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**Article**

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# Financial Sector Reforms and Economic Growth in Ghana: a Dynamic ARDL Model

Erasmus L. Owusu<sup>1</sup>, Nicholas M. Odhiambo<sup>2</sup>

## ABSTRACT

This paper examines the relationship between financial sector reforms and sustainable economic growth in Ghana. Employing the autoregressive distributed lag (ARDL) bounds testing approach and using GDP per capita as a growth indicator, this paper establishes a long-run relationship between economic growth and financial reforms, which is represented by an index calculated using principal component analysis (PCA). The paper finds that in the long run, financial sector reforms have an insignificant impact on economic growth in Ghana. This supports numerous past studies that have reported mixed or inconclusive results on the effects of financial reforms on economic growth. The paper concludes that increase in capital stock, not financial sector policy reforms, affects economic growth in Ghana. This paper therefore recommends an increase and modernization of capital stock in order to promote real sector growth in Ghana.

## KEY WORDS:

Africa; Ghana; Economic Growth; Financial Sector Reforms; ARDL Bounds Testing Approach

## JEL Classification:

C32; G12; O16; O47

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## 1 Introduction

The purpose of this paper is to empirically investigate and provide insight into the impact of financial liberalization on sustainable economic growth in Ghana (a member of the Economic Community of West African States – ECOWAS). ECOWAS is made up of 15 countries in the West African sub-region, namely, Benin, Burkina Faso, Cape Verde, Ivory Coast, Gambia, Ghana, Guinea-Bissau, Guinea, Liberia, Mali, Niger, Nigeria, Senegal, Sierra Leone and Togo. This paper constructs a financial liberalization index factor [This factor will be used instead of dummies to represent the

effect of financial sector reforms in Ghana. A similar approach was employed by Caprio, Honohan and Stiglitz (2001) and Laeven (2003)], taking into account all the relevant policies of financial liberalization used in Ghana using principal component analysis (PCA). The paper uses the Phillips and Peron (1988) unit root test and the Dickey-Fuller Generalized Least Squares (DF\_GLS) in order to test for the stationarity of the variables. The paper then applies the empirical analytical ARDL Bounds testing approach in order to establish a long-term relationship between financial liberalization and sustainable economic growth using time-series data. Lastly, a dynamic unrestricted error-correction model (UECM) is derived from the ARDL Bounds testing model to analyze the existing short-run relationship. The sources of the data include various issues of the World Bank's World Development Report (2009a), the World Bank's African Development Indicators (2009b),

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the IMF's International Financial Statistics, the Bank of Ghana, Ghana Statistical Services and other relevant sources.

This paper contributes to the literature on financial liberalization by establishing whether financial sector reforms have a positive influence on economic growth in Ghana. The paper uses time series data from 1969 to 2008, covering periods of both financial repression and financial liberalization. However, the main period of this paper is the post-liberalization period. The motivation for using financial liberalization index factors is to ensure that all the various financial sector reforms implemented in the attainment of full financial liberalization status are taken into account for Ghana and to help solve the problem of the quantification of the effect of financial liberalization, which is one of the problems often associated with empirical studies in this area (Caprio et al., 2001; Laeven, 2003).

In addition, most recent studies published on financial reforms and economic growth are based on evidence mainly from South American and the East Asian countries, with little or no attention devoted to African countries, especially countries in the ECOWAS region. The potential weakness of this paper is that the application of the findings to any other country should come with a proviso. Additionally, we did not apply Bartlett's test for sphericity to the financial liberalization index, and we did not obtain its Kaiser-Meyer-Olkin (KMO) coefficient. We therefore recommend that future studies apply this test to see if they reach the same conclusion.

This paper is divided into six sections, including the introduction. In section two, the paper reviews financial sector reforms in Ghana. This is followed in section three by the literature review, both theoretical and empirical. In section four, the paper looks at the methodology and the empirical analysis. The conclusion is elaborated in section five, followed by the references.

## 2 An overview of financial Sector Reforms in Ghana

From its independence in 1957 to the year 1983, Ghana pursued a growth strategy policy, which can only be described as a policy based on inward-oriented trade, led by the public sector, and aimed at the achievement of social welfare objectives (Aryeetey, 1994). As a result, the budgetary pressures and the fast-depleting

external reserves that led to shortages in the Ghanaian economy in the 1960s forced the introduction of price-control policies for the administrative allocation of scarce goods and services.

These policies extended to the financial services as well. By the mid-1960s, the price control regime became official with the establishment of a Price and Income Board. In the financial sector, banks were forced to provide credit on the basis of social and political considerations, and they were obliged to make sure that these credits were channeled into priority sectors, such as agriculture. In order to cope with the cost of credit, exchange rates and interest rates were fixed by the government.

The price-control regime instigated distortions in the market that led to the misallocation of resources. Economic growth rates declined as a result of price distortions, which affected the production of the real sector in the economy. The control of the foreign exchange market led to the over-valuation of the domestic currency and therefore weakened the export sector at the expense of an increased appetite for foreign goods, which worsened the balance of payments. According to Sowa and Acquaye (1999), the control of interest rates together with the high rate of inflation brought about a system of financial repression, which weakened the development of the financial sector and subjected the allocation of credit to political patronage.

An integral part of this inward-oriented policy strategy was the control that the government had over the financial sector. There were interest rate ceilings – both on deposits and credits – and there was no stock market. Government policies favored the mobilization of savings and the allocation of credits through government-owned financial institutions (Bank of Ghana, 2009). Despite this policy favoritism, domestic savings mobilization by the banks was unsatisfactory. For instance, between 1969 and 1986, financial deepening in Ghana, as measured by the ratio of M2 to GDP, averaged 17.3%. This poor performance could be attributed to: (i) citizens' lack of confidence in the financial sector during that period; (ii) low deposit interest rates (fixed by the government); and (iii) the emergence of the large-scale migration of Ghanaian workers – especially to Nigeria and Libya – for “greener pastures.”

Under the supervision of the IMF and the World Bank, Ghana went through massive structural reforms as part of the economic recovery programme (ERP), leading to the removal of distortions in the economy. These reforms included financial reforms to deregulate interest rates, remove credit controls and introduce the floating of exchange rates, among others. The need for a stock market in Ghana became inevitable after the financial reforms and the further divestiture of a host of state-owned enterprises. As a result, the Ghanaian Stock Exchange was incorporated in July 1989 as a private company under the Ghana companies code 1963 (Act 179). It was recognized as an authorized stock exchange under the Stock Exchange Act of 1971, and it was allowed to commence trading on November 12, 1990. However, the status of the exchange was changed to that of a public company in April 1994. The number of listed companies increased from 13 in 1990, to 19 in 1995, and to 32 in 2007. In 2009, the number of companies listed on the stock exchange stood at 37. Of these 37 companies, 14 were companies that operated in the financial sector (Ghana Stock Exchange [GSE], 2009).

The increase in the number of listed companies has also been reflected in market capitalization, which increased from as little as just over US\$ 2.6 million in 2004, to approximately \$11.5 billion in 2006, and to \$12.8 billion in 2010 (GSE, 2010). At the same time, the annual turnover ratio remained at approximately 3.2% in 2004, decreasing from an all-time high of 6.5% in 1998. This, however, increased to 5.2% in 2008. At present, the GSE holds trading every working day. All out-of-hours trades are subsequently reported to the GSE at the next trading session. All trading transactions are agreed on the floor of the exchange, except for Ashanti Gold shares, which can be traded both through the GSE and over the counter after GSE trading hours.

### 3 Theoretical and Empirical literature review

#### 3.1 Theoretical issues

Financial repression is defined rather widely in the literature. An economy is described as financially repressed if it has a broad range of characteristics. According to McKinnon (1989), an economy is finan-

cially repressed, when tax and other issues distort the domestic capital market. These taxes and distortions, he argues, take two general forms: interest rate controls and direct credit-allocation programs. According to Eschenbach (2004), financial repression can also be the combination of indiscriminate nominal interest rate ceilings and high and accelerating inflation. A high reserve requirement can also play a role. Financial repression is based on the theory of liquidity preference, as propagated by Keynes (1936). He argued that the full employment equilibrium level of the real interest rate tends to be lower than that generated by liquidity preference. Therefore, interest rates had to be lowered in order to avoid a decrease in income. Tobin (1965) also suggested a model whereby small household producers allocate their wealth among money and productive capital. He argued that financial repression reduces the demand for money in favor of productive capital, thereby increasing the capital/labor ratio and accelerating economic growth.

McKinnon (1973) and Shaw (1973) were the first to formalize the theory of interest rate liberalization. This suggests that the total removal of all restrictions on the financial sector would inevitably lead to rapid economic growth. During the 1980s, neo-structuralists criticized the McKinnon-Shaw school of thought and argued that interest rate liberalization would slow down economic growth because households do not hold all their investments in financial assets. Using Tobin's portfolio framework for households, they argued that in response to an increase in interest rates on deposits, households would substitute deposits for gold or cash and loans in the informal sector; hence, there would be no impact on economic growth. Their arguments followed similar directions as those put forward by Keynes and Tobin. The principal critics of the McKinnon-Shaw hypothesis were Van Wijnbergen (1983) and Taylor (1983).

Van Wijnbergen's (1983) hypothesis contrasted those of McKinnon (1973) and Kapur (1976). Van Wijnbergen expressed the view that McKinnon's and Kapur's results depend crucially on one implicit assumption about asset market structure that is never stated explicitly: that the portfolio shift into bank deposits comes from "unproductive" assets, such as gold, cash or inventories. Van Wijnbergen (1983) further argued that it is not at all obvious that bank

deposits are substitutes for cash or gold, rather than loans extended to the informal sector.

Stiglitz (1989) also criticized the policy of financial liberalization on the theoretical ground of market failures in financial markets. Neo-structuralists argued that high interest rates increase inflation in the short run through cost-push effects and decelerate economic growth as a result of the reduced real credit volume. These theoretical considerations are, however, complemented by policy requirements in developing countries where, if the government is unable to collect sufficient tax revenue, it imposes financial repressive measures as an implicit tax on the financial sector (Fry, 1995).

Fry (1995) stated that financial repression is a severe and unintended form of financial restriction, which he considered to be a second-best policy for governments with low tax-raising powers. Reserve requirements, obligatory holdings of government bonds, or interest rate ceilings help authorities to divert savings to the public sector at low or zero costs.

### 3.2 Empirical Evidence

Research findings based on the McKinnon-Shaw hypothesis have rather mixed results. Additionally, available evidence shows that in addition to macro-economic stabilization, sound and proven regulation of the financial sector seems to play a significant and important role in the successful implementation of interest rate reform policy in developing countries.

Berthélemy and Varoudakis (1995) explored the relationship between financial liberalization and economic growth. They based their analysis on convergence club tests, which help to check for any potential poverty traps. They used sample data from 91 countries in the 1960-1985 period. They concluded that educational attainment is a priority factor with respect to economic development but that financial factors such as interest rate liberalization could lead to high or low economic growth outcomes.

In other words, convergence groups with similar long-run economic growth rates have the same impact as financial liberalization. These authors also showed that inadequate financial conditions may severely limit economic growth in countries that already have a sufficient stock of human capital to begin the process of economic development. They concluded that this indicates the existence of poverty traps.

In another study, Levine and Zervos (1998) used cross-sectional data from 47 countries for the period from 1976 to 1993 in order to investigate the impact of stock market activity on economic growth, capital stock growth, productivity growth, and the private savings rate. They reported a strong positive relationship between stock market liquidity (as measured by initial value traded as a ratio of GDP plus the initial turnover ratio – i.e., value traded as a ratio of average market capitalization), real GDP growth, capital stock growth and productivity growth.

They also found that other financial variables, such as stock market size, volatility and integration into international capital markets were not necessarily strongly linked to economic growth. Furthermore, using stock market liquidity and financial deepening (as measured by bank credits to the private sector as a ratio of GDP) in their model, they simultaneously showed a positive relationship with economic growth. They argued that this is an indication that banks and stock markets provide different financial services in an economy. Adu et al. (2013) investigated the long-run growth effects of financial development in Ghana. They used indices created from principal component analysis (PCA) and confirmed that the impact of financial development on economic growth in Ghana depends on the indicator used to proxy financial development.

## 4 Methodology and Empirical Analysis

### 4.1 Methodology

According to the McKinnon and Shaw hypothesis and neo-classical economists, financial liberalization is expected to ultimately lead to an increase in economic growth. Based on this assumption, this paper specifies a model designed to evaluate the impact of financial liberalization on the macro-economic developments. This paper uses Beck et al. (2000) and specifies a modified model for real GDP per capita, a measure of economic growth, as a function of government expenditure, inflation and the financial liberalization index, as well as variables for labor and capital formation as

$$\ln Y_t = C_t + a \ln K_t + b \ln L_t + q \ln GEXP_t + p \ln INFL_t + w \ln FLBL_t + e_t \quad (1)$$

where  $Y$  = RGDP – the GDP per capita;  $K$  = the capital stock;  $L$  = labor force;  $GEXP$  = real government expenditure;  $INFL$  = inflation;  $FLBL$  = combined financial liberalization index;  $C_i$  = constant parameter;  $e$  = white noise error term; and  $\ln$  = natural log operator.

Real government expenditure ( $GEXP$ ) is calculated as a ratio of GDP. This variable was included because it is expected to crowd out private investments. This has a significant consequence on financial deepening and, hence, on economic growth. According to Barro and Sala-i-Martin (2004), government expenditure does not directly affect productivity, but it leads to distortions in the private sector. Real per capita growth (RGDP), which is computed as real GDP divided by the total population, is generally used to indicate the size of individual income and the economic development of a country.

To improve the efficiency of capital requires human effort. This paper has accounted for this by including capital stock ( $K$ ) and a labor factor ( $L$ ) in equation (1). Furthermore, inflation ( $INFL$ ) has been included as a macro-economic indicator because it can be viewed as an indicator of poor macroeconomic policies that are likely to make a country prone to crises and, hence, to negatively affect growth (Fischer, 2005).

According to Fischer (2005), inflation is detrimental to economic growth. Additionally, De Gregorio (1995) noted that higher inflation has the effect of reducing labor supply; hence, it reduces economic growth. To minimize the effect of some outlier rates, this paper uses the natural log of one plus the rate of inflation. As mentioned in the introduction, the combined financial sector reform index ( $FLBL$ ) is determined by using PCA. This index has been included in the model in order to show the effects of various policy changes on the process of implementing the financial liberalization policy. The coefficient of  $FLBL$  is expected to be positive and statistically significant. According to Shrestha and Chowdhury (2006), in order to derive the financial liberalization indices, some arbitrary value must be assigned to each of the financial liberalization policy variables.

Each policy variable could take a value between 0 and 1, depending on the implementation status (Caprio et al., 2001; Laeven, 2003). Thus, when a particular sector is fully liberalized, the corresponding policy variable takes a value of 1, and when that sector

remains regulated, it takes a value of 0. To capture the scenario of part, step-wise or gradual liberalization in a particular sector, partial values such as 0.33, 0.50, and 0.66, respectively, would be assigned. A value of 0.50 would indicate the first phase of partial deregulation in a two-step deregulation process, whereas values of 0.33 and 0.66 would indicate the first and second steps, respectively, in a three-phase deregulation process.

The two-phase process takes a value of 1 in the second phase, and the three-phase process takes a value of 1 in the third phase. In other words, if a sector is fully liberalized in a single phase, the value assigned in this case is 1, but if liberalization is completed in two phases, then 0.5 is assigned for the first phase, and 1 is assigned for the second. Similarly, if liberalization takes place in three phases, then the number assigned is 0.33 for the first phase, 0.66 for the second phase, and 1 for the last phase (Shrestha and Chowdhury, 2006).

The above methodology is applied to Exchange Rate policies, Regulatory and Legal Reforms policies, Institutional Restructuring policies, Capital Account liberalization policies, Monetary control policies, Interest Rate policies, Capital Market development, Secondary Reserve requirement policies and the Creation of Universal banking policies in Ghana in order to establish the interest rate liberalization index. The signs of the constant elasticity coefficients  $a$ ,  $b$  and  $w$  are expected to be positive; however,  $p$  and  $q$  are expected to be negative.

In the first stage of the ARDL methodology, this paper estimates the ARDL model of interest by ordinary least squares (OLS) in order to test for the existence of a long-run relationship among the relevant variables; in other words, whether the null hypothesis of no long-term relationship is rejected or accepted. This is performed by conducting a Wald test (F-test version for bound-testing methodology) for the joint significance of the lagged levels of the variables, i.e., testing the null hypothesis against the alternative hypothesis. In this case, the asymptotic distribution of the Wald test (F-statistic) is non-standard under the null hypothesis of no co-integration relation between the variables of interest, irrespective of whether the explanatory variables are purely  $I(0)$  or  $I(1)$ .

The second stage begins once the long-run relationship or co-integration has been established. In

this stage, the testing involves the estimation of the long-run coefficients (which represent the optimum order of the variables after selection by AIC or SBC) and then calculating the associated error correction model in order to establish the adjustment coefficients of the error correction term (Masih et al., 2008). The short-run effects are therefore captured by the coefficients of the first-differenced variables in the UECM model. According to Bahmani-Oskooee and Brooks (1999), the existence of a long-term relationship is established from Equation (1), but this does not necessarily mean that the estimated coefficients are stable.

There is, however, the need to perform a series of test diagnoses on the model established. This involves testing the residuals (i.e., homoscedasticity, non-serial correlation, etc.), as well as stability tests to ensure that the estimated model is statistically robust.

The unrestricted error correction model (UECM) of equation (1) is estimated as follows:

$$\begin{aligned} \Delta \ln Y_t = & c_0 + \delta_1 \ln Y_{t-1} + \delta_2 \ln K_{t-1} + \delta_3 \ln L_{t-1} + \delta_4 \ln GEXP_{t-1} + \\ & + \delta_5 \ln INFL_{t-1} + \delta_6 FLBL_{t-1} + \sum_{i=1}^p \alpha_i \Delta \ln Y_{t-i} + \sum_{i=0}^q \beta_j \Delta \ln K_{t-j} + \\ & + \sum_{i=0}^q \gamma_i \Delta \ln L_{t-i} + \sum_{i=0}^q \lambda_i \Delta \ln GEXP_{t-r} + \sum_{i=0}^q \theta_p \Delta \ln INFL_{t-p} + \\ & + \sum_{i=0}^q \phi_z \Delta FLBL_{t-z} + e_t \end{aligned} \quad (2)$$

Where: i) the coefficients  $\alpha_p$ ,  $\beta_p$ ,  $\gamma_p$ ,  $\lambda_p$ , and  $\theta_p$  represent the short-run dynamics of the model; ii) the coefficients  $\delta_i$  represent the long-run multipliers corresponding to long-run relationships; iii)  $c_0$  is the drift; and iv)  $e_t$  is the white noise error term.

## 4.2 Empirical Analysis

### 4.2.1 Unit root tests for variables

As indicated in section one, the results of the Dickey-Fuller generalized least squares (DF-GLS) and the Phillips and Peron (PP) unit root tests for the variables used are shown in Tables 1a, 1b, 2a and 2b. The DF-GLS lag length is selected automatically by AIC, while the PP truncation lag is selected automatically on the Newey-West bandwidth.

The results from Tables 1a, 1b, 2a and 2b show that all the variables are either I(0) or I(1) using both unit

root tests. The null hypothesis that the variables have unit roots on the basis of Akaike Information Criteria (AIC) and on the Newey-West bandwidth are therefore rejected.

### 4.2.2 Co-integration Analysis: ARDL bounds Test

The results of the co-integration test based on the ARDL bounds testing approach are reported in Table 3.

Thus, the null hypothesis of the non-existence of co-integration among the variables is rejected. This implies that there is a long-run co-integration relationship among the variables when the model is normalized on real GDP per capita ( $\ln$ RGDP) in Ghana. The long-run results of the selected model are reported in Table 4 below.

The results reported in Table 4 show that the coefficient of the real government expenditure ( $\ln$ GEXP) is statistically insignificant and has an unexpected *a priori* sign. The coefficient of inflation ( $\ln$ INFL) is statistically significant at the 5% level, and it has the expected negative sign. Furthermore, the coefficient of the combined financial Sector Reform index (FLBL), which serves as the proxy for the changes and implementation of the policy, has the expected sign but is statistically insignificant. Thus, financial sector reforms in Ghana have insignificant impact on economic growth in the long run.

However, capital accumulation ( $\ln$ K) has the expected sign and is statistically significant at the 5% level. Thus, a 1% increase in capital accumulation leads to an increase of approximately 0.9% in economic growth in the long run. The short-run dynamics of the model are shown in Table 5.

The coefficients of  $\Delta \ln$ RGDP<sub>-1</sub>,  $\Delta \ln$ K,  $\Delta \ln$ K<sub>-1</sub> and  $\Delta \ln$ INFL are all statistically significant at the 10% level. However, the coefficients of  $\Delta \ln$ L,  $\Delta \ln$ GEXP and  $\Delta$ FLBL are all statistically insignificant. The coefficient of ECM(-1) is found to be statistically significant at the 5% level, with the expected negative sign. This confirms the existence of a long-run relationship between the variables. The coefficient of the ECM(-1) term is -0.22, which suggests a relatively slow rate of adjustment.

The magnitude of the coefficient of the ECM(-1) term implies that the disequilibrium occurring due to a shock is totally corrected in approximately 4 years and 7 months at a rate of 22% per annum.

**Table 1a.** DF-GLS unit root tests for variables in levels

| Variable      | No Trend | Result | Trend  | Result |
|---------------|----------|--------|--------|--------|
| <i>FLBL</i>   | 0.920    | N      | -1.781 | N      |
| <i>lnGEXP</i> | -1.784   | N      | -2.818 | N      |
| <i>lnINFL</i> | -2.119   | N      | -2.478 | N      |
| <i>lnK</i>    | -0.333   | N      | -2.079 | N      |
| <i>lnL</i>    | -0.738   | N      | -2.352 | N      |
| <i>lnRGDP</i> | -1.293   | N      | -1.152 | N      |

Note: \*, \*\* and \*\*\* denote the rejection of the null hypothesis at 10%, 5% and 1% significance levels, respectively. S = Stationary and N = Non-stationary. In is the natural log operator. The log of one plus the rate of inflation was used to diminish the impact of some outlier observations.

**Table 1b.** PP unit root tests for variables in levels

| Variable      | No Trend  | Result | Trend    | Result |
|---------------|-----------|--------|----------|--------|
| <i>FLBL</i>   | 0.154     | N      | -2.222   | N      |
| <i>lnGEXP</i> | -2.379    | N      | -2.312   | N      |
| <i>lnINFL</i> | -3.784*** | S      | -3.947** | S      |
| <i>lnK</i>    | -0.559    | N      | -1.798   | N      |
| <i>lnL</i>    | -0.796    | N      | -2.308   | N      |
| <i>lnRGDP</i> | -0.567    | N      | -0.395   | N      |

Note: \*, \*\* and \*\*\* denote the rejection of the null hypothesis at 10%, 5% and 1% significance levels, respectively. S = Stationary and N = Non-stationary. In is the natural log operator. The log of one plus the rate of inflation was used to diminish the impact of some outlier observations.

**Table 2a.** DF-GLS unit root tests for variables in first differences

| Variable               | No Trend  | Result | Trend      | Result |
|------------------------|-----------|--------|------------|--------|
| $\Delta$ <i>FLBL</i>   | -5.526*** | S      | -5.814***  | S      |
| $\Delta$ <i>lnGEXP</i> | -4.419*** | S      | -5.093***  | S      |
| $\Delta$ <i>lnINFL</i> | -5.925*** | S      | -10.345*** | S      |
| $\Delta$ <i>lnK</i>    | -7.291*** | S      | -7.927***  | S      |
| $\Delta$ <i>lnL</i>    | -6.834*** | S      | -6.865***  | S      |
| $\Delta$ <i>lnRGDP</i> | -4.400*** | S      | -4.480***  | S      |

Note: S = Stationary and N = Non-stationary.  $\Delta$  is the difference operator, and In is the natural log operator. \*, \*\* and \*\*\* denote the rejection of the null hypothesis at 10%, 5% and 1% significance levels, respectively.



**Table 2b.** PP unit root tests for the variables in first differences

| Variable          | No Trend  | Result | Trend     | Result |
|-------------------|-----------|--------|-----------|--------|
| $\Delta FLBL$     | -5.688*** | S      | -5.671*** | S      |
| $\Delta \ln GEXP$ | -4.236*** | S      | -4.229*** | S      |
| $\Delta \ln K$    | -8.102*** | S      | -8.305*** | S      |
| $\Delta \ln L$    | -6.744*** | S      | -6.693*** | S      |
| $\Delta \ln RGDP$ | -4.382*** | S      | -6.178*** | S      |

Note: S = Stationary and N = Non-stationary.  $\Delta$  is the difference operator, and  $\ln$  is the natural log operator. \*, \*\* and \*\*\* denote the rejection of the null hypothesis at 10%, 5% and 1% significance levels, respectively.

**Table 3.** Economic Growth and financial liberalization – Bounds F-test for co-integration

| Dependent variable                                       | Function  |      |      |      | F-test statistics |      |
|--|---|------|------|------|-------------------|------|
| $\ln Y = \ln RGDP$                                       | $F_{\ln Y}(\ln Y   \ln L, \ln K, \ln GEXP, \ln INFL, FLBL)$ |      |      |      | 3.769**           |      |
| Asymptotic Critical Values                               |   |      |      |      |                   |      |
| Pesaran et al. (2001),<br>p.301, Table CI(iv)<br>Case IV | 1%  |      | 5%   |      | 10%               |      |
|  | I(0)  | I(1) | I(0) | I(1) | I(0)              | I(0) |
|  | 3.50  | 4.63 | 2.81 | 3.76 | 2.49              | 3.38 |

Note: \*\* denotes statistical significance at the 5% level.

**Table 4.** Economic Growth and financial Reforms – Results of the ARDL (2, 2, 0, 0, 1, 1) long-run model selected on the basis of AIC

| Regressor  | Co-efficient | Standard Error | T-Ratio | Prob. |
|------------|--------------|----------------|---------|-------|
| C          | 8.416        | 6.543          | 1.501   | 0.111 |
| $\ln K$    | 0.899        | 0.701          | 2.273   | 0.041 |
| $\ln L$    | -0.873       | 1.593          | -0.659  | 0.630 |
| $\ln GEXP$ | 0.422        | 0.151          | 1.250   | 0.141 |
| $\ln INFL$ | -1.242       | 0.556          | -1.809  | 0.050 |
| $FLBL$     | 0.155        | 0.691          | 0.907   | 0.203 |

Note: Dependent variable:  $\ln Y = \ln RGDP$ .

**Table 5.** Economic Growth and financial Reforms – Results of the ARDL (2, 2, 0, 0, 1, 1) ECM model selected on the basis of AIC

| Regressor                     | Co-efficient | Standard Error             | T-Ratio               | Prob. |
|-------------------------------|--------------|----------------------------|-----------------------|-------|
| $\Delta \ln \text{RGDP}_{-1}$ | 0.259        | 0.179                      | 1.882                 | 0.066 |
| $\Delta \ln K$                | 0.089        | 0.057                      | 2.233                 | 0.041 |
| $\Delta \ln K_{-1}$           | -0.134       | 0.026                      | -3.861                | 0.001 |
| $\Delta \ln L$                | -0.269       | 0.239                      | -0.859                | 0.456 |
| $\Delta \ln \text{GEXP}$      | 0.069        | 0.049                      | 1.578                 | 0.182 |
| $\Delta \ln \text{INFL}$      | -0.184       | 0.048                      | -5.536                | 0.000 |
| $\Delta \text{FLBL}$          | 0.029        | 0.015                      | 1.074                 | 0.104 |
| $\text{Ecm} (-1)$             | -0.218       | 0.109                      | -2.963                | 0.034 |
| R-Squared                     | 0.895        | R-Bar-Squared              | 0.796                 |       |
| S.E. of Regression            | 0.023        | F-Stat.                    | F(9, 28) 8.679[0.000] |       |
| Residual Sum of Squares       | 0.011        | DW-statistic               | 2.581                 |       |
| Akaike Info. Criterion        | 80.006       | Schwarz Bayesian Criterion | 71.078                |       |

Note: Dependent variable:  $\Delta \ln Y = \Delta \ln \text{RGDP}$ .

**Table 6.** Economic Growth and financial reforms – ARDL-UECM model diagnostic tests

| LM Test Statistics          | Results      |
|-----------------------------|--------------|
| Serial Correlation: CHSQ(1) | 2.596[0.205] |
| Functional Form: CHSQ(1)    | 1.528[0.252] |
| Normality: CHSQ(2)          | 1.149[0.723] |
| Heteroscedasticity: CHSQ(1) | 0.114[0.851] |

Additionally, the regression for the underlying ARDL model fits very well at R square = 98.7%, and it also passes all the diagnostic tests against serial correlation, functional form, normality and heteroscedasticity, as shown in Table 6. Finally, an inspection of the cumulative sum (CUSUM)

and the cumulative sum of squares (CUSUMSQ) graphs (see Figures 1 and 2) from the recursive estimation of the model reveals that there is stability, and there is no systematic change detected in the coefficient at the 5% significant level over the sample period.

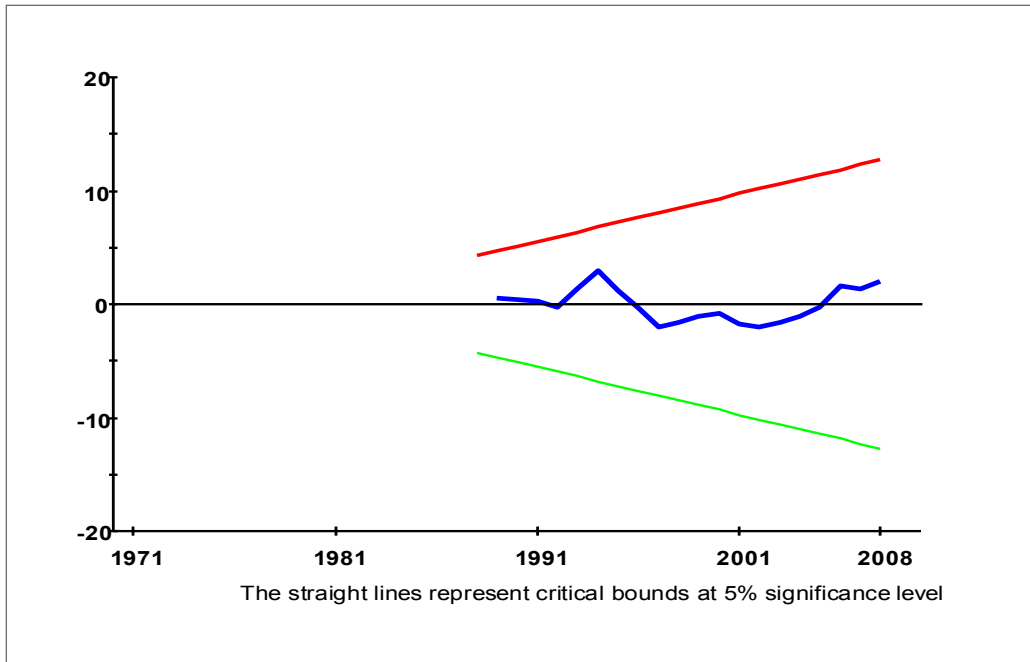


Figure 1. Economic Growth and Financial Liberalization – Plot of CUSUM for the coefficients of stability in the ECM model

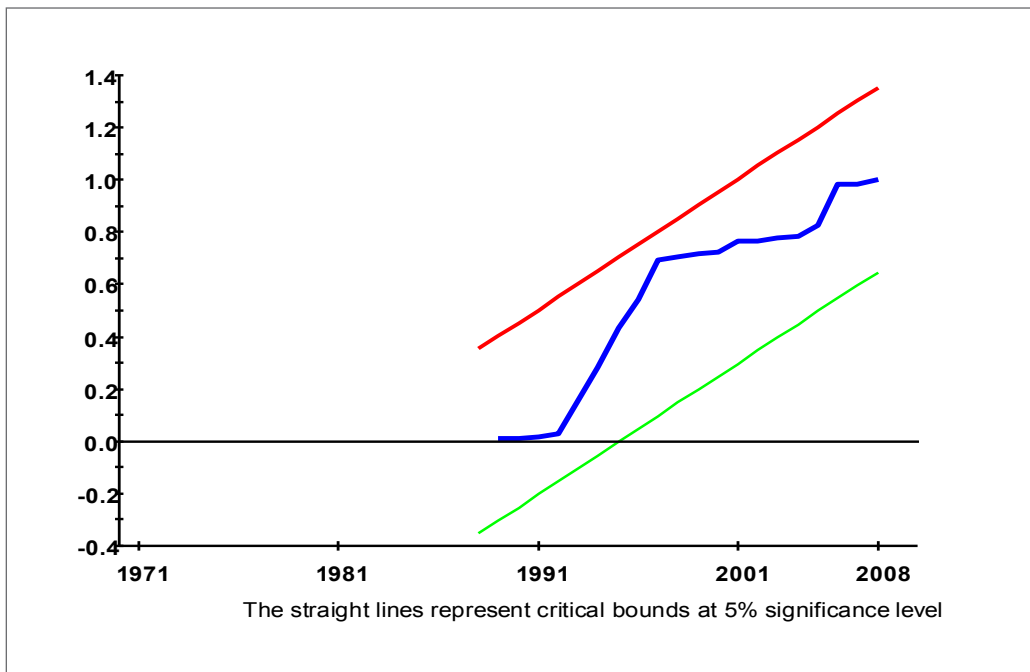


Figure 2. Economic Growth and Financial Reforms – Plot of CUSUMSQ for the coefficients of stability in the ECM model

## 5 Conclusion

The main objective of this paper was to empirically examine and investigate the impact of financial sector reforms on sustainable economic growth in Ghana. This paper employed the ARDL bounds testing approach, the unrestricted error correction model (UECM) and the co-integration analysis popularized by Pesaran, Shin and Smith (2001) to establish the long-run relationship between the relevant time series variables. It also applied a multi-dimensional financial sector reform index constructed from a number of financial liberalization policy measures implemented as a result of the financial sector reforms in Ghana. A proviso that should be taken into consideration is that it has been recognized by many economists that co-integration techniques may not be appropriate when the sample size is too small (Narayan and Smyth, 2005).

The unit root tests employed suggest that all the variables were found to be either I(0) or I(1) stationary. Additionally, all the dependent variables were found to be co-integrated with the independent variables. This means that long-run relationships between the variables of interest were established. The empirical findings show that the impact of financial sector reforms on economic growth in Ghana is positive but insignificant in the long run, as well as in the short run. The findings therefore do not lend support to the neo-classical theory that financial liberalization leads to economic growth. A similar conclusion was reached by Hye and Wizarat (2011) in the case of Pakistan. This paper, however, finds that the increase in capital stock leads to economic growth in Ghana. To this end, we recommend that future studies apply Bartlett's test for sphericity to the financial liberalization index and obtain its Kaiser-Mayer-Olkin (KMO) coefficient to see if they reach the same conclusion.

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