasing trend in 1998 after implementation of exchange controls easing measure; and both net inflow of FDI and net portfolio investment reached their highest level since 1970 in 2001 after the limit in foreign investment was raised.

²Refers to developing countries that are more developed than the least developing countries, yet too small to be classified as emerging markets. According to the FTSE classification of markets as at September 2016, the frontier markets in Africa are: Botswana, Cote d'Ivoire, Ghana, Kenya, Mauritius, Morocco, Nigeria, Tunisia (FTSE Russell, 2016).

2.2 Stock market liberalization

Most of the stock exchanges currently existing in Sub-Saharan Africa were already established by the time the liberalization process started in the region. In effect, most developing economies started the process by opening their capital accounts, then liberalization of stock markets followed suit in early 1990s. These measures opened domestic stock markets to foreign investors and contributed considerably to the integration of these developing stock markets to the rest of the world.

All of the markets under consideration undertook stock market liberalization measures as part of their greater liberalization agenda. In fact, in most cases, these measures were adopted directly, or presented themselves, as a direct result of the liberalization of capital accounts. Although it seemed to immediately increase foreign contributions to the respective domestic markets, it appeared to be short lived as domestic investors have been dominating the markets in recent years (cf. Table 7 in Appendix). Moreover, in the BRVM, Nigeria Stock exchange and Nairobi Stock exchange, the liberalization measures do not seem to have had a considerable impact on stock market size, since the markets remained considerably small up to date. The same can be said of market liquidity in all four markets as they are all still highly illiquid.

2.3 Financial sector liberalization

Before the financial liberalization measures were undertaken, the financial systems in Sub-Saharan Africa were narrow and totally unprepared for a comprehensive banking sector reform process over a short period (Moyo, Nandwa, Oduor and Simpasa, 2014). The characteristics of the financial systems such as depth and sophistication of the financial markets are heterogenous across most Sub-Saharan African countries. The financial sector in the region is generally characterized as underdeveloped in terms of efficiency and depth, as it is mostly dominated by foreign-owned banks, which are relatively small banks compared to other regions (Moyo, *et al.*, 2014). According to Beck, *et al.* (2011), the total assets of an average bank in Sub-Saharan Africa amounts to US\$ 200 million, while the total assets of a non-African bank average US\$ 1 billion.

Financial sector liberalization in the four economies considered in this study occurred from the 1980s to the early 1990s. In all four cases, interest rates were fully liberalized and credit controls were abolished by 1993. While undertaking these financial reforms, these government showed commitment to deepen their financial systems, adopt sound monetary policy and boost economic growth through the encouragement of investment. However, the results of these efforts did not transpire through the level of domestic credit provided to the private sector which remains relatively low and volatile (cf. Table 8 in Appendix). Moreover, the values of commercial banks and other lending, which is still quite insignificant in these economies, may suggest that the abolishment of credit controls requires to be paired with additional measures in order to boost investment in the region and improve financial integration.

3 Literature review

McKinnon (1973) and Shaw (1973), pioneered the notion of financial repression, and demonstrated that a repressed financial sector discourages both saving and investment, since the rates of return are lower than the ones obtained in competitive markets. McKinnon (1973) and Shaw (1973) arguments strongly reject the theory of financial repression through interest rate controls and government intervention advanced by Keynes (1936) and Tobin (1965). Over the years, several models have been developed in support and as extension of McKinnon (1973) and Shaw's (1973) work. Generally, these models pay more attention to the effects of financial liberalization on the quality or the quantity of investment. For instance, the free market neoclassical ideas suggest that financial sector liberalization enhances the mobilization of savings and the channeling of capital into the most appropriate sectors of the economy (Yusuf *et al.*, 2014). This implies an improvement of the amount of physical capital and its productive uses and an increase in the level of economic growth. Economic growth, in turn, raises the level of income, thus reducing the level of poverty.

According to Rancière, Tornel and Westermann (2008), financial liberalization denotes the liberalization of the capital account and the deregulation of domestic financial markets. Concretely, this involves measures such as removing restrictions on capital inflows and outflows, allowing foreign investors to purchase and hold domestic equity and to freely repatriate capital, dividends and interests, abolishing directed credit allocation, denationalizing banks, liberalizing interest rate, liberalizing entry to the banking sector, as well as strengthening prudential regulations. These measures can be regrouped into three different forms of liberalization, namely, capital account liberalization, stock market liberalization and financial sector liberalization.

Capital account liberalization generally involves a decision by central authorities to eliminate limits on capital inflows and outflows. The proponents of this form of liberalization postulate that the abolishment of capital flows restrictions will create an unlimited flow of international capital, through which the cost of capital will be lowered, risk diversification will be possible, and investment in projects yielding higher returns will be encouraged (Tswamuno, *et al.*, 2007). Hence, the implementation of capital account liberalization measures will offset low savings levels and boost the level of investment, employment as well as economic growth. Stock market liberalization, which is one particular form of capital account liberalization, is a policy undertaken by authorities to open a domestic equity market to foreign investors (Henry, 2000).

The post Keynesians advanced arguments against the McKinnon-Shaw hypothesis focusing on the function of effective demand (Owusu, 2011). They reason that effective demand is influenced by income distribution. Therefore, in contrast to the McKinnon-Shaw hypothesis, investment and savings have distinct functions with typical Keynesian features. This implies that the liberalization of interest rate could engender a drop in production and growth, and lead to financial instability (Owusu, 2011).

Moreover, some critics maintain that the standard efficiency argument, which is the basis of the

reasonings of liberalization's advocates, is far from the reality of capital account policy. Capital and financial markets are inherently different from markets for common goods and services, since the main function of financial and capital markets is to gather information, essentially to assess the profitability of projects and firms, as well as to monitor and ensure the appropriate use of funds (Stiglitz, 2000). Even that seldom applies to developing countries where information asymmetries are endemic to financial markets and transactions. These markets are thus unable to gather enough relevant information to ensure the flow of capital to sectors where its marginal productivity tops opportunity costs. Additionally, some critics of the financial liberalization theory argue that numerous conditions have to be met prior to liberalization, and that the benefits of financial liberalization cannot be established as long as countries disregard the importance of reform complementarities (Njikam, 2017).

A number of studies were conducted to examine the linkage between financial liberalization, economic growth and poverty reduction. In the case of Sub-Saharan African countries, many (i.e. Yusuf, *et al.* (2014) and Fowowe (2008)) found a positive causality relationship between financial liberalization and economic growth. Fowowe (2008) who covered the period 1978 – 2000 for 19 Sub-Saharan African countries, found that in all cases, economic growth was positively affected by financial liberalization (Fowowe, 2008). However, Yusuf, *et al.* (2014) showed that financial liberalization does not directly impact poverty reduction in the six Sub-Saharan African countries studied during the sample period 1996 – 2011. The authors concluded from their analysis that, without maintaining supervisory and regulatory frameworks, macroeconomic stability, as well as sound institutions and policies in the Sub-Saharan African economies, the implementation of financial liberalization reforms may exacerbate the living standard of the poor segment of the society (Yusuf, *et al.*, 2014).

Furthermore, Reinhart and Tokatlidis (2000), in their analysis of financial liberalization reforms on financial development in Africa, found that financial liberalization on the continent was not followed by financial deepening as was the case in other regions of the world. In effect, while there was an improvement in the monetary aggregates, the credit aggregates remained the same. Many African countries even experienced a credit crunch. This prompted the idea that liberalization in Africa has not been accompanied by the kind of fiscal discipline that allows credit to flow to the private sector, as it was the case in other regions of the world (Reinhart and Tokatlidis, 2000). Moreover, while many developing countries appeared to have greater access to international capital markets after financial liberalization occurred, this was not the case for African countries where capital account liberalization has been more slow-moving.

When examining the determinants of financial development, Law and Habibullah (2009) narrowed their analysis down to three determinants, namely trade openness, institutional quality and financial liberalization. The panel data analysis was conducted using data from 27 economies selected from the G-7, East Asia, Europe and Latin America; and covered the period 1980-2001. According to Law and Habibullah's (2009) findings, domestic financial sector liberalization promotes banking sector develop-

ment, while stock market development is encouraged by stock market liberalization measures. However, these results also show that developed economies are more responsive to financial liberalization measures than developing economies.

A similar study by Karikari (2010) focused on examining the effect of governance and financial liberalization on financial development in 37 Sub-Saharan African countries for the period 1996 – 2008. Karikari's (2010) results confirmed the argument derived from previous studies maintaining that financial liberalization alone does not lead to development. In effect, the author found that improvement in financial liberalization lowered financial development in the Sub-Saharan African countries during the period 1996 – 2002, and argued that the effect of liberalization on financial development may lie on the level of institutional quality. Karikari's (2010) concluded that the practice of good governance in the Sub-Saharan African countries could have contributed to the success of the massive financial liberalization undertaken in those countries in the late 1980s and early 1990s. Additionally, rule of law seemed to have less power on financial development than political stability.

Interestingly, Moyo, *et al.* (2014) investigated the hypothesis that an increase in banking sector competition because of financial liberalization boosts financial stability in 16 Sub-Saharan African countries during the period 1995 - 2010. The results of the analysis showed that firstly, economic freedom, easing of restrictions and entry of foreign banks all contributed to improving competition in the banking sector; and secondly, in the period after implementation of financial liberalization reforms, an increase in competition was associated with an increase in the lead time to episodes of bank distress (Moyo, *et al.*, 2014). However, Moyo, *et al.* (2014) emphasized that the government's pursuit of sound macroeconomic policies and enhancement of the effectiveness of institutions allowing the success of the banking industry are crucial to stabilize the banking system in a competitive and liberalized economy.

Although there has been extensive research conducted on the relationship between liberalization and economic growth in Sub-Saharan Africa over the years (i.e. Tswamuno, *et al.* (2007); Owusu (2011); Nwadiubu, Sergius and Onwuka (2014); Le Roux and Moyo (2015); Njikam (2017)), the literature on the link between financial liberalization and stock market development in the region is rather scarce. One of the few studies that can be found is Kinuthia and Etyang (2014) examination of the impact of stock market liberalization on stock market performance and economic growth in Kenya. The evidence indicated that the liberalization of the stock market in Kenya had a significantly positive influence on stock market performance and economic growth. In fact, stock market liberalization had a positive impact on investment and stock market liquidity, which in turn positively affected real GDP per capita (Kinuthia and Etyang, 2014).

Prior to that, Dhir (2007) examined the impact of liberalizing the stock market on the volatility in 12 selected emerging stock markets between February 1976 and December 2006. The results of the analysis showed that there is no significant evidence of time varying impact of stock market liberalization on volatility. However, it is seen that for most countries, except Argentina and the Philippines, opening of

the markets had a differential effect on volatility both during and after the liberalization period. In some cases, the effect was significantly positive, while in others it was significantly negative (Dhir, 2007).

Likewise, Nyang'oro (2013) explored the impact of foreign portfolio flows on the performance of the stock market in Kenya. Focusing on the period April 1996 – December 2011, the empirical analysis uncovered a relationship between stock market return and lagged unexpected flows, rather than contemporaneous flows values. In fact, a lag in unexpected flows are linked to a fall in equity prices (Nyang'oro, 2013). Moreover, with inflow of foreign portfolio investments, there was an increase in stock prices, potentially due to an increase in demand. However, there was no significant feedback effect found between foreign portfolio flows and stock returns. Nyang'oro (2013) argued that it may be an indication of the fact that the market is attractive to foreign investors mainly for risk diversification purposes, and not for returns. Finally, there was a positive relationship between stock market returns and expected portfolio flows, suggesting that market performance is stimulated by an increase in expected portfolio flows which builds investors' confidence in the market (Nyang'oro, 2013).

Balogun, Dahalan and Hassan (2016) extended the analysis of stock market liberalization and financial development on the development of stock markets to seven Sub-Saharan African economies. The conclusion drawn from the analysis was that liberalization of the stock market has a long-run positive impact on stock market development in the Sub-Saharan African countries under consideration. Moreover, liberalizing the stock markets improves financial development which also has a positive effect on the development of the stock market in the long run.

The majority of existing studies used cointegration tests and VECM models. In an attempt to explore better tools for this type of analysis, this study will rather make use of the Bayesian VAR, which is more elaborate than the unrestricted VAR, and especially more appropriate when modeling large datasets. In effect, during the choice of variables, lag length selection, and specification of identification restrictions, the unrestricted VAR scantily makes use of a-priori information. This may lead to overfitting, when there is a large number of parameters, weak sample information or a short data set. Typically, in-sample overfitting leads to poor quality unconditional and conditional (Canova, 2007). These shortcomings can be addressed when using the Bayesian methods, as less dramatic in-sample fitting can be made and out-of-sample performance is improved (Canova, 2007).

4 Methodology and Data

This study employs the Bayesian VAR (BVAR) that addresses the shortcomings of the unrestricted VAR. The BVAR which was initially developed to improve forecasting in the macroeconomics field, has evolved substantially over the years and is now applied for divers purposes.

4.1 Analytical framework

The Vector Autoregressive (VAR) models are atheoretical models used to capture and evaluate linear interdependence between time series (Woźniak, 2016). Introduced by Sims (1972), they successfully capture stylized facts about time series such as dynamic linear interdependence, robust autocorrelations at annual frequencies, and the deteriorating pattern in the values of autocorrelations when the lag order increases (Woźniak, 2016). According to Woźniak (2016), the dynamic interdependence between series which is analyzed through the Granger causality hypothesis, is efficiently captured by the VAR, making it a crucial tool for empirical macroeconomic research. With the introduction of an econometric technique named parameter shrinkage, the Bayesian VAR was developed.

Pioneered by Thomas Bayes, the Bayes' theorem was presented as an answer to the inverse probability problem. A simple representation of Bayes' rule is written as:

$$p(\theta|Y) = \frac{p(Y|\theta)p(\theta)}{p(Y)}, \quad (1)$$

where θ is a collection of all the parameters included in the model; Y is the data used for the estimation of the parameters; and p is some probability distribution.

The left-hand side of equation 1 gives the posterior distribution; that is, a conditional distribution of the collection of parameters θ given the data Y . This distribution is a full designation of the information gathered about the parameters of the model after observation of the data (Woźniak, 2016). The first element of the numerator on the right-hand side of equation 1 presents the likelihood function. This is the conditional distribution of the data given the parameters of the model. The second element of the numerator on the right-hand side represents the prior distribution of the parameters θ . This symbolizes the uncertainty about θ before the data is observed; and is outlined as a marginal distribution of θ . The specification of this distribution by an investigator is required, as it is the information about the parameters that is being included in the statistical inference. When both the prior and the likelihood functions are known for all hypothesis, the exact posterior can be computed using Bayes' formula. However, in most cases the prior probabilities are unknown and they have to be made up as subjective beliefs about the parameters.

In equation 1, the computation of the posterior distribution involves the division of the joint distribution of the data and the parameters by a denominator called the marginal data density (or marginal likelihood in statistics). This is the total probability of the data considering all possible hypotheses, and substantiate the model embodied in the data. The marginal density can be obtained from an integral of the joint distribution of the data and the parameters, with respect to the parameters.

The likelihood function of an m variable VAR(q)

The VAR can be written in two formats:

$$\mathbf{Y} = \mathbf{X}\mathbf{A} + \mathbf{E} \quad (2)$$

$$y = (I_m \otimes X)\alpha + ee \sim (0, \sigma_e \otimes I_T) \quad (3)$$

where \mathbf{Y} and \mathbf{E} are $T \times m$ matrices; \mathbf{X} is a $T \times k$ matrix; $\mathbf{X}_t = [y'_{t-1}, \dots, y'_{t-q}, \bar{y}'_t]$; y and e are $mT \times 1$ vectors; I_m is the identity matrix of dimension m , and $\alpha = \text{vec}(\mathbf{A})$ is a $mk \times 1$ vector.

Based on equation 2, the likelihood function is:

$$L(\alpha, \Sigma_e) \propto |\Sigma_e \otimes I_T|^{-0.5} \exp\{-0.5(y - (I_m \otimes X)\alpha)'(\Sigma_e^{-1} \otimes I_T)(y - (I_m \otimes X)\alpha)\} \quad (4)$$

After careful decomposition, equation 4 becomes:

$$\begin{aligned} L(\alpha, \Sigma_e) &\propto |\Sigma_e \otimes I_T|^{-0.5} \exp\{-0.5(\alpha - \alpha_{ols})'(\Sigma_e^{-1} \otimes X'X)(\alpha - \alpha_{ols}) \\ &\quad - 0.5[(\Sigma_e^{-0.5} \otimes I_T)y - ((\Sigma_e^{-0.5} \otimes X)\alpha_{ols})]'[(\Sigma_e^{-0.5} \otimes I_T)y - ((\Sigma_e^{-0.5} \otimes X)\alpha_{ols})]\} \\ &= |\Sigma_e|^{-0.5k} \exp\{-0.5(\alpha - \alpha_{ols})'(\Sigma_e^{-1} \otimes X'X)(\alpha - \alpha_{ols}) \\ &\quad \times |\Sigma_e|^{-0.5(T-k)} \exp\{-0.5 \text{tr}[(\Sigma_e^{-0.5} \otimes I_T)y - ((\Sigma_e^{-0.5} \otimes X)\alpha_{ols})]'(\Sigma_e^{-0.5} \otimes I_T)y \\ &\quad - (\Sigma_e^{-0.5} \otimes X)\alpha_{ols}]\} \\ &\propto \mathbb{N}(\alpha | \alpha_{ols}, \Sigma_e, X, y) \times \mathbb{W}(\Sigma_e^{-1} | y, X, \alpha_{ols}, T - k - m - 1) \end{aligned} \quad (5)$$

where tr is the trace of a matrix.

From equation 5, it is observed the possibility to decompose the likelihood function of a VAR(q) into the product of a Normal density for α , conditional on its OLS estimate α_{ols} and on Σ_e , and a Wishart density for Σ_e^{-1} , also conditional on α_{ols} , with $(T-k-m-1)$ degrees of freedom and $[(y - (I_m \otimes X)\alpha_{ols})'(y - (I_m \otimes X)\alpha_{ols})]^{-1}$ as a scale matrix.

Consequently, with a combination of the appropriate prior restrictions, the conditional posterior distribution for the VAR coefficients and the covariance matrix of the reduced form shocks can be analytical derived. Under the assumptions of the Normal-Wishart prior, which combines the two blocks of the likelihood, the conditional posterior of Σ_e^{-1} will be Wishart, while the conditional posterior of α will be Normal (Canova, 2007). There also exist other prior assumptions that permit analytical computation of conditional posteriors.

In this analysis, the Minnesota prior was specified. This is a commonly used class of prior distribution. In this case, α and Σ_α are functions of a small number of hyperparameters (Canova, 2007). Particularly, the assumption of the Minnesota prior is that $\bar{\alpha} = 0$ except for $\bar{\alpha}_{i1} = 1, i = 1, \dots, m$; that Σ_α is diagonal, and it also assumes that the $\sigma_{ij,l}$ element that corresponds to lag l of variable j in equation i is of the form:

$$\begin{aligned} \sigma_{ij,l} &= \frac{\phi_0}{h(l)} \text{ if } i = j, \forall l \\ &= \phi_0 \times \frac{\phi_1}{h(l)} \times \left(\frac{\sigma_j}{\sigma_i}\right)^2 \text{ otherwise when } i \neq j, j \text{ endogenous, } \forall l \\ &= \phi_0 \times \phi_2 \text{ for } j \text{ endogenous.} \end{aligned} \quad (6)$$

In this case, the hyperparameters are ϕ_i , $i = 0, 1, 2$; the scaling factor is $\frac{\sigma_i}{\sigma_i}$ ²; and $h(l)$ represents a deterministic function of l . The features of interest are captured in the prior (i.e. equation 6). These are, the tightness of the variance of the first lag as represented by ϕ_0 ; the relative tightness of the exogenous variables as represented by ϕ_2 ; and the relative tightness of the variance of lags other than the first one as represented by $h(l)$. Generally, either a harmonic decay $h(l) = l^{\phi_3}$ or a geometric decay $h(l) = \phi_3^{-l+1}$, $\phi_3 > 0$, is assumed. With σ_i , $i = 1, \dots, m$ being unknown, equation 6 makes use of consistent estimates of standard errors of the variables i, j .

Canova (2007) explains that the logic of a prior can be understood by noting the fact that the m time series are a-priori characterized as random walks. This is due to the typical appropriateness of univariate random walk models, when forecasting macroeconomic time series. However, while the imposition of the random walk hypothesis is done a-priori, each time series may represent a more complex process a posteriori, if the data contains sufficient information to require it (Canova, 2007).

In dealing with the ‘‘curse of dimensionality’’, restrictions are introduced by the Minnesota prior in a versatile manner, by imposing probability distributions on the coefficients of the VAR, effectively reducing the dimensionality of the issue while simultaneously reasonably accounting for the uncertainty faced by the researcher (Canova, 2007).

4.2 Model Specification

The three measures of financial liberalization that are considered in this model are the capital account liberalization index (CAPLIB), stock market liberalization index (STOCKLIB) and the financial sector liberalization index (FINLIB). The effect of these measures of financial liberalization on stock market development are examined including a stock market development index (DEVINDEX) and two control variables, namely inflation (INF) and investment (INV). When examining the effect of each of these forms of liberalization in isolation for the four selected markets, the BVARs estimated can be written as three systems of four equations of the form:

$$y_{i,t} = A(L)y_{i,t-1} + C\bar{y}_{i,t} + e_{i,t}, \quad e_{i,t} \sim (0, \Sigma_e) \quad (7)$$

where

$$y_{i,t} = \begin{bmatrix} DEVINDEX_{i,t} \\ CAPLIB_{i,t} \\ INF_{i,t} \\ INV_{i,t} \end{bmatrix}, \quad \text{for country } i \text{ in Model 1;}$$

$$y_{i,t} = \begin{bmatrix} DEVINDEX_{i,t} \\ STOCKLIB_{i,t} \\ INF_{i,t} \\ INV_{i,t} \end{bmatrix}, \quad \text{for country } i \text{ in Model 2;}$$

and

$$y_{i,t} = \begin{bmatrix} DEVINDEX_{i,t} \\ FINLIB_{i,t} \\ INF_{i,t} \\ INV_{i,t} \end{bmatrix}, \text{ for country } i \text{ in Model 3.}$$

After the stationarity tests have been run and the models estimated, the impulse-response functions and variance decompositions are estimated.

4.3 Data and descriptive statistics

The data sample consist of quarterly values of the variables included in the model for different time periods specific to each country considered. The difference in the period covered by the data samples stems from the unavailability of data in some of the countries. The sample period for each country is given in Table 1. Moreover, the study focuses on four Sub-Saharan African stock markets namely the Nigeria Stock Exchange, the Nairobi Stock Exchange, the Johannesburg Stock Exchange and la Bourse Regionale des Valeurs Mobilieres (BRVM).

To examine the relationship between financial liberalization and the development of stock markets, the study employs three indicators of stock market development, as defined in Levine and Zervos (1998) These are size, liquidity and volatility. The market size (SIZE) is measured by the market capitalization ratio, and is calculated by dividing the value of listed shares by the GDP. Market liquidity is measured using both the value traded ratio (VTR) and the market turnover ratio (MTR). Volatility in the market is measured as a 12-month rolling standard deviation estimate based on the daily returns of the All share index. The data for these variables was collected from the Federal Reserve of St Louis database and the World Bank's World Development Indicators (WDI) database. A simple average of the values of the four indicators of financial liberalization are used to construct an overall index of stock market development (DEVINDEX).

The rate of inflation is measured by the percentage change in the consumer price index; and the level of investment is measured by the ratio of gross fixed capital formation to GDP. Quarterly values of the CPI were collected from the IMF International Financial Statistics database, while annual values of the gross fixed capital formation/GDP were collected from the World Bank's WDI database.

The Chinn-Ito index is used to represent capital account openness and is used in this study as a measure of capital account liberalization (CAPLIB). This index introduced by Chinn and Ito (2006) measures a country's degree of capital account openness and is based on the binary dummy variables that codify the tabulation of restrictions on cross-border financial transactions reported in the IMF's Annual Report on Exchange Arrangements and Exchange Restrictions (Chinn and Ito, 2006). The financial sector liberalization index (FINLIB) is extracted from the New Database of Financial Reforms constructed by Abiad, Detragiache and Tressel (2009). The index takes into account seven different dimensions of financial sector policy, namely credit controls and excessively high reserve requirements,

interest rate controls, barriers to entry into the financial system of new domestic banks or other potential competitors, state ownership in the banking sector, financial account restrictions, prudential regulations and supervision of the banking sector, and securities market policy. For each dimension included, a final score on a graded scale from zero to three is given, where 0=fully repressed, 1=partially repressed, 2=partially liberalized, 3=fully liberalized. After equal weight is assigned to each dimension, the final scores for all dimensions are added to get the aggregate index for each country for every year. The index then takes values between 0 and 21.

These two indexes that are presented in annual frequency have been transformed into quarterly frequency using information on the specific reforms dates provided by the IMF Annual Report on Exchange Arrangements and Exchange Restrictions. Moreover, the Abiad, *et al.* (2009) database only provides data up to 2005. Thus, information from the IMF AEAER and central bank reports was used to extend the dataset until 2014.

Furthermore, the stock market liberalization index (STOCKLIB) was built following the same methodology as Abiad, *et al.* (2009). Four dimensions of stock market liberalization were included in the index. These are: local purchase of equity by non-residents, equity sales or issue locally by non-residents, purchase of equity abroad by residents and equity sale or issue abroad by residents. A final score on a graded scale from 0 to 3 is given to each dimension; and the final scores for all dimensions are added to get the aggregate index for each country for every year. Because the index includes only four dimensions, it then takes values between 0 and 12.

Additionally, due to the unavailability of the required stock market development data in higher frequency than annual, an interpolation method had to be used to transform the datasets from annual to quarterly frequency. This was done to avoid the issues that the study could encounter when using a sample that is too small. The method used for the interpolation is Newton's method with divided differences. Since interpolating high degree polynomials with such volatile data as financial data is usually difficult, each interpolated point was constrained to the bounds of known values (i.e. the annual values).

Table 1 gives a summary of the descriptive statistics of the six variables included in the models for every country. The table shows statistics such as the mean, maximum, minimum, standard deviation for the six datasets for each market.

While Nigeria is seen to rank among the top 2 markets in terms of stock market development (DEVIN-DEX), financial sector liberalization (FINLIB) and Stock market liberalization (STOCKLIB), it has the lowest average level of real investment and the highest level of inflation for the sample period. Moreover, the six variables exhibit substantial variability both across indicators within the same country and across countries, with high standard deviations reported for all indicators during the sample periods. The highest standard deviation was seen in the stock market development index for South Africa.

Table 2 presents the correlations and the corresponding p-values of the six variables for each market

Table 1: Descriptive statistics

Panel A: WAEMU

	DEVINDEX	INF	INV	FINLIB	CAPLIB	STOCKLIB
Mean	7.750	0.946	11.473	13.269	-1.066	4.923
Maximum	15.517	4.899	19.277	14.000	-0.126	8.000
Minimum	1.442	-2.339	8.253	7.750	-1.189	0.000
Std Deviation	4.290	2.159	2.857	1.689	0.341	3.633
Period covered	1989Q1 - 2014Q4					

Panel B: SOUTH AFRICA

	DEVINDEX	INF	INV	FINLIB	CAPLIB	STOCKLIB
Mean	51.265	2.328	21.131	13.744	-1.294	5.675
Maximum	116.342	6.137	32.103	19.250	-0.126	10.000
Minimum	19.594	-1.196	15.150	3.000	-1.895	0.000
Std Deviation	23.864	1.274	4.796	5.268	0.484	3.463
Period covered	1975Q1 - 2014Q4					

Panel C: NIGERIA

	DEVINDEX	INF	INV	FINLIB	CAPLIB	STOCKLIB
Mean	9.894	4.582	10.557	14.731	-1.094	8.346
Maximum	22.151	22.296	16.555	18.000	-0.597	11.000
Minimum	1.589	-4.682	5.459	8.750	-1.895	1.000
Std Deviation	5.327	5.473	3.258	3.237	0.581	3.780
Period covered	1989Q1 - 2014Q4					

Panel D: KENYA

	DEVINDEX	INF	INV	FINLIB	CAPLIB	STOCKLIB
Mean	8.982	3.146	18.184	12.583	0.308	7.146
Maximum	19.522	17.401	21.386	15.500	1.091	9.000
Minimum	2.627	-3.287	15.388	6.750	-1.895	4.000
Std Deviation	4.384	3.691	1.852	3.073	1.241	1.914
Period covered	1989Q1 - 2012Q4					

Source: Author's estimations

considered. As can be observed from Table 2, stock market development is negatively related to inflation and positively related to STOCKLIB and FINLIB in all four markets. While in the WAEMU and Kenya, DEVINDEX is also positively related to investment, it is the opposite in South Africa and Nigeria where it is negatively related. In almost all the markets, inflation is negatively related to all three forms of liberalization, except in the WAEMU, where there is a significantly positive correlation between inflation and CAPLIB. Investment is also negatively related to all three forms of liberalization in all markets except in the WAEMU where there is significantly positive relationship between investment and CAPLIB. The next section will present the empirical analysis conducted and will give the interpretation of the findings.

5 Empirical Analysis and Findings

Each variable is subjected to the Augmented Dickey Fuller (ADF) test to examine stationarity. The test equation included both an intercept and a trend, and the AIC was used for the optimal lag order in the ADF test. The results are presented in Table 3 below.

For the four markets, almost all the variables are found to be $I(1)$. In other words, DEVINDEX, INV,

Table 2: Correlations and p-values

Panel A: WAEMU

VARIABLES	DEVINDEX	INF	INV	CAPLIB	FINLIB	STOCKLIB
DEVINDEX	1.000					
INFLATION	-0.083 (0.399)	1.000				
INVESTMENT	0.520 (0.000)	0.008 (0.939)	1.000			
CAPLIB	-0.076 (0.446)	0.411 (0.000)	0.140 (0.157)	1.000		
FINLIB	0.552 (0.000)	0.146 (0.138)	0.374 (0.000)	0.050 (0.6173)	1.000	
STOCKLIB	0.583 (0.000)	-0.179 (0.069)	0.095 (0.339)	-0.492 (0.000)	0.592 (0.000)	1.000

Panel B: SOUTH AFRICA

VARIABLES	DEVINDEX	INF	INV	FINLIB	CAPLIB	STOCKLIB
DEVINDEX	1.000					
INFLATION	-0.556 (0.000)	1.000				
INVESTMENT	-0.511 (0.0000)	0.407 (0.0000)	1.000			
FINLIB	0.855 (0.000)	-0.568 (0.000)	-0.777 (0.000)	1.000		
CAPLIB	0.205 (0.009)	-0.408 (0.000)	-0.102 (0.201)	0.251 (0.001)	1.000	
STOCKLIB	0.879 (0.000)	-0.568 (0.000)	-0.707 (0.000)	0.973 (0.000)	0.217 (0.006)	1.000

Panel C: NIGERIA

VARIABLES	DEVINDEX	INF	INV	FINLIB	CAPLIB	STOCKLIB
DEVINDEX	1.000					
INFLATION	-0.312 (0.001)	1.000				
INVESTMENT	-0.313 (0.001)	-0.028 (0.779)	1.000			
FINLIB	0.638 (0.000)	-0.482 (0.000)	-0.127 (0.199)	1.000		
CAPLIB	0.590 (0.000)	-0.475 (0.000)	-0.017 (0.865)	0.930 (0.000)	1.000	
STOCKLIB	0.620 (0.000)	-0.440 (0.000)	-0.219 (0.025)	0.939 (0.000)	0.922 (0.000)	1.000

Panel D: KENYA

VARIABLES	DEVINDEX	INF	INV	FINLIB	CAPLIB	STOCKLIB
DEVINDEX	1.000					
INFLATION	-0.043 (0.679)	1.000				
INVESTMENT	0.425 (0.000)	-0.001 (0.996)	1.000			
CAPLIB	0.317 (0.002)	-0.330 (0.001)	-0.104 (0.313)	1.000		
FINLIB	0.482 (0.000)	-0.336 (0.001)	-0.068 (0.507)	0.929 (0.000)	1.000	
STOCKLIB	0.468 (0.000)	-0.346 (0.001)	-0.158 (0.125)	0.889 (0.000)	0.952 (0.000)	1.000

Note: p-values in parenthesis

Source: Author's estimations

Table 3: Results of the unit root tests

In levels				
Variables	WAEMU	South Africa	Nigeria	Kenya
DEVINDEX	-2.806(0.199)	-2.655(0.257)	-1.132(0.918)	-1.264(0.891)
INF	-4.350(0.004)***	-8.118(0.000)***	-3.149(0.101)	-3.826(0.019)**
INV	-0.994(0.939)	-1.017(0.938)	-1.561(0.801)	-2.522(0.317)
FINLIB	-4.110(0.008)***	-2.100(0.541)	-1.233(0.898)	-0.944(0.946)
CAPLIB	-2.513(0.321)	-3.333(0.068)*	-1.557(0.803)	-1.758(0.717)
STOCKLIB	-1.565(0.800)	-2.114(0.534)	-1.109(0.922)	-1.479(0.830)
First differences				
Variables	WAEMU	South Africa	Nigeria	Kenya
DEVINDEX	-10.931(0.000)***	-10.807(0.000)***	-10.918(0.000)***	-9.310(0.000)***
INF	-11.885(0.000)***	-12.099(0.000)***	-11.312(0.000)***	-12.960(0.000)***
INV	-9.904(0.000)***	-11.490(0.000)***	-10.635(0.000)***	-9.176(0.000)***
FINLIB	-2.513(0.321)	-5.549(0.000)***	-10.396(0.000)***	-4.142(0.008)***
CAPLIB	-9.958(0.000)***	-12.541(0.000)***	-10.157(0.000)***	-9.615(0.000)***
STOCKLIB	-10.130(0.000)***	-12.708(0.000)***	-10.421(0.000)***	-9.731(0.000)***

Source: Author's estimations

Note: The MacKinnon (1996) one sided p-values are in the parenthesis. *, **, *** implies significance at 10 percent, 5 percent and 1 percent level, respectively.

CAPLIB, STOCKLIB in level form were non-stationary at the 5 percent level of significance; while their first differences were stationary at the 1 percent level of significance, for all four markets. FINLIB was also non stationary at the 5 percent level of significance for all markets, except WAEMU where it was found to be $I(0)$. INF in level form is stationary at the 1 percent level of significance for all countries, except for Nigeria where it was found to be $I(1)$. The literature suggests that the inclusion of non-stationary variables in a VAR model could lead to spurious regressions, and that the estimated parameters cannot be trusted. However, as argued by Sims (1980) and Sims, Stock and Watson (1990), non-stationary variables in their level form can be used in the VAR in cases where the investigator is not interested in point estimates of the variables. In other words, if the end-purpose of the analysis is to capture the dynamic responses of non-policy variables as a result of unexpected shocks in the policy variables, there is no issue in incorporating the non-stationary variables in levels. In that case, when estimating the impulse response functions, the shocks can be identified by using the Cholesky decomposition method where a recursive structure is imposed on the model. An alternative option would be to identify the policy shocks through the imposition of theory-backed restrictions on the contemporaneous relationships between the variables under consideration in the model. Hence, the crucial dynamic relationships between variables are well captured when using non-stationary variables in level form in the VAR model, thus providing valuable insights on policy analysis. Therefore, the non-stationary variables was used in level form throughout this study.

5.1 Model 1: Capital account liberalization and stock market development

The model used to examine the effect of capital account liberalization on stock market development for each market considered is referred to as Model 1 and will include four variables, namely DEVINDEX, INF, INV and CAPLIB, for each market. Finally, the impulse functions and variance decompositions are estimated. For all four markets the optimal lag order was found to be 1. Thus in the four cases, BVAR(1) models were estimated. A Minnesota/Litterman prior is specified in all cases, with univariate AR as the initial residual covariance matrix, degrees of freedom correction, and hyper-parameters $\mu = 0$, $\lambda_1 = 0.1$, $\lambda_2 = 0.99$ and $\lambda_3 = 1$.

The impulse response functions reveal the responsiveness of the non-policy variable (i.e. the dependent variable) to a shock (i.e. a one-unit increase) to a policy variable (i.e. the independent variable). Since the objective of Model 1 is to identify the effect of capital account liberalization on stock market development, only the functions of the response of DEVINDEX to a shock to each of the other three variables (i.e. CAPLIB, INF and INV) will be presented. Moreover, the impulse definition included a Cholesky decomposition with the ordering set as $\begin{bmatrix} CAPLIB \\ INF \\ INV \\ DEVINDEX \end{bmatrix}$. This Cholesky ordering assumes that CAPLIB has a contemporaneous effect on INF, INV, and DEVINDEX but the reverse does not apply. Similarly, INF has a contemporaneous effect on INV and DEVINDEX but the reverse does not apply; and INV has a contemporaneous effect on DEVINDEX but the reverse does not apply.

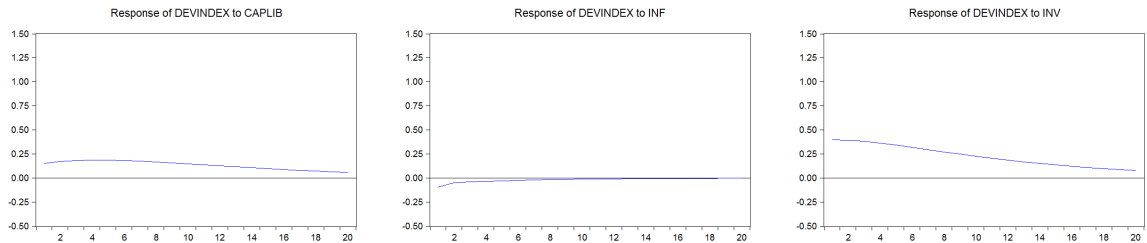
Figure 1 presents the impulse response functions for Model 1 for the four stock markets considered. From the figure, it can be seen that a unit shock to CAPLIB produces similar responses of DEVINDEX in Nigeria and Kenya. In effect, there is a negative response of DEVINDEX in the first quarter after the shock occurred. Although the response was considerably small, it increases in subsequent periods and become positive by the third quarter. Up to the 20th quarter, the response stays positive but gets closer to zero. In the WAEMU, although the immediate response of DEVINDEX to a shock to CAPLIB is positive, has similar trend to the one observed in Nigeria and Kenya, as the response remains positive and approaching zero by the 20th quarter. In that market, the positive response of the development index is also considerably small, being less than 0.25 percent.

Conversely, DEVINDEX in South Africa has an opposite response to a one-unit increase in CAPLIB. The response in the first quarter is considerably small (less than 1 percent) and negative. It remains constant and negative even after the 20th quarter. In all four markets, the response of DEVINDEX to a unit shock to INF is considerably small, hence insignificant. Interestingly, a unit shock to investment in Nigeria produces an initial negative response of the stock market development index, which progressively becomes more negative until the 9th quarter, and subsequently approaches zero. While in the other three markets, the initial response of DEVINDEX to a unit shock to INV is positive, it subsequently decreases, reaching a negative value in South Africa by the 20th quarter; reaching the value of zero in Kenya by the 15th quarter; and closely approaching zero in the WAEMU by the 20th quarter.

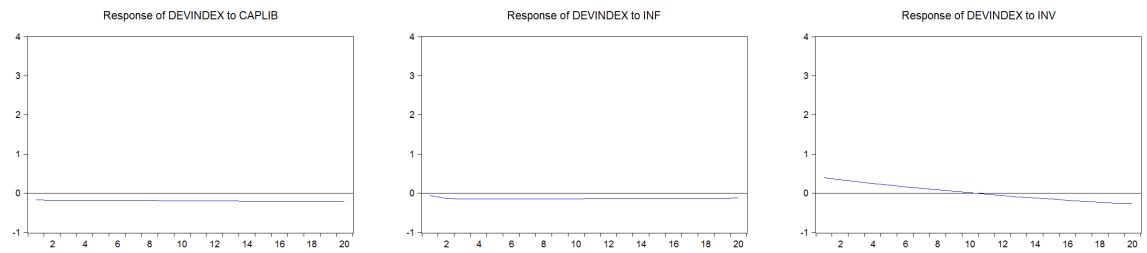
The variance decomposition was estimated from Model 1 for each of the markets to get more insight

Figure 1: Impulse-response functions for Model 1

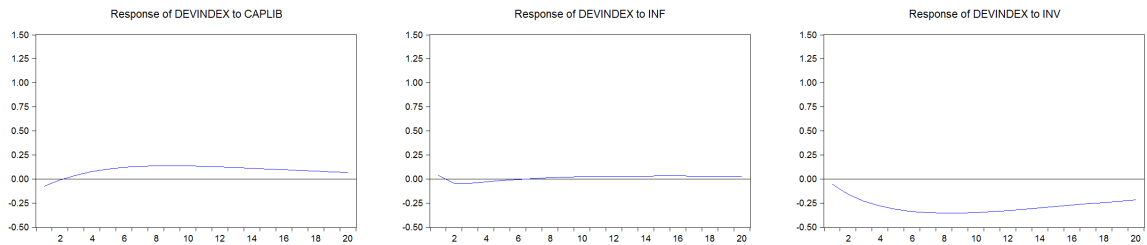
A- WAEMU



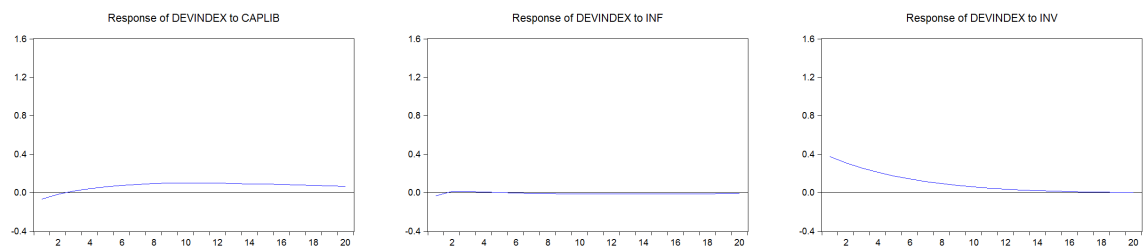
B- SOUTH AFRICA



C- NIGERIA



D- KENYA



Source: Author's estimations

about the actual value of each policy variable in explaining stock market development. Table 4 summarizes the results. There is some evidence that innovations in INV are relatively important in explaining the variations in the DEVINDEX in the WAEMU, Nigeria and Kenya. In the WAEMU, it represents 7.3 percent of the variance decomposition of DEVINDEX in the first quarter, 13.6 percent in the 10th quarter and 14.9 percent in the 20th quarter; in Nigeria, 0.16 percent in the first quarter and 17.73 percent in the 20th quarter; and in Kenya, 7.66 percent in the first quarter, 6.29 percent in the 10th quarter and 5.94 percent in the 20th quarter. However, innovations in INF are relatively insignificant in explaining the variations in DEVINDEX at less than 0.5 percent between the 1st and 20th quarter for all four markets; while innovations to CAPLIB have a small, yet increasing, part in explaining variations in DEVINDEX, at less than 5 percent for the WAEMU, Nigeria and Kenya; and less than 0.5 percent in the case of South Africa.

Table 4: Variance Decomposition for Model 1

Panel A: WAEMU

Variance Decomposition of DEVINDEX:					
Period	S.E.	DEVINDEX	INF	INV	CAPLIB
1	1.470	91.207	0.399	7.329	1.070
10	2.818	82.543	0.210	13.580	3.667
20	2.919	80.333	0.201	14.941	4.525

Panel B: SOUTH AFRICA

Variance Decomposition of DEVINDEX:					
Period	S.E.	DEVINDEX	INF	INV	CAPLIB
1	3.504	98.420	0.025	1.300	0.255
10	10.384	99.019	0.173	0.491	0.317
20	13.765	98.960	0.192	0.446	0.401

Panel C: NIGERIA

Variance Decomposition of DEVINDEX:					
Period	S.E.	DEVINDEX	INF	INV	CAPLIB
1	1.440	99.523	0.064	0.158	0.262
10	2.845	87.715	0.099	10.821	1.365
20	3.076	79.839	0.176	17.731	2.254

Panel D: KENYA

Variance Decomposition of DEVINDEX:					
Period	S.E.	DEVINDEX	INF	INV	CAPLIB
1	1.343	92.030	0.063	7.660	0.247
10	2.608	92.932	0.027	6.289	0.752
20	2.698	92.322	0.048	5.944	1.686

Source: Author's estimations

5.2 Model 2: Stock Market liberalization and stock market development

In this case, the model is referred to as Model 2 and will also include DEVINDEX, INF, INV, as in Model 1, and the liberalization index considered here which is STOCKLIB, for each market. Then, the impulse functions and variance decompositions are estimated.

For three of the markets, i.e. WAEMU, South Africa and Nigeria, the optimal lag order was found to be 1. In the case of Kenya, the AIC, SC and HQ chose different lag orders. However, because the

SC is known to be more parsimonious when estimating the coefficients, one lag order selected by the SC will be used for Kenya. Thus, in all four cases, BVAR(1) models with the same Minnesota prior and hyperparameters specification as Model 1 were estimated in Model 2.

Again, only the impulse response functions of the response of DEVINDEX to a shock to each of the other three variables (i.e. STOCKLIB, INF and INV) are presented. Moreover, the impulse definition in this model also included a Cholesky decomposition with the ordering set as $\begin{bmatrix} STOCKLIB \\ INF \\ INV \\ DEVINDEX \end{bmatrix}$. This Cholesky ordering assumes that STOCKLIB has a contemporaneous effect on INF, INV, and DEVINDEX but the reverse does not apply. Similarly, INF has a contemporaneous effect on INV and DEVINDEX but the reverse does not apply; and INV has a contemporaneous effect on DEVINDEX but the reverse does not apply.

Figure 2 depicts the impulse response functions for Model 2 for the four markets considered in the study. From the figure, it is interesting to see that the response of DEVINDEX to a unit shock to STOCKLIB generally follows the same trend in all four stock markets. The initial response is negative, although it immediately increases and stays positive and high (i.e. around 1 percent) in the case of South Africa, even after the 20th quarter where it is still persistent. In the case of the WAEMU, Nigeria and Kenya, the response is not as persistent, and approaches zero by the 20th quarter. Noticeably, the response of DEVINDEX to a unit shock to STOCKLIB in the WAEMU is considerably higher than the response of the development index to CAPLIB in Model 1.

Similar to Model 1, the response of DEVINDEX to a unit shock to INF is insignificant, for all markets; while there is an initial negative response of DEVINDEX to a unit shock to investment in Nigeria. The progressively becomes more negative until the 9th quarter, and subsequently approaches zero. In Kenya, the WAEMU and South Africa, the initial response of DEVINDEX to a unit shock to INV is positive, but subsequently decreases. It reaches a negative value in South Africa by the 20th quarter; the value of zero in Kenya by the 15th quarter; and closely approaches zero in the WAEMU by the 20th quarter.

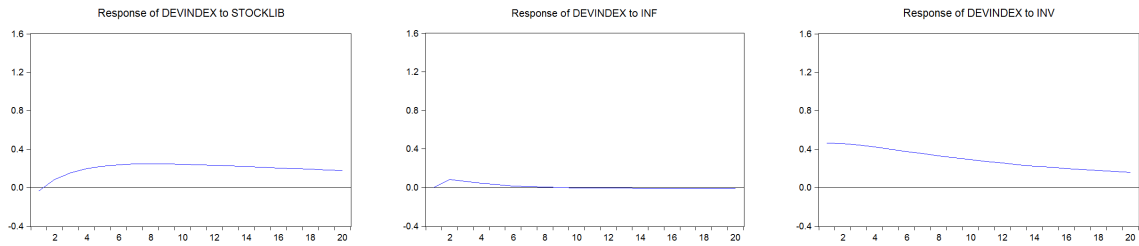
In this model, innovations to INF are still insignificant in explaining the variations in DEVINDEX, for all four markets. In all four cases, however, innovations to STOCKLIB get relatively more important in the variance decomposition of DEVINDEX over time. Although in all cases, it is less than 0.5 percent in the 1st quarter, it increases over time reaching 10.7 percent, 9.2 percent, 3.8 percent and 2.4 percent in WAEMU, South Africa, Kenya and Nigeria, respectively, in the 20th quarter. Interestingly, in this model, innovations to INV are more significant in the variance decomposition of DEVINDEX in the WAEMU, at 24.5 percent in the 20th quarter.

5.3 Model 3: Financial sector liberalization and stock market development

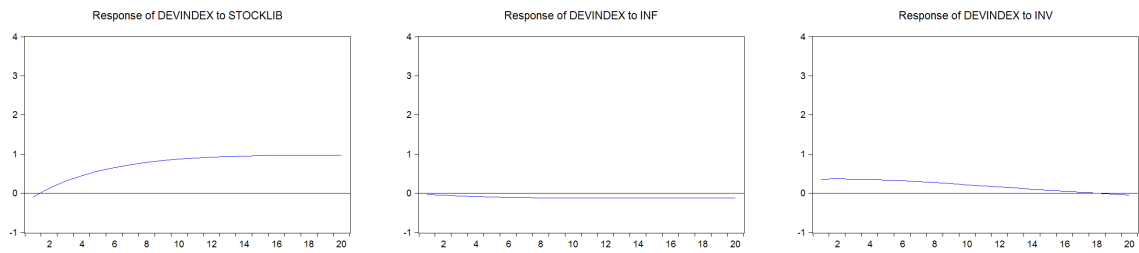
The analysis of the effect of financial liberalization on stock market development using the Bayesian VAR method is referred to as Model 3 and will include four variables, that are the same three included in the Model 1 and 2 (i.e. DEVINDEX, INF, INV) and the liberalization index FINLIB, for each market.

Figure 2: Impulse-response functions for Model 2

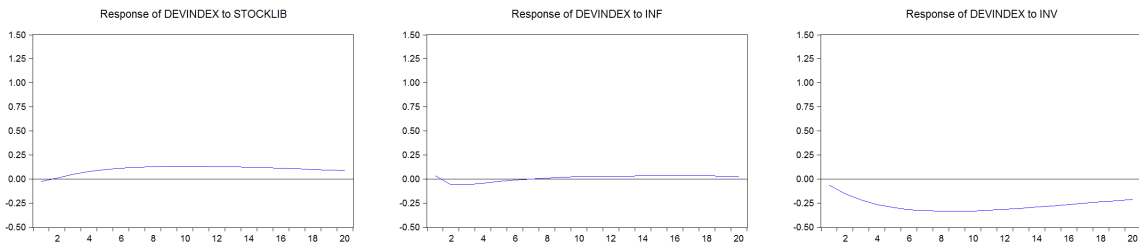
A- WAEMU



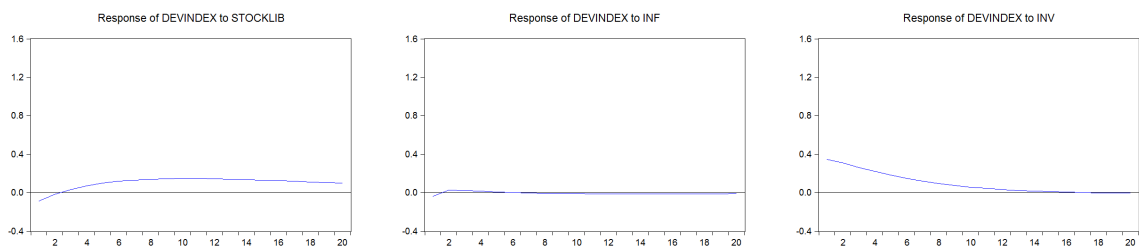
B- SOUTH AFRICA



C- NIGERIA



D- KENYA



Source: Author's estimations

Table 5: Variance Decomposition for Model 2

Panel A: WAEMU

Variance Decomposition of DEVINDEX:					
Period	S.E.	DEVINDEX	INF	INV	STOCKLIB
1	1.474	90.084	0.000	9.860	0.055
10	2.612	71.533	0.198	22.105	6.164
20	2.823	64.549	0.178	24.527	10.747

Panel B: SOUTH AFRICA

Variance Decomposition of DEVINDEX:					
Period	S.E.	DEVINDEX	INF	INV	STOCKLIB
1	3.543	98.894	0.009	1.021	0.076
10	9.254	94.471	0.106	1.164	4.259
20	11.777	89.866	0.180	0.791	9.163

Panel C: NIGERIA

Variance Decomposition of DEVINDEX:					
Period	S.E.	DEVINDEX	INF	INV	STOCKLIB
1	1.438	99.717	0.049	0.198	0.036
10	2.834	88.883	0.153	9.759	1.204
20	3.047	80.804	0.231	16.564	2.401

Panel D: KENYA

Variance Decomposition of DEVINDEX:					
Period	S.E.	DEVINDEX	INF	INV	STOCKLIB
1	1.354	92.987	0.086	6.527	0.400
10	2.573	91.893	0.047	6.320	1.740
20	2.681	90.268	0.066	5.871	3.794

Source: Author's estimations

The optimal lag order selection criteria for Model 3 for the four countries selected one as the optimal lag order for South Africa and Nigeria. For Kenya, both the SC and the HQ also selected lag order 1, while the AIC selected lag order 2. In the case of the WAEMU, the AIC, SC and HQ chose different lag orders. However, because the SC is known to be more parsimonious when estimating the coefficients, lag order 1 selected by the SC will be used for the WAEMU. Thus, in all four cases, BVAR(1) models were estimated as Model 3, specifying a similar Minnesota/Litterman prior to the first two models.

Similar to the first two model, the impulse definition in this model also included a Cholesky decomposition with the ordering set as $\begin{bmatrix} FINLIB \\ INF \\ INV \\ DEVINDEX \end{bmatrix}$. The assumption of this Cholesky ordering is that FINLIB has a contemporaneous effect on INF, INV, and DEVINDEX but the reverse does not apply; INF has a contemporaneous effect on INV and DEVINDEX but the reverse does not apply; and INV has a contemporaneous effect on DEVINDEX but the reverse does not apply.

The impulse response functions for Model 3 for the four markets considered in the study are depicted in Figure 3. From the figure, it can be seen that while in both South Africa and Kenya, the initial response of DEVINDEX to a one unit increase in FINLIB is negative; the initial response of DEVINDEX was null in the WAEMU and positive in Nigeria. In subsequent periods, the response in all markets increased and stayed positive after the 20th period. Noticeably, the response of DEVINDEX to FINLIB in Kenya only becomes positive after the 4th quarter and stays constant even after the 20th quarter. The same persistence is also seen in South Africa; while in the WAEMU and Nigeria, the response gets

Table 6: Variance Decomposition for Model 3

Panel A: WAEMU

Variance Decomposition of DEVINDEX:					
Period	S.E.	DEVINDEX	INF	INV	FINLIB
1	1.472	90.866	0.137	8.995	0.001
10	2.511	82.388	0.144	13.008	4.460
20	2.589	78.717	0.146	13.358	7.778

Panel B: SOUTH AFRICA

Variance Decomposition of DEVINDEX:					
Period	S.E.	DEVINDEX	INF	INV	FINLIB
1	3.542	98.512	0.013	0.995	0.479
10	9.211	95.990	0.074	1.860	2.076
20	11.593	92.998	0.112	1.485	5.405

Panel C: NIGERIA

Variance Decomposition of DEVINDEX:					
Period	S.E.	DEVINDEX	INF	INV	FINLIB
1	1.444	98.934	0.126	0.146	0.795
10	2.782	84.684	0.061	10.817	4.437
20	3.002	75.517	0.118	18.449	5.916

Panel D: KENYA

Variance Decomposition of DEVINDEX:					
Period	S.E.	DEVINDEX	INF	INV	FINLIB
1	1.352	91.829	0.002	6.291	1.877
10	2.484	91.732	0.162	6.589	1.516
20	2.572	89.622	0.179	6.266	3.933

Source: Author's estimations

closer to zero by the 20th quarter. The response of DEVINDEX to INF and INV is similar to Model 2, for all four markets.

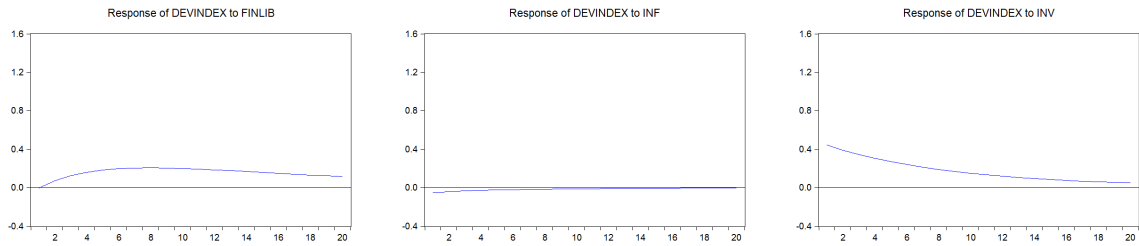
This model also confirms the insignificance of innovations in INF in explaining variations in DEVINDEX for all four markets. Innovations in FINLIB are more significant than innovations in CAPLIB in explaining variations in DEVINDEX for all the stock markets considered. Like in Model 2, the proportion of FINLIB in the variance decomposition of DEVINDEX increases over time, but it is still lower than the proportion of STOCKLIB in Model 2. Innovations in INV are, in this case, still the most important of the three variables, in explaining variations in DEVINDEX, in all markets, except South Africa where the proportion of FINLIB exceeds INV in the 20th quarter.

6 Conclusion and Recommendations

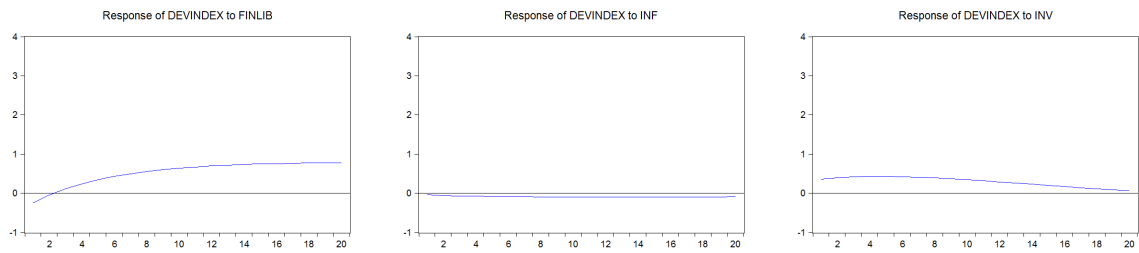
The main objective of this study was to investigate the relationship between liberalization in the financial sector and the development of stock markets in Sub-Saharan Africa. This study focused on four stock markets, which together constitute more than 80 percent of the total market capitalization in the Sub-Saharan African region. These are the Nigerian stock exchange, the Nairobi stock market, the Johannesburg stock exchange and the West African stock market (i.e. the Bourse Regionale des Valeurs Mobilières). Moreover, the study looked at three separate dimensions of financial liberalization:

Figure 3: Impulse-response functions for Model 3

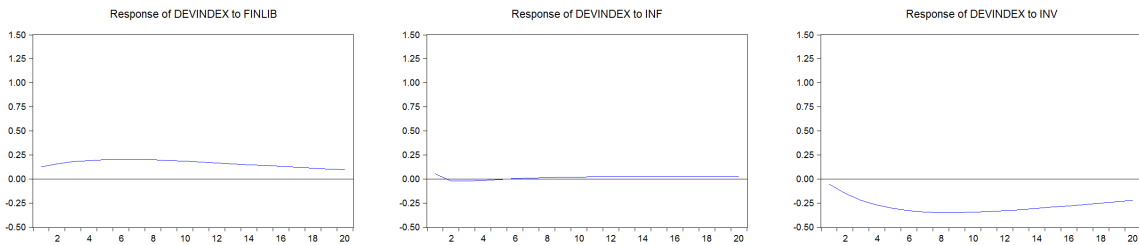
A- WAEMU



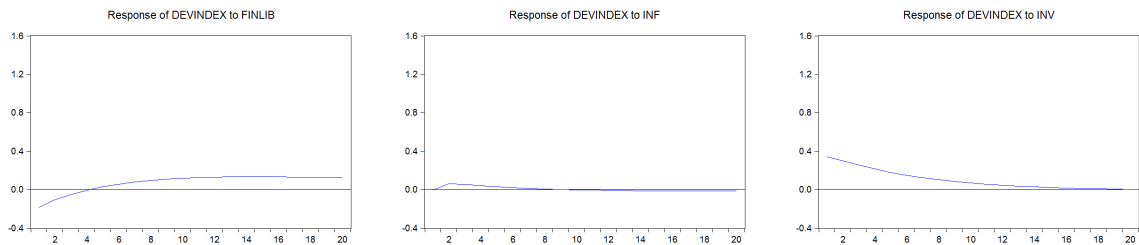
B- SOUTH AFRICA



C- NIGERIA



D- KENYA



Source: Author's estimations

capital account liberalization, stock market liberalization and financial sector liberalization. Due to unavailability of data, different sample periods were used for each of the stock markets considered.

The scrutiny of the evolution of liberalization in the Sub-Saharan African region showed that financial liberalization was not a uniform process across the Sub-Saharan African region. Most economies joined the movement in the 1980s, and while some undertook many reforms in the same year, others adopted a gradual method to liberalization by implementing only a couple of measures per year. Although most countries took considerable steps towards liberalization since 1980, a great number of them are still found with a low liberalization index in 2014. There was also some reversal of the reforms initially adopted due to their adverse effects on economic growth and development, or in the face of tough economic conditions experienced.

For this study, the data sample consisted of quarterly values of the variables included in the model for different time periods specific to each country considered. The variables used in the models were the stock market development index, the capital account liberalization index, stock market liberalization index, financial sector liberalization index, as well as two control variables (i.e. inflation and investment). A preliminary analysis of correlation among the variables showed that stock market development is negatively related to inflation and positively related to stock market liberalization and financial sector liberalization in all four markets. While in the WAEMU and Kenya, stock market development is also positively related to investment, it is the opposite in South Africa and Nigeria where they are negatively related. In almost all the markets, inflation is negatively related to all three forms of liberalization, except in the WAEMU, where there is a significantly positive correlation between inflation and capital account liberalization. Investment is also negatively related to all three forms of liberalization in all markets except in the WAEMU where there is significantly positive relationship between investment and capital account liberalization.

Moreover, in both Nigeria and Kenya, stock market development initially responded negatively to an increase in capital account liberalization. Although the response quickly becomes and stays positive, it starts dying out by the fifth year. Besides a positive yet considerably small initial response of stock market development to capital account liberalization in the WAEMU, the subsequent trend is similar to Nigeria and Kenya. An opposite response was observed in South Africa, with a small negative initial response of stock market development, which remains constant and negative. Innovations in investment are relatively more important in explaining the variations in stock market development in most markets than innovations to capital account liberalization that have a small, yet increasing, part in explaining variations in stock market development.

Additionally, stock market development was found to respond positively to a shock to stock market liberalization, in the long run, for all countries. While in South African, this effect was relatively high and persistent. In the case of the WAEMU, Nigeria and Kenya, the response was not as persistent, and starts dying out by the fifth year. In the WAEMU particularly, stock market development responded

more strongly to stock market liberalization than it did to capital liberalization. This is confirmed by the variance decomposition which showed that, in all four cases, innovations to stock market liberalization get relatively more important in explaining the variations of stock market development over time.

Furthermore, although the initial responses of stock market development to an increase in financial sector liberalization varied across markets, it subsequently becomes positive and persistent in most cases. Innovations in financial sector liberalization are more significant than innovations in capital account liberalization in explaining variations in stock market development for all the stock markets considered.

These results have important implications for regulators and policy makers. Firstly, the existence of negative correlation between stock market development and inflation in all four markets, suggests that policy makers in these countries should pay special attention to inflation targeting policies in order to positively contribute to enhancing the markets. Secondly, the positive correlation found between stock market development and the liberalization of stock markets and the financial sector in all four countries, also advocate for the opening of financial markets to international investors, as well as the deepening of the sector. Additionally, this is confirmed by the positive long-run response of stock market development to all three forms of liberalization in all the markets considered. More emphasis should therefore be put on improving financial openness process and removing of the restrictions in the financial sectors of the respective economies, as this will contribute to boosting the effectiveness of the deliverance of credit to the private sector, efficient credit evaluation and public sector surveillance, which is provided through the stock market.

Due to the unavailability of high frequency data for most of the variables selected and in most of the countries considered, annual values of the data had to be used with Newton's method of interpolation to create a dataset in quarterly frequencies. This could have affected the robustness of the results, and has increased the risk of data mining. Thus, the results of these analysis should be interpreted with caution.

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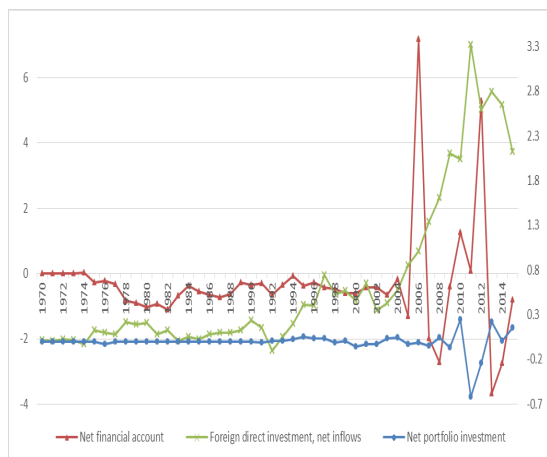
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APPENDIX

Figure 4: Capital account balances in current US\$ billion (1970 – 2015)

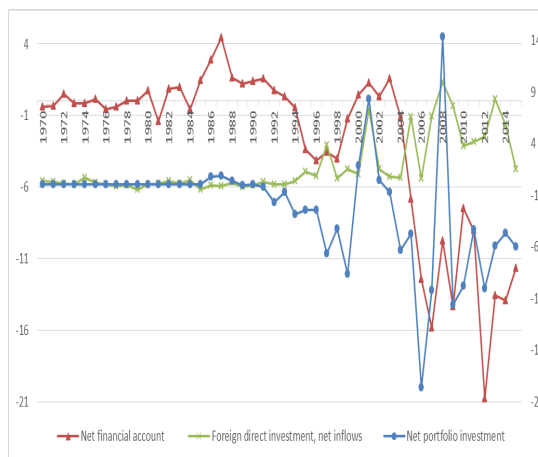
(a) WAEMU



Source: IMF data (2017)

Note: Foreign direct investment and net portfolio investment are measured on the secondary axis

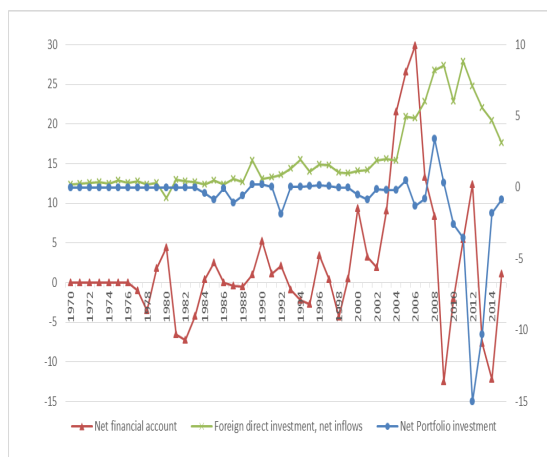
(b) South Africa



Source: IMF data (2017)

Note: Foreign direct investment and net portfolio investment are measured on the secondary axis

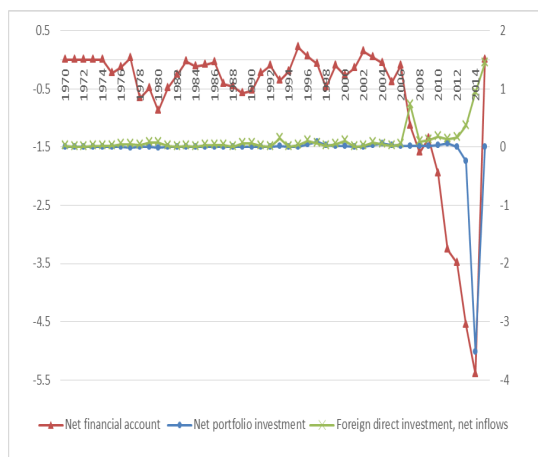
(c) Nigeria



Source: IMF data (2017)

Note: Foreign direct investment and net portfolio investment are measured on the secondary axis

(d) Kenya



Source: IMF data (2017)

Note: Foreign direct investment and net portfolio investment are measured on the secondary axis

Table 7: Stock Markets indicators

Panel A: WAEMU(1989 - 2014)

Year	Market size (%)	Liquidity (%)	Volatility
1989	4.8	1.1	–
1990	5.4	3.1	–
1991	5.1	1.3	–
1992	4.8	0.7	–
1993	3.0	1.6	–
1994	1.4	9.9	–
1995	0.4	32.9	–
1996	0.5	30.6	–
1997	8.9	2.3	–
1998	14.7	1.0	–
1999	12.5	4.9	0.08
2000	7.4	4.2	0.07
2001	6.3	1.2	0.10
2002	9.5	1.5	0.13
2003	10.7	1.5	0.09
2004	11.8	2.6	0.09
2005	13.0	1.6	0.14
2006	18.4	3.3	0.30
2007	31.9	2.5	0.21
2008	34.0	3.5	0.21
2009	26.4	3.8	0.18
2010	25.9	3.5	0.09
2011	27.5	1.7	0.09
2012	25.0	2.4	0.14
2013	37.8	3.1	0.20
2014	34.4	3.4	0.13

Panel B: SOUTH AFRICA (1975 – 2014)

Year	Market size (%)	Liquidity (%)	Volatility
1975	62.4	3.9	0.24
1976	57.3	3.7	0.25
1977	55.8	3.8	0.17
1978	60.8	4.0	0.20
1979	68.3	5.5	0.20
1980	64.0	10.1	0.24
1981	72.3	4.1	0.26
1982	86.8	3.7	0.38
1983	91.4	4.3	0.28
1984	73.7	2.9	0.19
1985	68.3	5.3	0.16
1986	99.1	6.6	0.20
1987	122.8	7.8	0.32
1988	111.2	3.5	0.23
1989	104.5	5.7	0.19
1990	111.7	6.6	0.19
1991	129.2	5.2	0.17
1992	133.4	4.2	0.18
1993	134.9	4.4	0.21
1994	164.7	5.8	0.11
1995	172.6	5.9	0.17
1996	161.7	11.2	0.14
1997	151.0	18.3	0.14
1998	131.9	29.9	0.41
1999	150.7	35.4	0.21
2000	160.6	32.2	0.17
2001	129.7	22.4	0.27
2002	131.5	31.4	0.17
2003	148.4	18.9	0.24
2004	164.3	22.3	0.13
2005	194.6	22.2	0.17
2006	226.2	28.3	0.13
2007	252.4	34.1	0.11
2008	213.9	33.0	0.26
2009	215.4	34.1	0.22
2010	247.8	29.8	0.17
2011	208.8	26.0	0.12
2012	202.5	28.2	0.09
2013	235.3	26.9	0.1
2014	256.5	27.4	0.1

Panel C: NIGERIA (1989 – 2014)

Year	Market size (%)	Liquidity (%)	Volatility
1989	3.8	0.4	–
1990	3.9	0.9	–
1991	5.3	0.6	–
1992	4.5	1.1	–
1993	11.7	1.6	–
1994	13.3	1.9	–
1995	17.0	1.7	–
1996	29.0	3.1	–
1997	35.8	3.9	–
1998	34.8	5.5	–
1999	18.2	1.7	–
2000	7.5	7.6	–
2001	10.9	10.3	–
2002	3.9	8.6	–
2003	10.7	11.8	–
2004	17.0	11.3	–
2005	17.8	9.8	0.27
2006	19.6	12.7	0.17
2007	35.5	29.4	0.21
2008	34.6	23.2	0.17
2009	20.9	12.7	0.27
2010	11.1	12.4	0.57
2011	10.8	8.7	0.20
2012	10.3	8.6	0.18
2013	13.2	9.1	0.14
2014	12.7	7.1	0.19

Panel D: KENYA (1989 – 2012)

Year	Market size (%)	Liquidity (%)	Volatility
1989	5.5	–	–
1990	5.3	2.2	–
1991	5.1	2.6	–
1992	6.3	2.3	–
1993	15.8	1.3	–
1994	30.4	3.2	–
1995	30.1	2.2	–
1996	15.2	3.9	–
1997	13.8	5.4	–
1998	14.0	3.8	–
1999	12.6	4.6	–
2000	9.5	3.1	–
2001	8.8	3.4	–
2002	9.4	3.0	–
2003	19.2	7.0	–
2004	25.3	7.0	–
2005	28.0	9.6	–
2006	35.7	14.8	–
2007	40.0	8.8	–
2008	35.8	5.8	–
2009	28.0	1.9	0.3
2010	31.1	6.4	0.3
2011	28.4	7.7	0.1
2012	25.4	7.9	0.2

Source: Federal Reserve Bank of St Louis (2017) and author's own estimations.

Table 8: Financial Sector Indicators

Panel A: WAEMU(1970 - 2015)

Year	Deposit interest rate (%)	Lending rate (%)	Real interest rate (%)	Domestic credit provided by financial sector (% of GDP)	Domestic credit to private sector (% of GDP)	Domestic credit to private sector by banks (% of GDP)	Commercial banks and other lending (current US\$ million)
1970	..	..	..	12.11	11.16	10.82	13.832
1971	..	..	..	12.86	11.83	11.50	53
1972	..	..	..	14.08	12.83	12.53	18.279
1973	..	..	..	16.31	15.14	14.84	196.888
1974	..	..	..	18.49	17.59	17.40	113.212
1975	..	..	..	22.55	21.50	21.28	282.832
1976	..	..	..	22.81	21.52	21.24	293.552
1977	..	..	..	23.20	22.21	21.82	689.35
1978	..	..	..	26.93	25.05	24.63	1011.854
1979	..	..	..	27.42	26.41	26.05	781.163
1980	..	..	..	28.64	26.75	26.41	1065.284
1981	..	..	..	29.44	25.82	25.57	825.965
1982	..	..	..	31.62	26.34	26.04	762.349
1983	..	..	..	32.54	26.18	25.96	243.51
1984	..	..	..	27.59	22.65	22.45	46.305
1985	..	..	..	26.70	22.57	22.37	-58.763
1986	..	..	..	29.28	22.59	22.82	-169.414
1987	..	..	..	27.28	22.42	23.15	-245.875
1988	..	..	..	26.49	22.27	22.95	-18.641
1989	..	..	..	24.34	20.89	21.18	90.504
1990	..	..	..	29.84	20.92	20.38	3.431
1991	..	..	..	20.42	18.72	18.50	-89.529
1992	..	..	..	19.67	17.53	16.99	-37.099
1993	..	..	..	18.99	17.40	16.71	-58.007
1994	..	..	..	15.64	12.40	11.70	-48.351
1995	..	..	..	14.30	11.30	10.93	-10.964
1996	..	..	..	13.88	11.25	10.92	97.602
1997	..	..	..	14.81	11.34	10.95	8.499
1998	..	..	..	15.14	11.90	11.56	-237.218
1999	..	..	..	14.93	11.19	11.11	-237.656
2000	..	..	..	15.19	11.87	11.83	3.27
2001	..	..	..	13.38	9.28	9.28	-64.266
2002	..	..	..	12.17	8.98	8.80	-114.062
2003	..	..	..	13.12	10.23	10.23	-114.574
2004	..	..	..	13.20	10.94	10.80	-38.656
2005	4.42	10.15	5.00	13.46	10.81	10.69	-88.46
2006	4.92	9.57	8.34	12.94	11.81	11.67	-95.227
2007	4.27	9.52	6.03	14.04	14.25	14.11	-201.765
2008	4.70	9.81	0.80	14.99	14.46	14.34	40.903
2009	4.91	9.81	7.65	17.60	15.82	15.69	313.045
2010	5.05	9.14	6.14	19.42	16.90	16.78	131.062
2011	5.22	8.96	2.19	21.31	18.83	18.67	191.148
2012	5.01	9.10	4.59	22.82	19.67	19.52	1725.487
2013	5.40	7.91	8.54	24.81	22.16	21.99	801.91
2014	5.35	7.90	7.17	26.23	22.60	22.45	-389.787
2015	5.23	7.96	5.74	28.93	24.05	23.91	-236.296

Panel B: SOUTH AFRICA (1970 – 2015)

Year	Deposit interest rate (%)	Lending interest rate (%)	Real interest rate (%)	Domestic credit provided by financial sector (% of GDP)	Domestic credit to private sector (% of GDP)	Domestic credit to private sector by banks (% of GDP)	Commercial banks and other lending (current US\$ million)
1970	..	8.17	3.72	88.60	68.30	50.29	..
1971	..	8.83	2.69	91.02	68.85	50.27	..
1972	..	8.79	-2.00	90.31	67.58	49.95	..
1973	..	8.00	-8.73	88.09	67.76	51.52	..
1974	..	10.17	-4.95	82.80	63.73	49.02	..
1975	..	11.79	1.01	87.55	65.83	51.31	..
1976	..	12.25	1.66	87.14	63.49	49.50	..
1977	8.00	12.50	1.20	87.77	61.98	48.03	..
1978	7.67	12.13	0.40	86.15	60.81	47.07	..
1979	6.00	10.00	-4.46	84.80	58.68	45.28	..
1980	5.54	9.50	-12.34	76.35	55.60	42.76	..
1981	8.19	14.00	3.70	82.21	60.66	47.35	..
1982	13.00	19.33	4.74	83.68	62.55	48.74	..
1983	13.71	16.67	0.08	88.13	66.84	50.90	..
1984	18.29	22.33	9.70	90.38	69.93	54.09	..
1985	17.02	21.50	4.02	96.81	73.40	54.17	..
1986	10.97	14.33	-2.33	94.92	72.77	50.49	..
1987	8.70	12.50	-1.74	93.50	73.41	49.67	..
1988	13.54	15.33	0.13	94.43	75.28	52.76	..
1989	18.13	19.83	2.20	93.58	77.85	52.58	..
1990	18.86	21.00	4.74	97.80	80.95	52.41	..
1991	17.30	20.31	3.96	..	..	..	..
1992	13.78	18.91	3.78	119.79	102.45	56.92	..
1993	11.50	16.16	-0.27	125.28	105.02	53.67	..
1994	11.11	15.58	5.50	131.67	111.01	56.04	20.4
1995	13.54	17.90	6.97	135.65	116.00	57.48	747.5
1996	14.91	19.52	10.76	135.94	116.72	59.96	-844.7
1997	15.38	20.00	11.12	134.54	113.36	61.85	-1120.0
1998	16.50	21.79	12.99	135.61	115.17	66.45	-699.1
1999	12.24	18.00	10.25	149.45	131.05	66.27	-1401.9
2000	9.20	14.50	5.24	148.57	130.31	67.34	-282.0
2001	9.37	13.77	5.69	179.48	138.79	74.43	-1511.3
2002	10.77	15.75	3.16	155.25	110.72	56.03	-2102.8
2003	9.76	14.96	8.66	159.92	115.86	60.77	-2165.8
2004	6.55	11.29	4.47	168.16	126.93	62.50	-668.2
2005	6.04	10.63	4.91	178.16	138.16	65.90	866.9
2006	7.14	11.17	4.60	192.50	156.98	73.62	-552.6
2007	9.15	13.17	3.97	192.66	160.12	78.29	255.1
2008	11.61	15.13	5.78	167.94	140.35	76.69	-596.8
2009	8.54	11.71	3.91	181.45	145.94	74.60	-478.8
2010	6.47	9.83	3.27	185.47	148.98	70.35	356.7
2011	5.67	9.00	2.32	171.54	139.60	67.59	-437.8
2012	5.44	8.75	3.29	181.18	146.47	68.63	-1089.3
2013	5.15	8.50	1.79	181.44	148.85	67.10	252.5
2014	5.80	9.13	3.24	184.90	150.87	66.93	3457.1
2015	6.15	9.42	5.25	178.11	148.74	68.86	9967.6

Panel C: NIGERIA (1970 – 2016)

Year	Deposit interest rate (%)	Lending rate (%)	Real interest rate (%)	Domestic credit provided by financial sector (% of GDP)	Domestic credit to private sector (% of GDP)	Domestic credit to private sector by banks (% of GDP)	Commercial banks and other lending (current US\$ million)
1970	3.00	7.00	-29.27	12.74	4.92	3.86	-16.126
1971	3.00	7.00	5.58	10.86	5.39	4.80	-13.44
1972	3.04	7.00	3.99	11.54	6.14	5.45	-9.459
1973	3.00	7.00	1.57	10.29	6.05	5.96	-137.497
1974	3.00	7.00	-25.67	-1.60	4.70	4.62	-103.527
1975	3.00	6.25	-13.97	4.44	6.81	6.43	-154.384
1976	2.67	6.50	-6.87	10.28	7.62	7.21	-278.445
1977	2.83	6.00	-4.26	17.71	9.24	8.74	23.069
1978	4.15	6.75	-6.29	21.58	10.99	10.71	1592.552
1979	4.47	7.79	-3.32	20.26	10.39	10.16	1233.733
1980	5.27	8.43	-3.55	21.35	12.23	12.03	1450.386
1981	5.72	8.92	-8.06	30.51	15.62	15.42	1725.592
1982	7.60	9.54	4.49	40.12	17.92	17.71	2414.671
1983	7.41	9.98	-3.33	47.80	17.00	16.85	1012.679
1984	8.25	10.24	-2.67	47.37	16.16	16.01	-411.211
1985	9.12	9.43	3.69	43.40	15.43	15.30	-953.167
1986	9.24	9.96	-1.50	48.67	20.03	19.91	-545.269
1987	13.09	13.96	-31.92	36.02	14.44	14.35	425.446
1988	12.95	16.62	-5.13	34.31	12.94	12.82	149.999
1989	14.68	20.44	-16.96	20.14	9.24	9.16	520.605
1990	19.78	25.30	14.65	21.90	8.71	8.69	-121.012
1991	14.92	20.04	2.07	21.46	9.40	8.95	-119.397
1992	18.04	24.76	-25.77	30.80	13.43	13.33	..
1993	23.24	31.65	4.37	39.24	12.32	12.20	..
1994	13.09	20.48	-8.03	46.44	15.03	14.95	..
1995	13.53	20.23	-43.57	23.62	10.05	10.02	..
1996	13.06	19.84	-9.71	13.26	9.01	8.98	..
1997	7.17	17.80	16.61	12.59	10.69	10.66	..
1998	10.11	18.18	25.28	18.20	13.00	12.98	..
1999	12.81	20.29	2.77	19.08	13.52	13.49	..
2000	11.69	21.27	-10.32	10.01	12.35	12.30	..
2001	15.26	23.44	23.84	19.30	16.57	16.51	..
2002	16.67	24.77	-10.81	19.55	13.04	13.02	..
2003	14.22	20.71	8.61	21.20	13.82	13.80	465.301
2004	13.70	19.18	19.37	11.70	13.14	13.12	539.796
2005	10.53	17.95	-3.34	8.60	13.24	13.22	1925.041
2006	9.74	16.90	-0.37	4.91	13.18	13.17	174.135
2007	10.29	16.94	11.61	19.20	25.25	24.57	2152.273
2008	11.97	15.48	4.19	26.55	33.75	33.65	719.309
2009	13.30	18.36	23.71	37.11	38.39	38.35	83.356
2010	6.52	17.59	-42.31	18.80	15.42	15.39	..
2011	5.70	16.02	5.94	22.15	12.48	12.46	..
2012	8.41	16.79	6.88	20.80	11.80	11.79	..
2013	7.95	16.72	10.25	21.85	12.59	12.59	..
2014	9.34	16.55	11.36	21.80	14.54	14.49	..
2015	9.15	16.85	13.60	23.07	14.22	14.19	..
2016	7.50	16.87	..	..	..	..	..

Panel D: KENYA (1970 – 2016)

Year	Deposit interest rate (%)	Lending interest rate (%)	Real interest rate (%)	Domestic credit provided by financial sector (% of GDP)	Domestic credit to private sector (% of GDP)	Domestic credit to private sector by banks (% of GDP)	Commercial banks and other lending (current US\$ million)
1970	3.50	..	..	16.40	15.12	15.12	29.497
1971	3.50	9	20.07	19.90	17.43	17.43	3.101
1972	3.50	9	7.70	20.06	16.49	16.49	38.211
1973	3.50	9	-1.09	21.98	17.89	17.89	108.272
1974	4.32	9.5	-5.64	23.41	17.98	17.98	146.957
1975	5.13	10	-1.64	26.79	17.33	17.33	35.452
1976	5.13	10	-7.49	25.72	16.83	16.83	69.844
1977	5.13	10	-5.90	24.88	17.51	17.51	-28.79
1978	5.13	10	6.71	30.67	21.71	21.71	311.704
1979	5.13	10	4.13	30.79	20.97	20.97	205.362
1980	5.75	10.58	0.94	30.11	21.81	21.81	221.87
1981	8.85	12.42	1.41	32.68	21.00	21.00	-31.587
1982	12.20	14.5	2.61	37.10	20.44	20.44	-39.606
1983	13.27	15.83	3.57	32.60	19.32	19.32	58.742
1984	11.77	14.42	3.84	32.08	18.99	18.99	-123.544
1985	11.25	14	5.26	31.91	19.33	19.33	8.248
1986	11.25	14	4.86	34.93	19.31	19.31	29.533
1987	10.31	14	8.16	37.47	18.42	18.42	153.202
1988	10.33	15	8.03	35.42	18.93	18.93	164.182
1989	12.00	17.25	6.82	32.72	19.22	19.22	160.773
1990	13.67	18.75	7.33	35.82	18.66	18.66	64.666
1991	..	19.00	5.75	37.38	19.96	19.96	273.529
1992	..	21.07	1.83	37.26	22.15	22.15	19.398
1993	..	29.99	3.41	29.06	18.50	18.50	-39.961
1994	..	36.24	16.43	36.23	19.83	19.83	-281.613
1995	13.60	28.80	15.80	42.75	25.81	25.63	-163.459
1996	17.59	33.79	-5.78	34.31	21.68	21.51	-194.531
1997	16.72	30.25	16.88	37.10	24.36	24.22	-121.502
1998	18.40	29.49	21.10	36.63	23.96	23.81	-1.578
1999	9.55	22.38	17.45	37.65	26.57	26.42	-67.541
2000	8.10	22.34	15.33	35.75	25.76	25.62	-80.572
2001	6.64	19.67	17.81	36.41	25.22	25.07	-143.907
2002	5.49	18.45	17.36	38.98	25.85	25.70	-66.516
2003	4.13	16.57	9.77	38.97	25.16	24.99	122.188
2004	2.43	12.53	5.05	39.38	27.29	27.13	-64.188
2005	5.08	12.88	7.61	37.36	26.28	26.13	-55.502
2006	5.14	13.64	-8.01	32.00	22.89	22.77	-60.923
2007	5.16	13.34	4.82	31.09	23.04	22.93	-10.914
2008	5.30	14.02	-0.98	33.90	25.38	25.28	-8.124
2009	5.97	14.80	2.84	35.58	25.02	24.93	24.47
2010	4.56	14.37	12.03	41.08	27.23	27.13	7.969
2011	5.63	15.05	3.84	41.68	30.57	30.42	16.671
2012	11.57	19.72	9.45	42.24	29.54	29.48	667.517
2013	8.64	17.31	11.34	42.94	31.71	31.63	-3.752
2014	8.37	16.51	7.89	44.25	34.16	34.10	-612.677
2015	9.19	16.09	6.36	45.20	34.89	34.82	734.318
2016	8.69	16.56	..	..	..	..	..

Source: IMF database (2017)

Note: “..” represents unavailable value