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Dynamic relation between macroeconomic variable, stock market returns and stock market development in Ghana

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Abstract

In recent times, the collapse of more than seven banks in Ghana and the raising of the minimum capital by the Central Bank of Ghana, have led to the argument that the stock market is the next best capital market for raising long terms funds. This study employs the ARDL cointegration approach to examine the long and short-term relationship between macroeconomic variables and stock market returns and development in Ghana. We found out that cointegration exist between the macroeconomic variables and stock market return and stock market development. The study revealed that log of the money supply, inflation rate and human capital has a negative impact on the stock market development whereas the log of foreign direct investment and interest rate has a positive impact on stock market development.

KEYWORDS

ARDL, co-integration, macroeconomic variables, stock market, unit root

1 | INTRODUCTION

Though debatable, stock markets have over the years been used as vehicles for mobilizing funds by private and public entities and are prominent indicators for predicting economic growth (Alshammary, 2014; Greenwood & Smith, 1997). Stock markets act as financial intermediaries and are important sources of capital and liquidity as they create a platform for a secondary market for the trading of listed securities (Kyereboah-Coleman & Agyire-Tettey, 2008; Yartey & Adjasi, 2007). As an integral part of the financial systems, stock markets play significant roles in the provision of finances for corporate entities in Africa. Mishkin (2007) pointed out that a well-functioning financial market is an important factor for promoting sustainable growth. The poorly performing financial markets is a sufficient justification for explaining why most developing countries have remained poor. In spite of this, developing countries, Ghana inclusive, have made important and giant strides towards establishing good and well-functioning financial markets. The development of the capital market has become the focus of governments, operators and market regulators for the mobilisation of long-term capital for businesses and government.

The financial sector of Ghana is dominated by universal banks, which have largely not been a reliable and dependable source of long-term financing. These universal banks are into the provision of short-term loans and are unable to supply long-term capital. In recent times, the collapse of more than seven banks (between 2017 and 2019) in Ghana and the raising of the minimum capital by the Central Bank of Ghana, have led to the argument that the stock market is the next best capital market for raising long terms funds. The establishment of the Ghana Stock Exchange (GSE) in 1990 was, therefore, seen as an important platform to help curb the issue of poor and lack of access to the long-term capital to private and public business entities in Ghana. Since its establishment, the GSE has witnessed lots of activities, with companies selling shares/stocks or planning to issue shares in the Ghanaian market. It is, therefore, not surprising that the GSE was adjudged one of the best performing stock

exchanges in the world in 2004 and had a year return of 144% in US dollar in that same year.

Numerous authors agree that sound macroeconomic situations are necessary and important determinants of stock market returns and development in emerging markets (Fink, Haiss, & Vuksic, 2009; Yartey & Adjasi, 2007). Others are of the view that macroeconomic variables are correlated with stock market returns and development (Naceur, Ghazouani, & Omran, 2007a; Kwon & Shin, 1999). The clarity of the direction of the correlation has been the subject of debate in the empirical literature. For instance, Acquah-Sam (2016) found that capital market development in Ghana is positively influenced by gross capital formation (GFI) and GDP growth, but negatively influenced by Treasury bill rates (T-BILLS) while inflation and foreign direct investments (FDI) did not have a significant impact on capital market development. Majid and Yusof (2009) found that real effective exchange rate (REER), money supply and treasury bill rate (TBR) are appropriate targets in order to stabilize the Islamic stock market. Stock market returns, inflation rate (InFR), real exchange rate, interest rates (InTRs), money supply and FDI display dissimilar paths based on factors, such as fluctuations in energy cost, financial crises, and shocks from heightened political activities. Relatively, the inconsistencies in the empirical researches has renewed the interest in researching the effect of macroeconomic variables and stock markets returns and development.

Clearly, stock market development and returns from the GSE are functions of the InFR, InTR, REER, industrial production (IPI), monetary policy, human capital (Hum) and FDI (Acquah-Sam, 2016; Kuwornu, 2012). From the foregoing, the main question asked in this article is: Do macroeconomic variables affect stock market returns and stock market development in Ghana? This article employs the autoregressive distributed lag (ARDL) approach to empirically estimate, the long-run relationship between macroeconomic variables and stock market returns and development using data on Ghana from 1992 to 2017. The error correction model is used to examine the short-run dynamics between macroeconomic variables and stock market returns and development.

This article adds to the existing empirical literature that examines the linkages between macroeconomic variables and stock market returns and development by first bringing to light the Ghanaian case. Thus, the study adds to the existing literature by presenting the empirical perspective of stock markets from an African and developing country context. This study is anticipated to have a direct effect on policymakers because the effect of macroeconomic variable on stock market and development may suggest amendments of macroeconomic policies to improve the health of capital market. Much of the similar empirical literature on the effect of macroeconomic variables and stock market returns have largely been inconclusive. Thus, investigating the relationship between macroeconomic factors and stock market returns and development, remains critical.

The next section presents the theoretical and empirical literature on the relationship stock market returns, stock market development and macroeconomic variables. Section 3 presents the data and methodology employed. Section 4 shows the empirical estimation for the macroeconomic variables and stock market returns and development in Ghana. Section 5 concludes the study.

2 | LITERATURE REVIEW

This section of the literature review is divided into two broad sections, that is, the empirical literature on the relationship between stock market return and macroeconomic variables and the relation between stock market development and macroeconomic variables in Ghana.

2.1 | Relationship between market returns and macroeconomic variables

Many studies have established the existence of the long-run relationship between macroeconomic variables and stock market returns and stock market development (Bekhet & Matar, 2013; Ozturk & Acaravci, 2011; Tian Gang & Ma, 2010). Thorbecke (1997) reported that expansionary money policy is associated with the recovery of the stock market since the prospect of returns increases. Supporting the earlier view of Thorbecke (1997), Ibrahim and Aziz (2003) posit that monetary policy (M2) has a positive effect on stock prices and returns. Tian Gang and Ma (2010) also argue that in China money supply and the exchange rate has a positive influence on stock price and returns. Contrary to both Ibrahim and Aziz (2003) and Thorbecke (1997), Patelis (1997) and Laopodis (2013) opined that an inverse relationship exists between stock market price and by extension stock market returns and monetary policy. According to Patelis (1997) and Laopodis (2013), the inverse relationship is best explained by the fact that monetary policy primarily raises the price of the assets, which decreases the expectation of stock returns and finally leads to a decline in the stock market.

Agenor (2000) reported that high inflation and real exchange rate are constraints to private sector investment and savings and these affect the allocation of resources on the stock exchange which finally affects the development and the performance of the stock market. With reference to InTR, the rising and fluctuating InTRs are generally associated with

declining stock market returns. Many studies have reported an inverse relationship between stock market returns and InTR (Bekhet & Matar, 2013; Chen, 2007; Jensen & Johnson, 1995). The reason for the negative relationship is because InTR serves as a restriction on monetary policy. A positive relationship has been established between stock prices and IPI (Maysami, Howe, & Hamzah, 2004).

Though, widely discussed in the empirical literature, there is very little consensus on the relationship between stock market and real exchange rate while inflation makes both lender and borrowers less eager to lend and borrow long-term financing from the capital market respectively. Sohail and Hussain (2009) observed a negative impact of consumer price index on stock returns, whereas, REER, IPI index, and money supply were identified to have a positive significant effect on stock returns in the long-run in the Lahore Stock Exchange in Pakistan.

Adam and Tweneboah (2008) concluded that InTR and inflation are significant determinants of stock market prices in the long-run, whereas in the short-run, inflation and exchange rates matter more in the Ghanaian stock exchange. Dasgupta (2012) from the Johansen and Juselius's co-integration test found that in the long run, the stock prices are positively related to InTR and IPI while inflation and the exchange rate are negatively related to Indian stock market return.

2.2 | Relationship between market development and macroeconomic variables

Empirical studies show that stock market development is significantly influenced by macroeconomic variables. Yartey (2010), for instance, using a panel data from 42 emerging countries spanning the period 1990 to 2004, reported that income level (GDP), capital flows (FDI), stock market liquidity and investment in the banking sector are vital indicators of stock market development. Vazakidis and Adamopoulos (2009) conducted a study in France to investigate the causal relationship between economic growth and stock market development using the VECM. Vazakidis and Adamopoulos (2009) found economic growth to be the cause of stock market development in France.

With reference to South Africa, Yartey (2008) investigated that determinants of stock market development. The empirical findings of Yartey (2008) were that gross domestic investment, bank credit to the private sector, GDP per capita, and stock market liquidity have a positive and significant effects on stock market development in South Africa. Naceur, Ghazouani, and Omran (2007b) also found that financial institutions, saving, inflation and stock market liquidity are essential determinants of stock market development. Using 17 countries in the Middle East and Central Asia, Billmeier and Massa (2007) investigated the macroeconomic determinants of stock market capitalization (MC). Contrary to other studies, Billmeier and Massa (2007) reported that good institutions and remittances contribute significantly to stock market development.

Earlier studies by Garcia and Liu (1999) opined that financial intermediary sector development, domestic investment, and GDP growth were the major factors determining stock market development among selected Latin America and Asian countries. Other variables influencing stock market development are real income, saving rate and stock market liquidity. Levine and Zervos (1998) showed that stock market development is positively and directly related to long-run economic growth.

3 | DATA, VARIABLES SELECTION, AND MODEL SPECIFICATION

3.1 | Description of data

This study used secondary data for the analysis. The data analysed in this study were made up of macroeconomic and stock market time series for the Ghanaian economy. The annual times series data used for this study span the period 1992–2017. The dataset utilised for this study was limited to 2017 because the year 2018 and 2019 witnessed the closing down of nine financial institution, some of which are listed on the GSE. Therefore, it was the view of the researchers that including 2018 and the early part of 2019 would not give the true reflection of the returns from the stock market. Additionally, getting access to daily and monthly data from the GSE was very difficult and almost impossible, hence, the focus on the annual data given by the GSE. The data used for this study were collected from the goods market, the money market, the labour market, the international financial market and the security and exchange market of Ghana. The stock index (GSEindex) and stock market development (MC was used as a proxy) data were gathered from the Ghana Stock Exchange whereas data on macroeconomic variables, such as, broad money supply (M2), FDI, Hum, IPI, InFR, InTR, REER were gotten from the Bank of Ghana, World Bank and the IMF databases. All variables gathered from the diverse sources were transformed into natural logarithms (ln).

The GSE All Share index was used in this study as a proxy for the returns of Ghana Stock Market. GSE All Share Index is utilised as a broad measure of market indicator to measure the overall performance of the stock market. This index is calculated by the Ghana Stock Exchange. Stock market development was also measured using MC as a proportion of GDP. In the context of this study, MC as a proportion of GDP measure equals the total market value

of listed shares divided by GDP. The choice of this measure of stock market development is because it is a less arbitrary measure of stock market development than any other measure (Pradhan, Arvin, Samadhan, & Taneja, 2013). The assumption underlying the Stock market development measure is that total market size is directly (positively) correlated with the capability to mobilize capital and diversify risk on an economywide basis. A high value of market capitalisation is an indication that either share prices have gone up or more shares are traded.

The 91-day Treasury bill (T-bill) yield was used as a proxy for InTR and the consumer price index was used as a proxy for inflation (FR). The IPI in this study was used as the proxy for the growth of the Ghanaian economy (economic growth). The IPI is widely used for assessing both the current state and the short-term outlook for GDP. An important reason for using IPI rather than GDP is because unlike GDP, IPI measures the value added by IPI, which represent a substantial share of GDP. FDI is measured as the net FDI inflows (liabilities in the balance of payments). Hum is computed as school accomplishment by the perpetual-inventory method. School accomplishment was aggregation of the estimated primary, secondary and tertiary level of education. Hum was used as proxy for Hum. Higher school attainment enhances human capacity, contributed to higher income. With such knowledge and income individuals can afford to invest in the stock market.

3.2 | Model specification

Two hypothesized model was specified for this study, that is, the GSIndex and the MC model. The hypothesized model estimated for the GSEIndex is specified as:

$$\begin{aligned}\ln GSE_t &= \propto_0 + \propto_1 \ln MS_t + \propto_2 \ln IPI_t \\ &+ \propto_3 \ln REER_t + \propto_4 \ln Hum_t + \propto_5 \ln INF_t \\ &+ \propto_6 \ln INTR_t, + \propto_7 \ln FDI_t + \varepsilon_t\end{aligned} \quad (1)$$

In addition, the model on MC is specified as follows:

$$\begin{aligned}\ln MC_t &= \beta_0 + \beta_1 \ln M2_t + \beta_2 \ln IPI_t + \beta_3 \ln REER_t \\ &+ \beta_4 \ln Hum_t + \beta_5 \ln INF_t + \beta_6 \ln INTR_t \\ &+ \beta_7 \ln FDI_t + \delta_t\end{aligned} \quad (2)$$

From both equations, $\propto_0$ and β_0 is the constant term of the GSEIndex and the MC model respectively. In addition, $\propto_1 ... \propto_7$ and $\beta_1 .... \beta_7$ are the coefficients of model 1 and model 2 respectively. The idiosyncratic error term for model 1 and model 2 are ε_t and $\delta_t$respectively. The idiosyncratic error terms are assumed to be identically and independently distributed.

4 | METHODOLOGY

The techniques adopted and considered in this study to examine the co-integration between macroeconomic variables and stock market index and development is the Autoregressive Distributed Lag (ARDL) model introduced by Pesaran, Shin, and Smith (2001). The choice of the ARDL is because unlike the Johansen–Juselius and Engle–Granger techniques, the ADRL is suitable for testing the cointegration among variables with a small sample size (Bekhet & Matar, 2013; Ozturk & Acaravci, 2011). The ARDL approach is appropriate regardless of the stationary properties of the variables in the samples. The ARDL allows inferences on long-run estimates and does not strictly demand that all variables in the model be stationary and have an equal order of integration (Bekhet & Matar, 2013). Thus, the ARDL is suitable regardless of the order of integration of the underlying variables($I(0)$ or $I(1)$), or are fractionally integrated. This implies that the ARDL is used once the absence of $I(2)$s are guaranteed (Bahmani-Oskooee & Bohl, 2000; Pesaran et al., 2001).

Since the variables used in this study have different optimal lags, the ARDL application was the most appropriate as it permits variables to have different optimal lags. This is not possible with the Johansen–Juselius cointegration procedures (Bekhet & Matar, 2013; Ozturk & Acaravci, 2011). There are several model selection criteria, but the Adjusted R^2 and Schwartz-Bayesian Criteria (SBC) was used in this article. The choice of the adjusted R^2 was because it is known for selecting the maximum relevant lag-length whereas SBC is a parsimonious model as it selects the smallest lag-length of the model.

To examine the bounds test of cointegration among variables used in the GSEIndex model in Equation (1), the ECM representation of the ARDL framework is employed and formulated for each variable Equation (3) as follows:

$$\begin{aligned}\Delta ln GSE_t &= \beta_{01} + \sum_{i=1}^{n1} \beta_{11} \Delta \ln GSE_{t-i} + \sum_{i=0}^{n2} \beta_{12} \Delta ln M2_{t-i} \\ &+ \sum_{i=1}^{n3} \beta_{13} \Delta IPI_{t-i} + \sum_{i=0}^{n4} \beta_{14} \Delta ln REER_{t-i} + \sum_{i=1}^{n5} \beta_{15} \Delta \ln Hum_{t-i} \\ &+ \sum_{i=0}^{n6} \beta_{16} \Delta ln InFR_{t-i} + \sum_{i=1}^{n7} \beta_{17} \Delta \ln InTR_{t-i} \\ &+ \sum_{i=0}^{n8} \beta_{18} \Delta ln FDI_{t-i} + \varphi_{11} ln GSE_{t-i} + \varphi_{12} ln M2_{t-i} \\ &+ \varphi_{13} ln IPI_{t-i} + \varphi_{14} ln REER_{t-i} + \varphi_{15} ln Hum_{t-i} \\ &+ \varphi_{16} ln InFR_{t-i} + \varphi_{17} ln InTR_{t-i} + \varphi_{18} \ln FDI_{t-i} + \mu_{t1}\end{aligned} \quad (3)$$

The ECM representation of the ARDL approach for MC in Equation (2) is presented in Equation (4) follows:

$$\begin{aligned}\Delta lnMC_t &= \beta_{01} + \sum_{i=1}^{n1}\beta_{11}\Delta \ln MC_{t-i} + \sum_{i=0}^{n2}\beta_{12}\Delta lnM2_{t-i} \\ &+ \sum_{i=1}^{n3}\beta_{13}\Delta IPI_{t-i} + \sum_{i=0}^{n4}\beta_{14}\Delta lnREER_{t-i} \\ &+ \sum_{i=1}^{n5}\beta_{15}\Delta \mathrm{Hum}_{t-i} + \sum_{i=0}^{n6}\beta_{16}\Delta lnInFR_{t-i} \\ &+ \sum_{i=1}^{n7}\beta_{17}\Delta \ln \mathrm{InTR}_{t-i} + \sum_{i=0}^{n8}\beta_{18}\Delta lnFDI_{t-i} \\ &+ \varphi_{11} ln\mathrm{MC}_{t-i} + \varphi_{12} ln\mathrm{M2}_{t-i} + \varphi_{13} ln\mathrm{IPI}_{t-i} \\ &+ \varphi_{14} ln\mathrm{REER}_{t-i} + \varphi_{15} ln\mathrm{Hum}_{t-i} + \varphi_{16} ln\mathrm{InFR}_{t-i} \\ &+ \varphi_{17} ln\mathrm{InTR}_{t-i} + \varphi_{18}\ln \mathrm{FDI}_{t-i} + \mu_{t1}\end{aligned} \tag{4}$$

Where all variables maintain their previous definitions, Δ is the first difference operator; β_{01} is the drift component, β_{11},..., β_{88} are the short-run coefficients, φ_{11},..., φ_{18} are the long-run coefficients, n_1,..., n_8 are the lag length, and μ_{t1},..., μ_{t1} are white noise error terms.

The succeeding step of the ARDL bounds test procedure is to test for a long-run relationship among the variables using an F-statistic. To begin with, the null hypothesis of Equations (3) and (4) is specified as

$$H_0 : \varphi_{11} = \varphi_{12} = \varphi_{13} = \varphi_{14} = \varphi_{15} = \varphi_{16} = \varphi_{17} = \varphi_{18}$$

This implies the nonexistence of the long-run relationship and an alternative hypothesis of the existence of a long-run relationship.

$$H_0 : \varphi_{11} \neq \varphi_{12} \neq \varphi_{13} \neq \varphi_{14} \neq \varphi_{15} \neq \varphi_{16} \neq \varphi_{17} \neq \varphi_{18}$$

The calculated F-statistics of no cointegration (null hypothesis) is compared with the critical value estimated by Pesaran et al. (2001) and tabulated by Narayan and Smyth (2005), which is decomposed into lower critical bounds ($I(0)$) and upper critical value bounds ($I(1)$). If the computed F-statistic exceeds the upper bound critical value, the null hypothesis of no cointegration is rejected independently of the order of integration of the series. Similarly, the decision rule is not to reject the null hypothesis if the test statistic falls below a lower bound but the result would be inconclusive if it falls inside the critical value band.

The selected ARDL and the ARDL ECMs models were estimated since cointegration was confirmed. Finally, the diagnostic and the stability tests are conducted to ascertain the goodness of fit of the selected ARDL model whereas the cumulative sum of recursive residuals (CUSUM) and the cumulative sum of squares of recursive residuals (CUSUMSQ) are employed to check the structural stability test.

5 | RESULTS AND DISCUSSIONS

The results of the time series unit root test performed to identify the nature of stationarity of the time series variables are presented in Table 1. The Augmented Dickey-Fuller (ADF) and Phillip-Perron (PP) unit root results for intercept and no trend suggest that lnMC, and lnFR were the only relevant variables stationary at levels, *I(0)*. Similar results were found when the unit root test was conducted with intercept and trend. This finding is consistent with authors like Bekhet and Matar (2013) and Kimani and Mutuku (2014), who have reported that macroeconomic variables are usually nonstationary at levels. However, after the first differences, each of these variables became stationary at order one, *I(1)*. Thus, we reject the null hypothesis that the variables are nonstationary, indicating stationarity of the variables at the first difference.

Since all variables are stationary at *I(1)*, it implies that shocks to the variables will have a temporal effect and the presence of mean reversion (economic implication) and also it would not produce spurious results when used for the regression (statistical implication). It was, therefore, appropriate to test whether the variables were co-integrated or not. The result of the bounds test for a co-integration test of the long-run relationships among the variables are presented in Table 2.

The cointegration test results presented in Table 2 shows that the macroeconomic variables are cointegrated over the period of analysis. We, therefore, proceeded to estimate the long-run growth effects of our measures of stock market development and stock market index.

The results of the long-run effects of macroeconomics on stock market returns and stock market development in Ghana are presented in Table 3. The results of the lnGSE model in Table 3, shows that the coefficients of InIPI, InFDI and InHum from the adjusted R-square and the SBC are significant at 1% level of significance whereas the coefficient of InTR is significant at the 5% level of significance. The negative relationship between stock performance and money supply is in similar to the findings of Frimpong (2009). The justification for this result is that an increase in money supply leads to an increase in InFR, which then leads to a fall in stock prices (Fama, 1981).

The positive long-run relationship between inflation and stock performance suggests that investors are compensated for inflation and will require higher returns to compensate for high inflation (Kuwornu, 2012). This implies that the GSE cannot be used as a hedge against inflation. This finding is in conformity with the findings of Owusu-Nantwi and Kuwornu (2012).

The positive relationship between FDI and stock returns shows that opening the GSE to nonresident

TABLE 1 Unit root results

		Intercept and no trend			Intercept and trend		
Variables	**Test perform**	**Level**	**1st diff**	**OI**	**Level**	**1st diff**	**OI**
lnMS	ADF	−2.601746	−3.57916**	I(1)	−1.49741	−4.19795**	I(1)
	PP	−5.996225***	−3.58493**	I(0)	−1.33992	−5.43356***	I(1)
lnFDI	ADF	−1.531148	−3.29146**	I(1)	−0.4443	−3.54643*	I(1)
	PP	−1.523748	−3.29146**	I(1)	−0.4443	−3.49125*	I(1)
lnMC	ADF	−3.080974**	−8.03019***	I(0)	−4.69458***	−7.7451***	I(0)
	PP	−3.072869**	−11.4906***	I(0)	−4.69458***	−11.0337***	I(0)
lnHum	ADF	−1.389249	−3.07983**	I(1)	−3.52346*	−3.20928	I(0)
	PP	−1.443298	−3.07983**	I(1)	−1.05937	−3.20928	
lnIPI	ADF	−1.374526	−3.3687**	I(1)	−2.70832	−3.46316*	I(1)
	PP	−1.979831	−4.58596***	I(1)	−1.82254	−4.94522***	I(1)
lnInFR	ADF	−2.784079*	−4.32067***	I(0)	−3.36284*	−4.24984**	I(0)
	PP	−2.784079*	−7.66601***	I(1)	−3.33517*	−8.11657***	I(0)
lnInTR	ADF	−1.518937	−4.06032***	I(1)	−2.97628	−3.90398**	I(1)
	PP	−1.665489	−3.76723***	I(1)	−2.27497	−3.63469**	I(1)
lnREER	ADF	−2.457616	−4.62383***	I(1)	−2.5543	−4.68785***	I(1)
	PP	−2.465629	−4.61516***	I(1)	−2.61571	−4.6828***	I(1)
GSEindex	ADF	−1.834985	−4.64853***	I(1)	−1.16178	−5.0625***	I(1)
	PP	−1.84347	−4.64794***	I(1)	−1.09618	−5.41186***	I(1)

Note: ***, **, and * denotes statistical significance at 1% level, 5% level and 10% level respectively.

TABLE 2 Results of bounds test for cointegration

				Critical bound		
	Model	**F-statistics**	**Significant level**	**Lower**	**Upper**	**Decision**
Adjusted R^2	lnGESindex	5.09***	1%	2.73	3.9	Co-integration
	lnMC	4.17***	5%	2.73	4.163	Co-integration
SIC	lnGSEindex	4.55**	5%	2.73	4.163	Co-integration
	lnMC	219.87***	1%	2.73	3.9	Co-integration

Note: The critical value bounds are from Table F in Pesaran and Pesaran (2009, p. 544), with an intercept and no trend. ***, and ** denotes significance levels at 1%, and 5% respectively.

Ghanaians and foreign investors permit investors to invest through the GSE without erstwhile support eased the listing of highly rated foreign-owned companies on the GSE (Adam & Tweneboah, 2008).

In model (2), almost all the proxy measures for stock market development estimated by the adjusted R^2 and SBC are statistically significant. The fact that the macroeconomic variables in the stock market return model (model 1) and the stock market development model (model 2) are cointegrated provide enough reasons for using the error correction model to investigate the short-run dynamics.

We, estimate the heteroscedasticity, normality, Durbin–Watson statistics (D-W) and serial correlation test to examine for any evidence of misspecification in the ARDL for model I and model II. The D-W suggests no problem of autocorrelation for both set of models and the test results for the heteroscedasticity, normality and serial correlation also show no evidence of heteroscedasticity, not normality and serial correlation respectively. The diagnostic test in Table 4, therefore, reveals that there is no evidence of misspecification in both sets of models.

The results of the short-term dynamics equilibrium relationship between model 1 and model II and their regressors are presented in Table 4. The negative significant level of CointEq(−1) in the short-run for model I and II confirm the existence of a long-term equilibrium

TABLE 3 Long-run coefficient estimates of stock market and stock market development

	Model 1		Model 2	
	Adjusted R^2	**SBC**	**Adjusted R^2**	**SBC**
Regressors	(1, 0, 1, 1, 1, 0, 1, 0)	(1, 0, 1, 0, 0, 0, 1, 0)	(1, 1, 0, 1, 1, 1, 1, 1)	(1, 1, 0, 0, 1, 1, 0, 0)
lnMS	−1.44(−1.35)	−0.84(−0.82)	−7.45***(−3.40)	−6.91***(−3.22)
lnMS(−1)			5.9854**(3.00)	5.48**(2.77)
lnIPI	−2.58**(−2.74)	−2.43**(−2.59)	0.83***(4.18)	0.64(0.52)
lnIPI(−1)	4.21***(4.27)	3.53***(3.83)		
lnREER	−2.01*(−2.03)	−2.36**(−2.37)	−5.64***(−3.62)	−6.23***(−4.42)
lnREER(−1)	−1.92(−1.67)		0.93***(4.61)	
lnInFR	0.26(0.79)	0.57**(2.16)	−0.87(−1.78)	−0.68(−1.59)
lnInFR (−1)	−0.27(−1.07)		1.26**(2.99)	0.96**(2.60)
lnInTR	0.86**(2.25)	0.36**(2.30)	0.64(0.94)	−0.24(−0.46)
lnInTR(−1)			−1.45**(−2.52)	−0.95(−1.71)
lnFDI	0.02(1.19)	0.01(0.47)	0.86***(29.13)	0.87***(32.26)
lnFDI(−1)	−0.76***(−4.63)	−0.75***(−4.49)	−0.70(−1.76)	
lnHum	5.95***(3.60)	5.58***(3.42)	−9.82**(−2.52)	−2.65(−1.47)
lnHum(−1)			11.07*(2.06)	
C	14.81***(3.37)	10.42***(2.96)	23.89***(3.88)	15.16**(3.25)
Adjusted R^2	0.94	0.93	0.99	0.99
Log-likelihood	19.34	16.68	13.04	8.30
F-statistic	29.76	33.40	165.24	186.82
Durbin-Watson	2.65	2.51	2.51	2.25
Mean depend. Var	3.08	3.08	8.78	8.78

Note: Figures in parentheses are the value of t-ratios; ***, ** and * denotes significance levels at 1%, 5% and 10% respectively.

TABLE 4 Short-run error correction representation of ARDL model (dependent variable: D[lnMC])

	Model 1		Model 2	
Regressors	**Adjusted R^2**	**SBC**	**Adjusted R^2**	**SBC**
D(lnMS)			−7.45*** (−6.90)	−6.91*** (−22.76)
D(IPI)	−2.58*** (−6.78)	−2.43*** (−6.12)		
D(lnREER)	−2.01*** (−3.84)		−5.64*** (−6.27)	
D(lnInFR)	0.26** (2.22)		−0.87*** (−4.68)	−0.68*** (−3.65)
D(lnInTR)			0.64** (2.05)	−0.24 (−0.74)
D(lnFDI)	0.02** (2.30)	0.01 (0.77)	0.86*** (56.44)	
D(lnHum)			−9.82*** (−5.53)	
CointEq(−1)*	−0.72** (−8.74)	−0.64*** (−8.02)	−0.17*** (−8.22)	−0.07*** (−56.54)
Heteroscedasticity $\chi^2(1)$	0.64		0.67	
Serial correlation $\chi^2(2)$	0.21		0.30	
D – W	2.13		2.93	
Normality	0.30		0.43	

Note: Figures in parentheses are the value of t-ratios; *, ** and *** denotes significance levels at 1%, 5% and 10% respectively.

relationship the macroeconomic variables (Bekhet & Matar, 2013; Narayan & Smyth, 2005). The speed of adjustment for correcting any disequilibrium is denoted by the size of the coefficient of CointEq(−1) (Pesaran & Pesaran, 2009). The results show that for model 1, the spend of adjustment for was 72% (adjusted R^2) and 64% (SBC). In model 2, 17% (adjusted R^2) and per cent (SBC) of the disequilibrium from the previous year can be brought back to long-term equilibrium in the present year.

In both sets of models (Table 4), the dependent and independent variables are log, hence, the results are interpreted as elasticities. The result of model 1, suggest that the coefficient of InIPI and InREER are positive and statistically significant whilst InInFR and InFDI are negative and statistically significant in the adjusted R^2. The elasticity coefficient in model 1 are 2.58 (InInIPI), 2.01 (InREER), 0.26 (InInFR) and 0.02 (InFDI). This means that a percentage increase in these macroeconomic variables causes the GSEIndex to fall by 2.58% and 2.01% in the cases of InIPI and InREER but increases the GSEIndex by 0.26% and 0.02% in the case of InInFR and InFDI. The findings also suggest in model 2, a percentage increase in InMS causes MC to fall by 7.45% (according to adjusted R2), and 6.91% (according to SBC) and a percentage increase in InInFR causes MC to fall by 0.87% (according to adjusted R2), and 0.68% (according to SBC). In addition, the results also indicate that a percentage increase InHum and InREER cause MC to decrease by 9.82% and 5.64% but a percentage increase InFDI, and

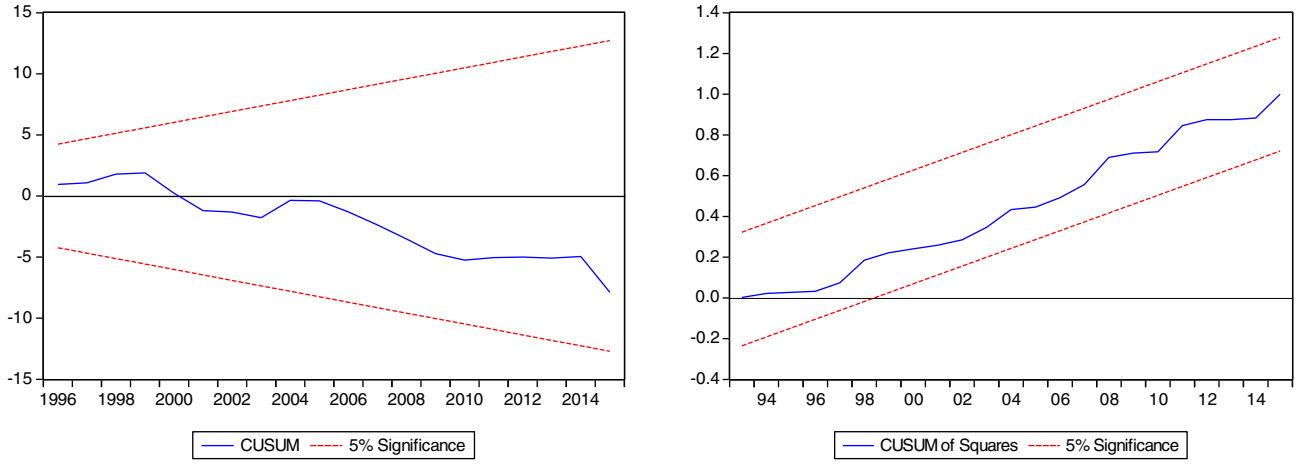

FIGURE 1 CUSUM and CUSUM of Square of Recursive Residuals of stock market returns [Colour figure can be viewed at wileyonlinelibrary.com]

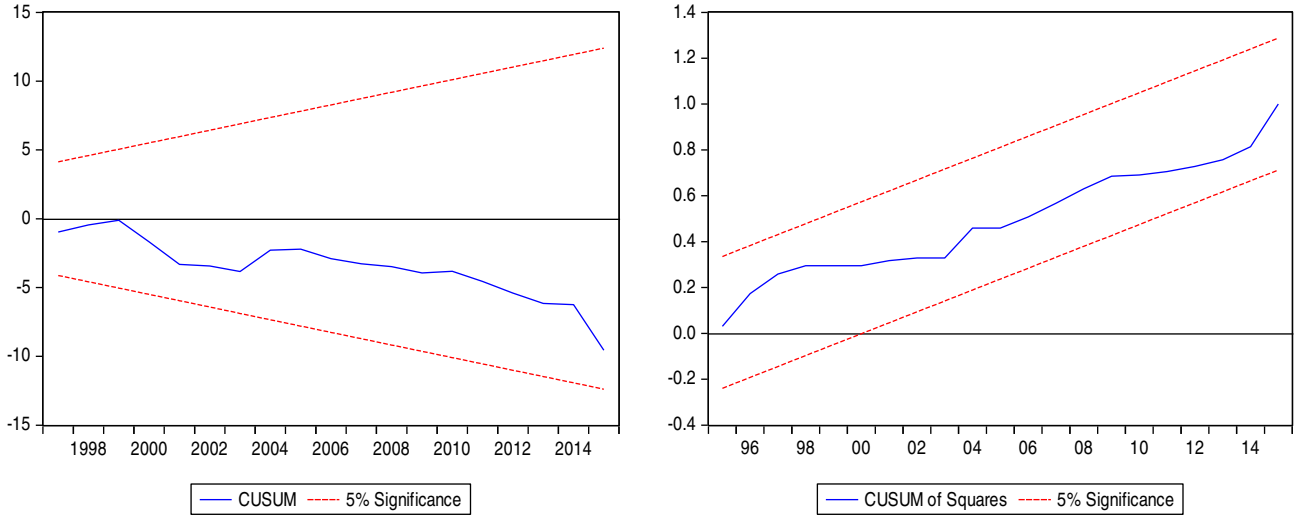

FIGURE 2 CUSUM and CUSUM of Square of Recursive Residuals of stock market development [Colour figure can be viewed at wileyonlinelibrary.com]

InInTR cause MC to increase by 0.86% and 0.64% respectively.

The cumulative sum of recursive residuals CUSUM and the cumulative sum of squares CUSUMQ were employed to check the ARDL model stability of the long-term coefficients with the short-term dynamics (Bahmani-Oskooee & Bohl, 2000; Pesaran et al., 2001) between the Ghana stock market returns and the Ghana stock market development and their causes. The rule of thumb is that if the plot of CUSUM and CUSUMSQ statistics stays within the two straight lines, then the null hypothesis cannot be rejected, implying that it stays within the 5% range of the significance level. By inspection, the CUSUM and CUSUMSQ graphs presented in Figure 1 and Figure 2 from the recursive estimation of both sets of models reveal that there is stability and no systematic change detected in the coefficients at 5% significant level over the sample period. Thus, both the CUSUM and CUSUMSQ of the coefficients of the error-correction model does not suggest any structural instability for both models tested.

6 | CONCLUSION

This study investigated the relationship between macroeconomic variables and GSEIndex and MC in Ghana using annual data from1992 to 2017 to test co-integration among the variables. The current article contributes to the knowledge in the empirical literature by employing the ARDL-bounds testing time series approach in examining co-integration among the goods market, the money market, the labour market, the international financial market and the security and exchange market variables in Ghana. The estimated results show robust evidence against the null hypotheses of unit roots in many of the series that was investigated. The results of the ARDL approach showed the existence of the long-term equilibrium relationship between macroeconomic variables and GSEIndex and MC. The stability tests using the CUSUM and CUSUMQ confirmed that the coefficients of the error-correction model are stable. The study shed more light on the relationship between the macroeconomic indicators and the stock market index and development.

The estimation of the long-term coefficients of the macroeconomic variables shows that the macroeconomic variables are very significant and important to the stock market returns and stock market development. The study revealed that log of the money supply, InFR and Hum has a negative impact on the stock market development whereas the log of FDI and InTR has a positive impact on stock market development. We found that money supply strongly influenced stock market development in the Ghanaian market. The CointEq(−1) coefficients have the expected negative sign and are highly significant indicating that the speed adjustment back from the short-term disequilibrium to the long-term equilibrium was between 72% (adjusted R^2) and 64% (SBC) in the case of stock market return and 17% (adjusted R^2) to 7% (SBC) in the case of stock market development. Therefore, it can be claimed that stock price variability is basically linked to economic variables, through changes in stock price that lags behind economic activities.

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