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# The Role of Financial Development in Ghana's Economic Growth Process

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**Abstract**

The study sought to revisit the nexus between financial sector development, by using the Principal Component Analysis (PCA) was disintegrated into banking sector development index (BSDI), stock market development index (SMDI), bond market development index (BMDI and economic growth using quarterly data from 1990:1 to 2015:4 for Ghana, applying the Maximum Likelihood Estimation technique and by employing the Autoregressive Distributed Lag (ARDL) approach and the Granger causality test. The study found a unique cointegration and statistically significant positive relationship between financial sector development and economic growth in the long run and short run for Ghana. The causality result revealed a unidirectional causality between financial sector development and economic growth running from financial sector development to economic growth. The study, therefore, recommends that the Government of Ghana through the Central Bank of Ghana needs to maintain a continuous effort in developing the financial sector. This will in turn spur financial sector development and eventually economic growth in Ghana.

**Keywords:** *Financial sector development; economic growth; Ghana; Principal Component Analysis (PCA).*

**JEL Classification:**

## 1. Introduction

Financial development is a very broad and complex concept that involves many financial markets and institutions and therefore cannot be measured by a single indicator as has been the case in the past. This is because according to Quartey and Prah (2008), measurement of financial development does not only affect the direction of causality of the variables in the model but also the magnitudes. Again, there is no doubt that financial development plays a crucial role in the economic growth and development process of a country like Ghana. Theoretical and empirical studies support the positive role of finance in the development process of both advanced and developing economies (Acheampong, 2007; McKinnon & Shaw, 1973). A large and growing amount of theoretical and empirical work has emerged following the pioneering work of Schumpeter (1911), who pointed out the productivity- and growth-enhancing effects of the services provided by a developed financial sector. He argued that financial intermediaries play a crucial role in fostering technological innovation and economic growth by providing basic services such as mobilising savings, monitoring managers, evaluating investment projects, managing and pooling risks, and facilitating transactions. Most of the literature has mainly focused on the role of macroeconomic stability, inequality, income and wealth, institutional development, ethnic and religious diversity and financial market imperfections (Christopoulos and Tsionas, 2004; Khan *et al*, 2005). Among these factors, it is well recognised that financial markets are crucial for economic growth. The seminal works of McKinnon (1973) and Shaw (1973) have supported Schumpeter's view to promote the development of the financial sector for economic growth. The authors criticised the Keynesian or financial repressionist view adopted by many governments in developing countries in the early 1970s. They argue that government restrictions on the banking system such as interest rate ceiling, high reserve requirements and directed credit programs hinder financial development and reduce output growth. Similarly, the endogenous growth literature stresses the influence of financial markets on economic growth. Well-developed financial markets promote investment and growth by channeling financial resources to the most productive uses.

However, while some economists have generally emphasised the central role of financial markets in economic growth, the empirical evidence on the relationship between financial development and economic growth is apparently inconclusive. Several authors have shown a positive link between financial development and economic growth (i.e for instance, King and Levine, 1993b; Neusser and Kugler, 1998; Rousseau and Wachte , 1998; Levine *et al*., 2000; Khan and Senhadji, 2003; Christopoulos and Tsionas, 2004; Khan *et al*, 2005; and Khan and Qayyum, 2006). Robinson (1952) argues that financial development follows economic growth as a result of higher demand for financial services. On the other hand, some studies show

a bi-directional relationship between financial development and economic growth (Demetriades and Hussein, 1996; Luintel and Khan, 1999) while others reject the existence of a finance-growth relationship (Lucas, 1988).

However, other theoretical and empirical views that give negative conclusions It is therefore imperative to investigate how financial development should be measured as this has implications for policy formulations and prescriptions on the economy. Empirically, studies that have used cross-section and panel data generally support the positive effect of financial development on economic growth. On the contrary, the studies based on time series data give contradicted results (Khan *et al*, 2005; Kiran *et al*, 2009). However, empirical studies based on cross-sectional data may not satisfactorily address country-specific effects as these countries could be at different stages of financial and economic development (see Odhiambo, 2009). According to Badun (2009), differences in financial sector development may reflect different institutional characteristics, different policies, and differences in their implementation. Therefore, there is the need to investigate the finance-growth relationship on a country case basis. Establishing this relationship is crucial because it has significantly different implications for development policy (see Calderon and Liu, 2003; Kiran *et al*, 2009).

Although there have been extensive empirical studies testing the views on the finance-growth nexus, the general observation from previous studies' is that such a relationship has been examined using either a single indicator of financial development (see Esso, 2009) or different indicators separately (Ahmed, 2008). Given the nature of the financial sector in Ghana and the recent financial crisis (financial sector clean up), it is unlikely that the use of one or more indicators separately will reflect the developmental level of the sector. As the choice of the financial development indicator may influence the ultimate findings of the study, it will be more appropriate to combine the indicators as they tend to complement each other, to generate a financial sector development index as a proxy for government policy in the sector.

To this end, Abu-Bader & Abu-Qarn, (2008) and Quartey and Prah (2008), believe that there is no single measure of financial development and different measures of financial development do not only affect the direction of causality but also the statistical power of the variables involved in a model specification and this has resulted in ineffective policy prescriptions. In the finance-growth literature, there is no consensus on how financial development should be measured; different indicators have been used to measure financial development. For instance, the ratio of broad money or liquid liabilities to GDP (M2/GDP or M3/GDP),credit to the private sector as a percentage of GDP (PSC % of GDP),private sector credit as a ratio of total domestic credit(PSC/TDC), stock market capitalisation as a percentage of GDP (SMC % of GDP), just to mention but a few. Obviously, in the face of these different

indicators for measuring financial development, results of empirical studies are bound to differ as have been the case in finance-growth literature across countries and Ghana in particular. A solution to having different indicators for measuring financial development is to construct an index using Principal Component Analysis (PCA) for financial development which will encapsulate, if not all the indicators for measuring financial development, a greater percentage of the indicators will be captured in the index and this is more representative than using a single measure for financial sector development.

Further, sources of economic growth are a function of many factors including financial development, however, specific market, and institution or both of financial sector that drives growth has not been established in the literature. Hence, this paper disaggregates financial development into the banking sector, stock market and bond market to capture the effect that each has on economic growth in Ghana using PCA in order to capture the effect that each has on economic growth in Ghana.

## 2. Literature review

### *2.1. Theoretical literature*

The theory on financial sector development as emphasised today, in developing countries, goes back to Schumpeter (1934) when he stresses the role of the banking sector as a financier of productive investments and in that way as an accelerator of economic growth. Traditional growth theory emphasises Neoclassical Theory of Economic Growth: Solow-Swan 1956 Model and Endogenous Growth Theories. Modern growth theory however identifies two specific channels through which the financial sector might affect long-run growth: through its impact on capital accumulation (including human as well as physical capital) and its impact on the rate of technological progress (De Gregorio, 1996). These effects arise from the intermediation role provided by financial institutions which enable the financial sector to: mobilise savings for investment; facilitate and encourage inflows of foreign capital (including FDI, portfolio investment and bonds, and remittances); and optimise the allocation of capital between competing uses, ensuring that capital goes to its most productive use (Bencivenga & Smith, 1991). Patrick (1966) formulates a hypothesis on two possible causal relationships between financial development and economic growth. The first – called demand following approach where financial sector development arises as the economy develops. He views the demand for financial services as dependent upon the growth of real output and upon the commercialisation and modernisation of agriculture and other subsistence sectors. According to Patrick (1966), the second causal relationship between financial development and economic growth is termed supply leading phenomenon where the widespread expansion of the financial sector leads to economic growth.

By implication, the establishment of financial institutions encourages the demand for financial services by the entrepreneurs in the modern, growth-inducing sectors.

*2.2. Empirical literature*

Starting with empirical studies, Goldsmith (1969) using data on 35 countries over the period 1860 to 1963 on the value of financial intermediary assets as a share of economic output, showed graphically a positive correlation between financial development and the level of economic activity. However, given his unwillingness to draw any causal interpretations from his graphical illustrations, Goldsmith did not take a stand on whether financial deepening causes growth. To Levine (2004), this study could be criticised on the basis that it was limited to only 35 countries, did not control for intervening factors and used only one proxy for financial development which may not be an accurate measure. King and Levine (1993) built on Goldsmith's work by studying 77 countries over the period 1960-1989. They controlled for other factors affecting long-run growth, examined the capital accumulation and productivity growth channels, constructed additional measures of the level of financial development, and analysed whether the level of financial development predicts long-run economic growth, capital accumulation, and productivity growth. They used three proxies for economic growth. The ratio of bank credit to domestic credit, central bank domestic credit and the ratio of credit to the private sector to GDP were used to proxy financial deepening. Running cross country regressions, they showed that financial depth is a good predictor of growth, capital accumulation and economic efficiency over the next 30 years even after controlling for income, education, and measures of monetary, trade, and fiscal policy. This study did not, however, deal formally with the issue of causality and simultaneity bias.

Bordo and Rousseau (2006) conducted a historical line of research using cross-country analysis with institutional variables. They used data for seventeen countries covering 1880 to 1997 to explore the link between finance, growth, legal origin and political environment. They found that political variables such as proportional representation election systems, universal female suffrage, frequent elections and infrequent revolutions or coups seem linked to larger financial sectors and higher conditional rates of economic growth. They, however, contend that most of the growth-enhancing role of financial development remains unexplained by institutional fundamentals. The paper concluded that institutions are important for the avoidance of financial crises, which can also affect economic growth. Cross-country regressions, however, have been criticised for ignoring large differences between countries (Arestis & Demetriades, 1997; Neusser & Kugler, 1998). The reliability of their results has also been questioned due to the instability of the long-time series used (Quah, 1993). Some economists have expressed scepticism about the ability of cross-country regressions to explain the direction of causality. For example,

Rousseau and Wachtel (2001) argue that often components, even pre-determined, measuring financial sector development remain correlated with the contemporaneous measures. As a result, several other studies have employed the panel methodology. The advantage of the panel methodology is that one can exploit the time-series and cross-sectional variation in the data, avoid biases associated with cross-country regressions and it permits the use of instrumental variables for all regressors and thereby providing more precise estimates of the finance-growth relationship. Allen and Ndikumana (2000) using four indicators of financial intermediation and three different panel techniques-simple OLS regressions, regressions including country-specific fixed effects, and regressions including a high-income dummy, found a positive correlation between financial development and the growth of real per capita GDP for the Southern Africa Development Community (SADC).

In the case of Egypt, Abu-Bader and Abu-Qarn (2008) examined the causal relationship between financial development and economic growth in Egypt during the period 1960–2001 within a trivariate vector autoregressive (VAR) framework (investment being the additional variable). They employed four different proxies of financial development and apply Granger causality tests using the cointegration and vector error-correction (VECM) methodology. They found strong support for the view that financial development and economic growth are mutually causal, that is, causality is bi-directional. Furthermore, the results revealed that financial development causes economic growth through both increasing resources for investment and enhancing efficiency.

Again, starting with cross-country regression studies, Huang (2005) studied the fundamental determinants of cross-country differences in financial development. Two prominent tools for addressing model uncertainty, Bayesian Model Averaging and General to-specific approaches were jointly applied to investigate the financial development effects of a wide range of variables taken from various sources. The analysis suggested that the level of financial development in a country is determined by its institutional quality, macroeconomic policies, and geographic characteristics, as well as the level of income and cultural characteristics.

Rajan and Zingales (2003) as well as Huang and Temple (2005) found the expected positive relationship between trade openness and financial development, at least in countries open to capital flows, which provides some support for the interest group theory of financial development. However, trade openness might affect financial development through channels other than easing the opposition of incumbent political and economic elites. For example, Do and Levchenko (2004) argue that in countries abundantly endowed with physical capital, specialisation in capital-intensive industries increases the demand for well-functioning financial intermediation.

Also, regardless of the estimation method and at any conventional level of rejection, Herger, Hodler, and Lobsiger (2008) endeavoured to explain the vast differences in the size of capital markets across countries, by drawing together theories emphasising cultural values, dysfunctional institutions, or impediments to trade as obstacles to financial development. To account for endogeneity, instrumental variables about culture, geography, and colonial history were employed. They found that trade openness and institutions constraining the political elite from expropriating financiers exhibit a strong positive effect on the size of capital markets.

Conversely, cultural beliefs and the cost of enforcing financial contracts seem not to introduce significant obstacles for financial development. They found that trade openness tends to enlarge the size of capital markets for both equity and debt finance in a statistically significant manner. Furthermore, they explain that an increase in trade relative to Gross Domestic Product (GDP) of one standard deviation entails an increase in the financial development of between one third and half a standard deviation. The positive entry of economic integration lends support to the interest group theory of Rajan and Zingales (2003), which claim that reducing impediments to trade increases the contestability of domestic markets, reduces monopoly rents, and thereby disciplines domestic elites not to corrupt the benefits of financial development away.

Baltagi, Demetriades and Law (2007), using panel data techniques and annual data, found that trade openness and financial openness together with economic institutions determines the financial development dissimilarity across countries. Their results showed that least open countries can benefit greatly in terms of financial development if they open either their trade or capital accounts. These countries can have even greater benefits if they open both, though opening only one can still result in banking sector development. On the other hand, countries that are most open benefit the least from added openness. Results from a study conducted by Kim, Lin and Suen (2010) consisting of 88 countries over the period 1960–2005 suggested that trade openness does play a critical role in determining the level of financial development. They found positive long-run and negative short-run effects of trade openness on financial development indicating that trade openness eventually contributes to financial development. However, when the countries are grouped in terms of income and inflation levels, their findings were consistent only in low-income or high inflation economies.

Druck, Plekhanov,and Dehesa,(2007) provided a cross-country empirical analysis of the determinants of financial deepening using a panel of 120 countries between 1997 and 2004 and found that higher credit-to-GDP ratios are associated with stronger creditor rights and lower inflation, and that the marginal effect of improvements in creditor rights protection is declining as the rate of inflation increases. Their analysis suggested that in a high inflation environment, controlling inflation and reducing

macroeconomic volatility should be given a priority. Once these goals are achieved, the focus of attention should shift to creditor rights protection and credit information management to report that lower inflation increases the amount of credit in their sample.

Huybens and Smith (1999) showed that higher levels of inflation are associated with smaller, less active and less efficient stock markets. Levine (2005) using data for 16 emerging market countries found out that following capital controls liberalisation, stock markets in these countries have become larger, more liquid and more integrated following liberalisation.

Financial openness, another indicator positively linked to financial development is regarded as a key form of financial liberalisation in a number of recent studies. Using cross-sectional studies to examine a wide range of countries over the period 1985-1995, Klein and Olivei (1999) determined whether opening capital accounts has an effect on financial development. With the ratio of liquid liabilities to GDP, the ratio of claims on the nonfinancial private sector to GDP and the ratio of private bank to private plus central bank assets as the measures of financial development and capital account liberalisation as the measure of financial openness, they established a positive association between capital account liberalisation and financial development.

Ito (2005) using panel data for 108 countries over the period 1980 to 2000, investigated whether financial openness results in financial development when the level of legal development is controlled. They found that financial openness can only have a positive impact on equity markets if legal systems and institutions are at a certain threshold level and are well developed; otherwise capital accounts can negatively affect equity market development. They further showed that developing general legal systems and institutions in a country, not precisely linked to financial transactions is vital to benefit from open financial markets. Their study also revealed that to increase the benefits of financial openness in emerging countries, law and order should be quite high. Also, using a sample of 35 emerging countries during the period 1976 to 2003, Huang (2006) found that financial openness is a key determinant of the difference in financial systems development across countries and discovers a strong link to suggest that financial openness and development exists in stock markets. He further explained that stock market liberalisation is part of extensive macroeconomic reforms like inflation stabilization and trade liberalisation.

In considering the banking sector development in transition economies, Jaffee and Levonian (2001) focused on the changing intensity of three policies that are commonly associated with financial repression, namely interest rate controls, statutory pre-emption and directed credit as well as the effects these policies had. The main findings of their studies were that the degree of financial repression has steadily increased between 1960 and 1980, and then declined somewhat before rising to a new peak at the end of the 1980s. Since the start of the overall economic reforms in

1991, the level of financial repression has steadily declined. Despite the high degree of financial repression, no statistically significant negative effects on savings, capital formation and financial development could be established which is contrary to the predictions of the financial liberalisation hypothesis. They further demonstrated that the level of GDP per capita and the saving rate have positive effects on the banking system structure as measured by bank assets, number, branches and employees for 23 transition economies.

Using pooled data from fifteen industrial and developing countries from 1980 to 1995, Garcia and Liu (1999) examined the macroeconomic determinants of stock market development, particularly market capitalisation. Their paper found that real income, saving rate, financial intermediary development, and stock market liquidity are important determinants of stock market capitalisation; macroeconomic volatility does not prove significant; and stock market development and financial intermediary development are complements instead of substitutes.

Do and Levchenko (2004) pointed out that to the extent a country's financial development is endogenous; it will in turn be influenced by trade. They build a model in which a country's financial development is an equilibrium outcome of the economy's productive structure: in countries with large financially intensive sectors financial systems are more developed. When a wealthy and a poor country open to trade, the financially dependent sectors grow in the wealthy country and so does the financial system. By contrast, as the financially intensive sectors shrink in the poor country, demand for external finance decreases and the domestic financial system deteriorates. They tested their model using data on financial development for a sample of 77 countries. They found that the main predictions of the model are borne out in the data: trade openness is associated with faster financial development in wealthier countries, and with slower financial development in poorer ones.

## 3. Methodology

### *3.1 Source of data and data*

The study employed quarterly secondary data which span from 1990:1 to 2015:4. The series were drawn from World Development Indicators, the Ghana Stock Exchange and Bank of Ghana. Thus, the purpose of this study is to investigate the relationship between financial sector development and economic growth in Ghana.

*Principal Component Analysis (PCA)*

Principal Components Analysis (PCA) in its simplest form involves a mathematical procedure that helps to transform a number of possibly correlated variables into a smaller number of uncorrelated ones which we call principal components. This type of analysis has two main objectives: reducing the dimensionality of the data set, and identifying new meaningful variables.

Principal component analysis here aids in determining the weights of the variables to be included in an index arbitrarily by constructing in such a way that the resulting components account for a maximal amount of variance in the data set. This method is more efficient in establishing the optimal weights of variables in comparison to other type of methods (equally weighted index and coefficient of variation type index) where variables are given equal or subjective weights which may bias the outcome of the study.

The eigenvalues are calculated for each component. The size of an eigenvalue indicates the amount of variance in the principal component explained by each component. The first principal component reflects the largest proportion of the total variability in the set of indicators used. The second component accounts for the next largest amount of variability not accounted for by the first component and so on.

It is however, imperative at this point, to indicate that in constructing indices for a variable that can be measured by various sets of indicators as is the case for financial development, the researcher is required to conduct Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy test whose test value should be at least 0.5 on a scale of one, indicating that there is enough evidence for the construction of an index for the indicators or variables under consideration.

To this end, the variables included in constructing the indexes for financial development are: private sector credit as a percentage of GDP by the banks (PSC), broad money supply as a percentage of GDP (M2GDP), total bank assets as a percentage of GDP (TBAGDP), total domestic credit as a percentage of GDP (DCGDP) for BSDI; stock market capitalisation as a percentage of GDP (SMC), stock market turnover ratio expressed in percentage (SMTOR), stock market total value traded as a percentage of GDP(SMTVT), for SMDI; public or government bond capitalisation as a percentage of GDP(GB), private or corporate bond as a percentage of GDP (PB), for BMDI; FSDI is constructed using all the indicators mentioned above.

Total domestic credit to the private sector as a ratio of Gross Domestic Product, (PSC) refers to financial resources provided to the private sector, such as through loans, purchases of non-equity securities, and trade credits and other accounts receivable, that establish a claim for repayment. This measure stresses the importance of the role played by the financial sector, especially the deposit money banks, in the financing of the private economy. It isolates credit issued to the private sector from the credit issued to governments, government agencies, and public enterprises. Also, it excludes credit issued by the Central Bank (Beck, Levine, & Loayza, 2000). This indicator is frequently used to assess the allocation of financial assets that the ratio of broad money to GDP cannot offer. M2GDP which is the broad money expressed as a ratio of GDP indicates the level of financial depth or level of monetisation. An

increase in private financial saving results in a higher M2 to GDP ratio, however, with high reserve requirements, credit to the private sector which eventually is responsible for the quantity and quality of investment and therefore to economic growth, may not increase. High domestic credit to the private sector indicates a higher level of domestic investment, indicating higher output, holding everything else constant. This measure has been used extensively in numerous works (Beck *et al*., 2000; King & Levine, 1993). Total bank assets as a ratio of GDP in percentage terms (TBAGDP) includes cash, government securities and interest-earning loans like mortgages, letters of credit and inter-bank loans of the banking sector. DCGDP indicates the overall credits that the banking sector can extend to the real sector of the economy.

Stock market capitalisation as percentage of GDP (SMC) is equal to the value of listed shares divided by GDP. It is an indicator of the size of the stock market. Stock market turnover ratio (SMTOR) in percentages is used as the efficiency indicator of stock markets. It is classified as the ratio of the value of total shares traded to stock market capitalisation. Stock market total value traded (% of GDP) is equal to the total shares traded on the stock market exchange divided by GDP. This indicator measures the activity or liquidity of the stock markets.

Private bond market capitalisation (% of GDP) is equal to the total amount of outstanding domestic debt securities issued by financial institutions and corporations as a share of GDP. Public bond market capitalisation (% of GDP) on the other hand is equal to the total amount of public domestic securities issued by governments as a share of GDP. Both of these indicators are used to determine the efficiency of bond markets.

Bond market development indicators have not been used in the literature on financial development. Even though these indicators have been employed excessively in equity market development literature, due to the short period of data availability they have not been used as indicators for financial development. Since this study investigates the development in the various markets of the financial sector and their effects on economic growth, the study considers these indicators in the analysis to obtain a broader perspective of the effects of financial development on economic growth. Hence the study proposes using the bond market development indicators so as to capture the efficiency and the effectiveness of bond markets on the overall level of financial development. Financial sector development index (FSDI) is constructed using all the indicators already explained above.

### *3.2. Methods and model*

#### ***Theoretical model for financial development and economic growth***

The paper adopts the Endogenous growth model which maintains that growth can arise when capital, both physical capital and human capital are augmented by additional inputs in the production function. The basic Endogenous growth model

explains economic growth as resulting from the combination of capital stock defined broadly to include – physical capital(K) and human capital(L), using basic Harror-Domar production function.

$$Y_t = f(K_t L_t) \quad (1)$$

The question that arises from equation (1) is how much of the increase in output can be attributed exclusively to changes in physical and human capital since other factors might affect output other than the factors indicated in equation (1). To account for this, Endogenous growth theorists employed the Cobb-Douglas production function expressed as:

$$Y_t = f(A_t K_t \ell) \quad (2)$$

Where Y is output or real GDP at time t, A is total factor productivity, K is capital stock (physical and human capital) and ℓ represents the naperian "e". Applying the Cobb-Douglas production function, Endogenous growth theorists stated the equation:

$$Y_t = AK_t^{\beta_1} \ell^{\varepsilon_t} \quad (3)$$

It is essential to note that A is not fixed, but varies with different production functions based on the factors being studied.

***Empirical model for financial development and economic growth***

The Cobb-Douglas production function described equation (3) is used as the basis for specifying the empirical model for this paper. This is augmented with an error term. It is essential to mention that, literature on economic growth indicates that, there are multitudes of potential variables that can affect the TFP (A). Following Dabel (2016); Asiedu (2013); Durlauf, Johnson and Temple (2005) and Eduboah (2018) the TFP was specified as:

$$A_t = f(BSDI_t, SMDI_t, BMDI_t, GEXP_t, RIR_t, INF_t, TOPN_t, FDI_t)^{\beta_q} \quad (4)$$

Where BSDI is banking sector development index, SMDI is stock market development index, BMDI is bond market development index, GEXP is government final expenditure, RIR is real interest rate, INF is inflation, TOPN is trade openness and FDI is foreign direct investment and q=1,2,3,,,,,,,n.

This implies that:

$$A_t = f(BSDI_t^{\beta_1}, SMDI_t^{\beta_3}, BMDI_t^{\beta_3}, GEXP_t^{\beta_4}, RIR_t^{\beta_5}, INF_t^{\beta_7}, TOPN_t^{\beta_8}, FDI_t^{\beta_9}) \quad (5)$$

Substituting equation (5) into equation (3) gives:

$$Y_t = BSDI_t^{\beta_1} SMDI_t^{\beta_3} BMDI_t^{\beta_3} GEXP_t^{\beta_4} RIR_t^{\beta_5} INF_t^{\beta_7} TOPN_t^{\beta_8} FDI_t^{\beta_9} \ell^{\varepsilon_t} \quad (6)$$

Consistent with the purpose of the study and in accordance with the literature, the study applied natural logarithm to equation (6) and estimated a log-linear model of the following form:

$$InY_t = In\Pi + \beta_1 BSDI_1 + \beta_2 InSMDI_2 + \beta_3 InBMDI_3 + \beta_4 InGEXP_4 + \beta_5 InRIR_t + \beta_6 InGFCF_6 + \beta_7 INF_t + \beta_8 InTOPN_t + \beta_9 InFDI_t + \varepsilon_t In\ell \quad (7)$$

If we denote $In\Pi = \beta_0$ , $RGDP_t = Y_t$, $K_t = GFCF_t$, and $In\ell = 1$, equation (7) can therefore be written as:

$$InRGDP_t = \beta_0 + \beta_1 BSDI_1 + \beta_2 InSMDI_2 + \beta_3 InBMDI_3 + \beta_4 InGEXP_4 + \beta_5 RIR_t + \beta_6 InGFCF_6 + \beta_7 INF_t + \beta_8 InTOPN_t + \beta_9 InFDI_t + \varepsilon_t \quad (8)$$

Where the coefficients: $\beta_1$ , $\beta_2$ , $\beta_3$, $\beta_4$ , $\beta_5$ , $\beta_6$, $\beta_7$ , $\beta_8$ , and $\beta_9$ are the parameters of the respective variables, $\beta_0$ is the intercept or constant term (drift), *t* denotes times and $\varepsilon$ is the error term. The following *a priori* signs are expected:
$\beta_1 > 0, \beta_2 > 0, \beta_3 > 0, \beta_4 > 0, \beta_5 > 0, \beta_6 > 0, \beta_7 > 0 , \beta_8 > 0,$ and $\beta_9 > 0$

The study adopted the autoregressive distributed lag (ARDL) model by Pesaran and Shin (1998) and Pesaran, Shin, and Smith (2001) to determine the long and short-run relationship.

## 4. Results and discussions

The section starts with the presentation of the results of the unit root. This was done fundamentally to ensure that the variables are stationary and that none of the variable was integrated of an order higher than two (2) since the ARDL procedure will crash in the presence of I(2) series. The Augmented Dickey-Fuller (ADF) test for unit root was used and the results are presented in Table 1.

**Table 1: Results of Unit Root Test with constant and trend: ADF Test**

| Levels | | | First Difference | | | |
|---|---|---|---|---|---|---|
| **Variables** | **ADF-Statistics** | **Lag** | **Variables** | **ADF-Statistics** | **Lag** | **I(0)** |
| LRGDP | -2.1995[0.4892] | 2 | ΔLRGDP | -5.0158[0.0004]*** | 1 | I(1) |
| LBSDI | -2.8682[0.1807] | 2 | ΔLBSDI | -5.4166[0.0001]*** | 1 | I(1) |
| LSMDI | -3.2983[0.0742]* | 2 | | | | I(0) |
| LBMDI | -1.1288[0.7022] | 2 | ΔLBMDI | -7.1946[0.0000]*** | 1 | I(1) |
| LGEXP | -2.9481[0.1527] | 1 | ΔLGEXP | -5.4236[0.0001]*** | 1 | I(1) |
| RIR | -4.8161[0.0009]*** | 2 | | | | I(0) |
| LGFCF | -4.3382[0.0043]*** | 2 | | | | I(0) |
| INF | -3.6072[0.0442]** | 2 | | | | I(0) |
| LTOPN | -2.6233[0.3165] | 2 | ΔLTOPN | -5.4418[0.0001]*** | 1 | I(1) |
| LFDI | -2.9957[0.2028] | 2 | ΔLFDI | -8.0157[0.0000]*** | 1 | I(1) |

***Note:*** ****, **, * indicates the rejection of the null hypothesis of non- stationary at 1%, 5%, 10% level of significance respectively, Δ denotes the first difference and I(0) is the lag order of integration. The values in parenthesis are the P-values.*

***Source:*** *Authors' computation using Eviews 9.0 Package.*

Since the test results have confirmed the absence of I(2) variables, the ARDL methodology is used for estimation.

*4.1. Cointegration analysis*

The F-statistics that the joint null hypothesis of lagged level variables of the coefficients is zero is rejected at 1 percent significance level in Table 2, since, the calculated F-statistics for $F_{LRGDP}$ (.) = 8.6447 exceeds the upper bound of the critical band value of 4.10.

**Table 2: Bounds Test results for Cointegration**

| Critical Value Bound of the F-statistic: intercept and no trend | | | | | | |
|---|---|---|---|---|---|---|
| **K** | **90% level** | | **95% level** | | **99% level** | |
| 9 | I(0)<br>1.95 | I(1)<br>3.06 | I(0)<br>2.22 | I(1)<br>3.39 | I(0)<br>2.79 | I(1)<br>4.10 |
| Calculated F-Statistics: | | | | | | |
| $F_{LRGDP}$ (LRGDP\|LBSDI, LSMDI, BMDI, LGEXP, RIR, LGFCF, INF, LTOPN, LFDI) 8.6447(0.0000)*** | | | | | | |

***Note:*** *Critical values are obtained from Narayan (2004), *** denotes statistical significance at the 1% level and K is the number of regressors in the bound test equations.*

*4.2. Long-run results (Economic growth is the dependent variable)*

Table 3 shows the results of the long run estimates based on the Schwartz Bayesian criteria (SBC). The coefficients indicate the long run elasticities.

**Table 3: Estimated Long Run Coefficients using the ARDL approach**

| ARDL(4, 4, 4, 4, 4, 2, 4, 1, 4, 2) selected based on SBC Dependent Variable: LRGDP | | | | |
|---|---|---|---|---|
| **Variable** | **Coefficient** | **Standard error** | **T-ratio** | **P-values** |
| LBSDI | 0.4174 | 0.0782 | 5.3356*** | [0.0000] |
| LSMDI | 0.1449 | 0.0430 | 3.3698*** | [0.0012] |
| LBMDI | 0.1200 | 0.0364 | 3.2967*** | [0.0031] |
| LGEXP | 0.1585 | 0.0405 | 3.9143*** | [0.0003] |
| RIR | -0.0075 | 0.0020 | -3.714*** | [0.0005] |
| LGFCF | 0.1751 | 0.0921 | 1.9007* | [0.0635] |
| INF | -0.0013 | 0.0005 | -2.6000** | [0.0165] |
| LTOPN | 0.1596 | 0.0770 | 2.0727** | [0.0133] |
| LFDI | 0.0527 | 0.0203 | 2.5880** | [0.0128] |

***Note:*** ****, **, * imply significance at the 1, 5, and 10 percent levels respectively.*

***Source:*** *Authors' computation using Eviews 9.0 Package.*

As shown in Table 3, all the estimated coefficients have their a priori expected signs. From the results, the coefficient of banking sector development index (BSDI), stock market development index (SMDI) and bond market development index (BMDI) which in all form financial sector development index is positive and statistically significant at 1 percent significance level, indicating that if the country were to increase banking sector development, stock market development and bond market development by 1 percent, then economic growth, measured as real gross domestic product will grow by approximately 0.42, 0.14 and 0.12 percent. This means that development in the financial sector has the potential for stimulating economic growth in Ghana at the aggregate level over the study period. This is consistent with the findings by Hye and Wizarat (2011), Sharif, Salehi & Alipour (2009) and that of Afangideh (2009). Other exogenous variables such as government expenditure, capital stock, trade openness and foreign direct investment are growth enhancing in the long run, however, interest rate and inflation are growth hampering as indicated in Table 3. The long-run results indicate that any disequilibrium in the system as a result of a shock can be corrected in the long-run by the error correction term. Hence, the error correction term that estimated the short-run adjustments to equilibrium is generated as follows:

ECM = LRGDP – 0.4174*LBSDI – 0.1449*LSMDI – 0.1200*LBMDI – 0.1585*LGEXP + 0.0075*RIR – 0.1751*LGFCF + 0.0013*INF – 0.1596*LTOPN – 0.0527*LFDI

The next step is to model the short-run dynamic relationship among the variables within the ARDL framework, once the long-run cointegration model has been estimated.

*4.3. Short-run results (Economic growth is the dependent variable)*

**Table 4: Estimated Short Run Coefficients using the ARDL approach**

| ARDL(4, 4, 4, 4, 4, 2, 4, 1, 4, 2) selected based on SBC Dependent Variable: DLRGDP | | | | |
|---|---|---|---|---|
| **Variable** | **Coefficient** | **Standard error** | **T-ratio** | **P-values** |
| D(LRGDP(-1)) | 0.4938 | 0.1190 | 4.1510*** | [0.0001] |
| D(LRGDP(-2)) | 0.4487 | 0.1036 | 4.3304*** | [0.0001] |
| D(LRGDP(-3)) | 0.3787 | 0.0866 | 4.3746*** | [0.0001] |
| D(LBSDI) | 0.1813 | 0.1594 | 1.1374 | [0.2612] |
| D(LBSDI(-1)) | 0.1079 | 0.1635 | 0.6598 | [0.5126] |
| D(LBSDI(-2)) | 0.3651 | 0.1291 | 2.8275*** | [0.0069] |
| D(LBSDI(-3)) | 0.4158 | 0.1278 | 3.2542*** | [0.0021] |
| D(LSMDI) | 0.0274 | 0.0135 | 2.0285** | [0.0482] |
| D(LSMDI(-1)) | 0.0687 | 0.0127 | 5.4097*** | [0.0000] |
| D(LSMDI(-2)) | 0.0518 | 0.0099 | 5.2259*** | [0.0000] |
| D(LSMDI(-3)) | 0.0468 | 0.0094 | 4.9847*** | [0.0000] |

| | | | | |
|---|---|---|---|---|
| D(LBMDI) | 0.0487 | 0.0181 | 2.6956*** | [0.0097] |
| D(LBMDI(-1)) | 0.0511 | 0.0153 | 3.3398*** | [0.0016] |
| D(LBMDI(-2)) | 0.0541 | 0.0145 | 3.7323*** | [0.0005] |
| D(LBMDI(-3)) | -0.0533 | 0.0125 | 4.2570*** | [0.0001] |
| D(LGEXP) | 0.3859 | 0.0987 | 3.9095*** | [0.0003] |
| D(LGEXP(-1)) | 0.4206 | 0.1031 | 4.0788*** | [0.0002] |
| D(LGEXP(-2)) | 0.2181 | 0.0963 | 2.2639** | [0.0282] |
| D(LGEXP(-3)) | 0.2469 | 0.0916 | 2.6970*** | [0.0097] |
| D(RIR) | -0.0276 | 0.0046 | 6.0350*** | [0.0000] |
| D(RIR(-1)) | -0.0100 | 0.0030 | 3.2985*** | [0.0019] |
| D(LGFCF) | 0.2648 | 0.0638 | 4.1490*** | [0.0001] |
| D(LGFCF(-1)) | 0.0574 | 0.0706 | 0.8134 | [0.4201] |
| D(LGFCF(-2)) | 0.1977 | 0.0637 | 3.1036*** | [0.0032] |
| D(LGFCF(-3)) | 0.2260 | 0.0601 | 3.7624*** | [0.0005] |
| D(INF) | -0.0162 | 0.0034 | 4.7584*** | [0.0000] |
| D(LTOPN) | 0.7439 | 0.0983 | 7.5706*** | [0.0000] |
| D(LTOPN(-1)) | 0.3477 | 0.1351 | 2.5733** | [0.0133] |
| D(LTOPN(-2)) | 0.2722 | 0.1282 | 2.1228** | [0.0391] |
| D(LTOPN(-3)) | 0.2741 | 0.1162 | 2.3596** | [0.0225] |
| D(LFDI) | 0.2074 | 0.0313 | 6.6213*** | [0.0000] |
| D(LFDI(-1)) | 0.0384 | 0.0208 | 1.8467* | [0.0711] |
| C | 0.6927 | 0.0739 | 9.3740*** | [0.0000] |
| ECM(-1) | -0.7670 | 0.1164 | -6.59*** | [0.0000] |

| | | | |
|---|---|---|---|
| R-squared | 0.8387 | Mean dependent variable | 0.0107 |
| Adjusted R-squared | 0.6946 | S.D. dependent variable | 0.0244 |
| S.E. of regression | 0.0135 | Akaike info criterion | -5.4706 |
| Sum squared residual | 0.0085 | Schwarz criterion | -4.2763 |
| Log likelihood | 289.1781 | Hannan-Quinn criterion | -4.9890 |
| F-statistic | 5.8200 | Durbin-Watson stat | 2.0210 |
| Prob(F-statistic) | 0.0000 | | |

***Note:*** ****, **, * imply significance at the 1, 5, and 10 percent levels respectively.*

***Source:*** *Authors' computation using Eviews 9.0 Package.*

Table 4 presents the results of the estimated error-correction model of economic growth in Ghana using the ARDL technique. The model is selected based on the SBC. The results show the expected negative sign of error correction term lagged

one period (ECMt-1) and it is highly significant at 1 percent significance level. This confirms the existence of the cointegration relationship among the variables with economic growth and various sub-sectors of the financial sector development index as well as other control variables in the model yet again. The ECM stands for the rate of adjustment to restore equilibrium in the dynamic model following a disturbance or shock. The coefficient of the lagged Error Correction Term, ECM (-1) is -0.7670. In other words, the statistically significant error correction term suggests that a deviation from the long-run equilibrium following a short-run disturbance or shock is corrected by about 77% at the end of each quarter in a year. According to Acheampong (2007), the rule of thumb is that, the larger the error correction coefficient (in absolute terms), the faster the variables equilibrate in the long-run when shocked in the short- run. Table 4 results reveal that the past performances of the Ghanaian economy, in this case real gross domestic product, influence the current performance of the economy. In Table 4, D (LRGDP (-1)), D (LRGDP (-2)), and D (LRGDP (-3)), all have positive and statistically significant effects on the current growth performance (DLRGDP) in Ghana. This is expected in that previous growth and expansion of the economy serves as an indication of prosperity and may attract more investment leading to more growth. Consistent with the long-run results, financial sector development which was disintegrated into banking sector development index (BSDI), stock market development index (SMDI), bond market development index (BMDI) together with the other exogenous variables in Table 4 are vital growth enhancing variables in the short-run except real interest rate and inflation.

### *4.4. Diagnostic and Stability tests*

The ARDL model used in the study passes the diagnostic tests as shown in Table 5. The model also passes the cumulative sum of recursive residuals (CUSUM) and cumulative sum of squares of recursive residuals (CUSUMSQ) as can be seen in the plots in Figure 1 and Figure 2.

**Table 5: Model Diagnostics**

| | |
|---|---|
| $F_{Auto}$ (4,73) | 0.88640 [0.476] |
| $X^2_{Auto}$ (1) | 2.9849 [0.1934] |
| $X^2_{Reset}$ (1) | 1.0941[0.3546] |
| $X^2_{Norm}$ (2) | 3.4972 [0.1740] |
| $X^2_{White}$ (1) | 0.8786[0.6636] |

***Note:*** *$X^2_{Auto}$, $X^2_{Reset}$, $X^2_{Norm}$, and $X^2_{White}$ are Lagrange multiplier statistics for test of serial correlation, functional form misspecification, non-normal errors and heteroskedasticity respectively. These statistics are distributed as Chi-square values with degree of freedom in parentheses. Values in parentheses [ ] are probability values.*

***Source:*** *Authors' computation using Eviews 9.0 Package.*

The *CUSUM* and *CUSUMQ* statistics are plotted against the critical bound of 5 percent significance level. According to Bahmani-Oskooee and Nasir (2004), if the plot of these statistics remains within the critical bound of the 5 percent significance level, the null hypothesis that all coefficients are stable cannot be rejected.

**Figure 1: Plot of Cumulative Sum of Recursive Residuals**

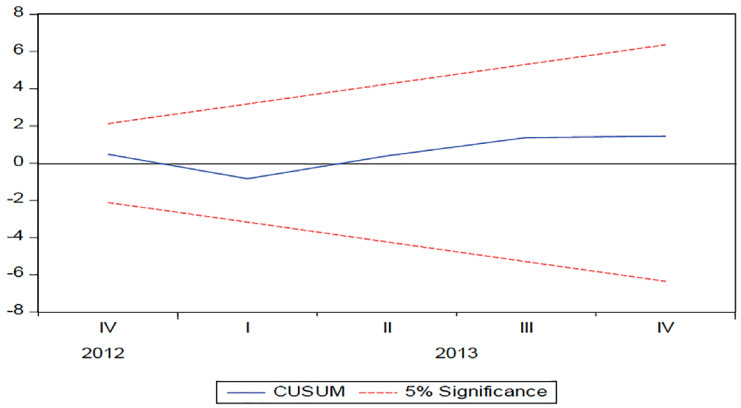
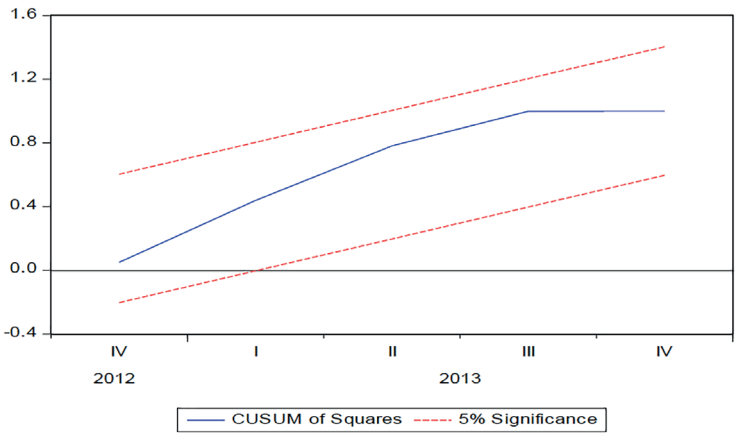



**Figure 2: Plot of Cumulative Sum of Squares of Recursive Residual**




*4.5. Granger Causality test*

Table 6 shows results for granger causality for the model. Financial sector development which was disintegrated into banking sector development index (BSDI), stock market development index (SMDI), bond market development index (BMDI) and economic growth using quarterly data from 1990:1 to 2015:4 for Ghana and applying Maximum Likelihood Estimation technique shows a unidirectional causality running from financial sector development to economic growth. Other exogenous variables in the Table also exhibited a unidirectional causality as vividly shown in the Table.

**Table 6: Results of Pair-Wise Granger Causality tests**

| Null hypothesis | F-statistic | P-values |
|---|---|---|
| LBSDI does not Granger Cause LRGDP | 6.0774 | [0.0033]*** |
| LRGDP does not Granger Cause LBSDI | 1.2780 | [0.2835] |
| LSMDI does not Granger Cause LRGDP | 5.1746 | [0.0074]*** |
| LRGDP does not Granger Cause LSMDI | 0.4859 | [0.1888] |
| LBMDI does not Granger Cause LRGDP | 3.0739 | [0.0181]** |
| LRGDP does not Granger Cause LBMDI | 4.0296 | [0.1210] |
| LGEXP does not Granger Cause LRGDP | 1.6802 | [0.1919] |
| LRGDP does not Granger Cause LGEXP | 4.5810 | [0.0127]** |
| RIR does not Granger Cause LRGDP | 2.1534 | [0.0437]** |
| LRGDP does not Granger Cause RIR | 0.2775 | [0.7583] |
| LGFCF does not Granger Cause LRGDP | 3.3454 | [0.0395]** |
| LRGDP does not Granger Cause LGFCF | 1.1181 | [0.3312] |
| INF does not Granger Cause LRGDP | 8.0321 | [0.0007]*** |
| LRGDP does not Granger Cause INF | 1.1096 | [0.3340] |
| LTOPN does not Granger Cause LRGDP | 4.1959 | [0.0047]*** |
| LRGDP does not Granger Cause LTOPN | 1.5173 | [0.3781] |
| LFDI does not Granger Cause LRGDP | 5.1043 | [0.0092]*** |
| LRGDP does not Granger Cause LFDI | 0.3478 | [0.1157] |

**Note***: ***, **, * indicates the rejection of the null hypothesis of no Granger causality at 1%, 5%, and 10% level of significance respectively.*

**Source:** *Authors' computation using Eviews 9.0 Package.*

## 5. Conclusion and recommendations

The paper looks at the cointegration nexus between financial sector development which was disintegrated into banking sector development index (BSDI), stock market development index (SMDI), bond market development index (BMDI) and economic growth using quarterly data from 1990:1 to 2015:4 for Ghana and applying Maximum Likelihood Estimation technique and using the Autoregressive Distributed Lag (ARDL) approach and the Granger causality test. The study found a unique cointegration and statistically significant positive relationship between financial sector development and economic growth in the long run and short run for Ghana. The causality result revealed a unidirectional causality between financial sector development and economic growth running from financial sector development to economic growth. The study, therefore, recommends that the Government of Ghana and the Central Bank of Ghana need to maintain a continuous effort in developing the financial sector. This will in turn spur financial sector development and eventually economic growth in Ghana.

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