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Impact of Economic Growth, Foreign Direct Investment and Financial Development on Stock Prices in China: Empirical Evidence from Time Series Analysis

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ABSTRACT

The study aims to empirically examine the dynamic relationship between gross domestic product (GDP), stock prices, Foreign direct investment (FDI) and domestic credit to the private sector for China by using the autoregressive distributed lag (ARDL) approach for the period 1999Q1:2015Q1. The study confirmed the long-run cointegration among the variables. The empirical results revealed that stock prices and the associated regressors are in a long-term equilibrium relationship; stock prices converge to the long-run equilibrium position by 18.6% speed of adjustment via channel of GDP, stock price, FDI, and domestic credit to the private sector. The findings of the study further revealed that FDI has a positive impact on stock prices in the long-run, while financial development has a negative effect. The robustness of the ARDL bounds test of cointegration was examined by using Johansen and Juselius's (1990) maximum likelihood cointegration approach. Finally, the results of Granger causality under the framework of vector error correction models showed a unidirectional short-run Granger causality that runs from stock prices to economic growth and from economic growth to FDI, specifying the absence of the FDI-led growth hypothesis. Likewise, a bi-directional causality has been found between financial development and stock prices.

Keywords: Stock Price, Autoregressive Distributed Lag, Cointegration, Granger Causality
JEL Classifications: C22, G10, B26

1. INTRODUCTION

A stock market can play a vital role in the economy of any country, which attracts the attention of finance experts, economist and the policy makers because of the perceived benefits that it provides to the economy. It is considered to be at the core of capital market activities and is an indicator of the business direction. It plays an intermediary role that mobilizes the savings of the economic units to accelerate and improve the growth and efficiency of an economy. In other words, it acts as the central part of an economy by facilitating the transfer of funds to achieve economic goals. In order to attain sustainable economic growth and development, the funds must be efficiently and effectively utilized in such a way to achieve the desired optimal output. Another important characteristic of stock market development, which influences economic growth, is risk diversification. Obstfeld (1994) argued that international risk could be diversified through internationally integrated stock markets that affectively enhance the allocation of resources in a more productive way and ultimately achieve economic growth. By facing the liquidity crises, the investor can realize an improved pay off by selling their shares to another agent. Various studies have proved the relationship between stock markets and economic development. A stock market can influence economic growth positively. This growth can be increased by raising the proportion of resources that are allocated to the economic entities and firms. The productivity risk can be minimized by the use of diversification and even the most risk averse investor can be encouraged to invest in different firms. Furthermore, an efficient stock market may induce investment opportunities by identifying investment worthy projects that may ultimately promote economic activity, minimize and diversify risk to the greatest extent and expedite the exchange of goods and services (Mishkin, 2001; Caporale et al., 2004). The stock market causes an increase in economic growth by increasing the liquidity of the financial assets, encouraging and promoting investment, and diversifying the global and domestic risk that increases the value of shareholders and in turn influences corporate governance. The stock markets also help in explaining future economic activity and describing the actual cause and affect between the future economic growth and the stock prices. Finally, the stock markets play a key role in managing corporate control mechanisms.

The economic performances of corporations are usually reflected by their stock prices and corporate managers try to increase the shareholder wealth. In fact, the relationship between stock prices, financial development, Foreign direct investment (FDI) and economic growth is deficient in terms of literature and very few studies are available which demonstrate a relationship between them. The motivation for selecting China for this study was that it remains one of the fastest growing nations with growth rates surpassing 4% due to its sound financial market, which is able to harness the desired liquidity needed to bolster economic growth. Others contend that it is capital accumulation or investment-based growth that is causing such a growth in economic performance (Acemoglu and Aghion, 2009). According to a study carried out by Rouseau and Wachtel (2000), a stock market crash is usually associated with a fall in performance in the banking sector. This is, however, contrary to the economic analysis and statistics for China, which show that, after the stock market crash of 2009, banks continued to post increases in profits. This is supported by Levine and Zervos (1998), who outlined that when liquidity in the banking sector is high, the effect of a stock market crash can be minimized and this will have an insignificant effect on economic growth. Greenwood and Jovanovic, 1989 argued that high liquidity in the banking sector further heightens the crash as speculators seek to profit from it. This is also in line with a study performed by Gale (1999), which showed that a stock market crash negatively influences economic growth. There is no consensus as to how exactly the stock market influences economic growth and financial development.

This study aims to derive a linkage between stock prices, FDI, domestic credit to the private sector and economic growth by using the autoregressive distributed lag (ARDL) Bounds testing approach, Johansen and Juselius (1990) maximum likelihood estimation and the vector error correction model (VECM) to analyze the causality. The rest of the study is organized as follows: Section 2 deliberates the literature review; Section 3 discusses the econometric methodology; Section 4 presents the results and discussion and Section 5 concludes the paper.

2. LITERATURE REVIEW

Levine and Zervos (1998) considered the practical relationship between stock market developments, investment developments and economic growth. Their study findings indicated that bank development and stock market liquidity are significantly related to long-run economic growth. The results further revealed that there is a difference between the type of financial services that are provided by banks and those that are provided by stock markets. Diamond and Dybvig (1984) and Williamson (1986) established models where agents and financial intermediaries would lower information costs about firms. King and Levine (1993) applied these models and found that by lowering information costs, financial institutions can promote an efficient allocation of resources, thereby enhancing technological innovation and long-run growth.

Rioja and Valev (2009) undertook a study on how stock markets and banks are affected by economic growth and generation of capital. They used the generalized method of moments (GMM) model to analyze country panel statistics from the period 1976 to 2004. The results revealed that banks had an effect on capital growth while stock markets had an effect on productivity. Their study further revealed that in countries with minimum income, credit in banks is the main source of economic growth and that stock markets do not significantly influence either productivity growth or capital accumulation. The results, however, showed that in high-income countries, stock markets and banks do independently effect capital development while productivity is positively related to stock market financing.

Ang (2009) investigated the impact of foreign direct investment and financial development on economic growth by using time series data from 1970 to 2004. The empirical results of their study suggested a positive impact of economic growth and negative impact of foreign direct investment on economic growth in the long-run.

Naceur and Ghazouni (2006) examined the correlation of stock markets, banks, and economic growth in the MENA region. GMM estimators were used to estimate the panel's model. The findings showed no significant correlation between stock markets, banks and economic growth. When controlled for stock market development, the results further showed that there is an inverse association between economic growth and bank development.

Aretis et al. (2001) carried out research on five developed economies and assessed the relationship between stock market development and economic growth utilizing Granger Causality and cointegration techniques. Their research used quarterly time series data and controlled the effects of market volatility and banking systems. For Germany, the results showed that there is a negative correlation between economic growth and banking development. Meanwhile, the results for Japan also showed a negative association between economic growth, banking development and the stock market. The study further exhibited that banking development and stock market combined contribute to economic growth, where banking development had a significant contribution to real gross domestic product (GDP) compared to the stock market.

In another study conducted by Capasso (2006), the author examined 24 innovative OECD countries and used a VEC model to investigate the connection between stock market development and economic growth. The findings showed a significant positive relationship between stock market developments and economic growth. It was also deduced from their study that the size of the economy and the amount of capital accumulation have an important bearing on the emergence and improvement of the stock market.

Dritsaki and Melina (2005) employed a trivariate VAR model to analyze the relationship between stock and credit markets with economic growth in Greece. Using monthly time series data, their study produced results supporting a positive causality between stock market and economic development, and a negative causality between banking improvement and economic growth.

Zang and Kim (2007) used panel data to analyze the nature of the connection between financial development and economic growth. Their study also utilized the Sims-Geweke test to search for causality and the results revealed that financial growth emanates from economic growth. In their study, they undertook a sensitivity analysis to regulate the soundness of their results and the results still showed that economic growth leads to financial development, which was unlike the results of the study performed by Levine et al. (2000).

King and Levine (1993) examined 18 countries using time series information from 1986 to 1992. They used market capitalization, number of stocks listed, stock value traded and stock turnover as variables. The study used correlation to rank the variables according to economic growth and development measure. A similar study was conducted by Demirguc-Kent and Levine (1996), who analyzed 18 countries utilizing the correlation rank technique. The findings indicated that a progressive correlation exists between stock market developments and economic growth.

Greenwood et al. (1997) examined the linkage between financial development and economic growth in Islamic countries. The study covered the period 1980-2005 and used the VAR method to examine the linkage between financial development and economic growth. The results showed that there is a positive association between economic growth and financial growth. The Granger causality test showed that the linkage stems from economic development to financial growth.

Tursoy and Faisal (2016) conducted a study to find an empirical relationship between GDP and stock price in Turkey by using quarterly data. They employed the ARDL model and the causality direction was investigated by using error correction term (ECM). Their findings suggests a bidirectional long-run and joint short-run and long-run causality. Furthermore, a unidirectional causality was found that runs from GDP to stock price.

Calderon and Liu (2002) used a standard regression method to study the relationship between stock markets and economic growth. A total of 109 countries were analyzed, which included both developed and developing countries. The results showed evidence of a bidirectional effect between stock markets and economic growth. A similar study was undertaken by Luintel and Khan (1999) but took a different approach and used a sample of 10 countries. The findings strongly supported the study by Calderon and Liu (2002) and concluded by establishing that a bidirectional causality exists between stock market and economic growth.

Rousseau and Wachtel (2000) undertook a study based on the USA, Canada, UK, Sweden and Norway using annual data from the period 1871-1929. The VEC model and Granger causality test were employed. The variables used were GDP, ratio of corporate stocks to corporate bonds and the size of the financial institutions. The results showed confirmation of a positive association between economic development and financial growth.

Other studies used the VEC model to analyze the linkage between stock markets, banks and economic development. For instance, Bassanini et al. (2001) analyzed 21 OECD countries for the period 1971-1998. Domestic credit to the private sector, market capitalization and liquid liabilities were used as variables. The findings of the study indicated that all the variables were positively and significantly related to economic growth. This finding supports the results of the study conducted by Ndikumana (2000) who analyzed 19 OECD countries using the same variables from the period 1970 to 1997. They concluded that stock markets and banks have a significant impact on economic growth. This is contrary to the study by Shan et al. (2001) who used time series data to analyze the linkages amongst stock markets, banks and economic growth for nine OECD countries and the results showed an adverse correlation between stock markets, banks and economic growth. This study is important to analyze the linkage between FDI, economic growth, stock price and financial development, as the relevant literature is deficient in this respect.

3. ESTIMATION METHODOLOGY

3.1. Data and Model Specification

The multivariate framework includes GDP in constant US dollars, domestic credit to the public sector as a percentage of GDP, FDI and stock market indices from the 1st quarter of 1999 to the 1st Quarter of 2015. The data has been collected from the Economic Research, Federal Reserve Bank of St. Louis[1] database. According to the empirical literature discussed in the literature review, we use stock prices, GDP, domestic credit to the private sector (which is used as proxy to measure the financial development) and FDI to identify the relationship between these variables. The long-run relationship can be expressed in the form of an econometric model using the log-log form to lessen the effect of heteroscedasticity, if it exists.

$$LSP_t = f(\beta_0 + \beta_1 LGDP_t + \beta_2 LDCPS_t + \beta_3 LFDI_t + \varepsilon_t) \tag{1}$$

The expected sign for β_1 is positive. The expected sign for β_2 is negative and the expected sign for β_3 is positive, as documented in the literature.

3.2. Unit Root

The selection of the most appropriate unit root test is very difficult in practice. To improve the robustness of the selected variables, several unit root tests exist, such as the Philips-Perron (PP) and augmented Dickey fuller tests. Enders (1995) recommended the use of both unit root tests.

1 https://research.stlouisfed.org/.

3.3. Bounds Test of Cointegration

The methodology used in this article is based on the ARDL bounds testing approach, developed by Pesaran et al. (2001). The ARDL bounds test can be performed by using the F-statistics or Wald test to check the significance of the lagged coefficient of variables.

The ARDL bounds test can be performed in three steps. The long-run cointegration is estimated among the variables in the first step. The F-test can be used to check the long-run cointegration among the estimated variables in the model. A joint significance test can be carried out by using the Wald test in which the lagged coefficients are equal to zero (Tang, 2003). The Wald test or the joint test of significance is used in cases where there are more than one lagged coefficients. The F-test or Wald test is utilized to determine the long-run relationship by comparing with the critical values given by Pesaran et al. (2001).

$$\Delta lnSP_t = \beta_0 + \sum_{i=1}^{n1}\beta_{1i}\Delta lnSP_{t-i} + \sum_{i=1}^{n2}\beta_{2i}\Delta lnGDP_{t-i} + \sum_{i=1}^{n3}\beta_{3i}\Delta lnFDI_{t-i} + \sum_{i=1}^{n4}\beta_{4i}\Delta lnDCPS_{t-i} + \lambda_1 lnSP_{t-1} + \lambda_2 lnGDP_{t-1} + \lambda_3 lnFDI_{t-1} + \lambda_4 lnDCPS_{t-1} + \upsilon t, \quad (2)$$

Where υ is an error term and Δ shows the first difference. SP is the stock price, GDP is the gross domestic product, FDI is foreign direct investment, and DCPS is domestic credit to the private sector.

The Wald test of joint significance is performed and the calculated F-statistics value is compared with both the upper and lower bounds critical values by Pesaran et al. (2001) at (1%, 5%, 10%) significance level. The tabulated Pesaran et al. (2001) presents values whether the model contains intercept and/or a trend or restricted intercept. The tabulated critical value consists of both upper and lower bounds values, comprising all the possible categorizations of the variables into $I(0)$, $I(1)$ or mutually cointegrated. If the value of the estimated F-statistics is higher than both the upper and lower bounds critical values, then it rejects the null hypothesis of no cointegration, implying that there is cointegration among the estimated variables in the model. If the estimated F-statistics value lies between the lower and upper bounds of the critical values, then the decision is inconclusive. If the F-statistics value falls below the lower bound value, this implies that the variables in the estimated model are not cointegrated.

The next step is to determine a long-run relationship among the variables. Then, the long-run elasticity and their coefficients are determined in the following step. The ARDL approach allows us to estimate simultaneously the short-run and the long-run effects of one variable over the other.

$$ln(SP)_t = \propto_1 + \sum_{i=1}^{p}\varnothing 1_i ln(GDP)_{t-i} + \sum_{i=1}^{p}\beta 1_i lnFDI + \sum_{i=1}^{p}\gamma 1_i ln(DCPS)_{t-i} + \mu_t \quad (3)$$

The long-run elasticities can be estimated by using Equation 3. From Equation 4, the short-run elasticities are estimated. The difference coefficients of variables represents the short-run elasticity. The confirmation of the long-run relationship among the estimated variable implies that an error correction representation exists. The signs of the error correction coefficients must be negative and significant, and the coefficient value should be between zero and one, showing the convergence of the dynamics to the long-run equilibrium after a short-run shock.

$$\Delta lnSP_t = \gamma_0 + \sum_{i=1}^{p1}\gamma_{1i}\Delta lnSP_{t-i} + \sum_{i=1}^{p2}\gamma_{2i}\Delta lnGDP_{t-i} + \sum_{i=1}^{p3}\gamma_{3i}\Delta lnFDI_{t-i} + \sum_{i=1}^{p4}\gamma_{4i}\Delta lnDCPS_{t-i} + \varphi EC_{t-1} + \vartheta t, \quad (4)$$

Where ECM_{t-1} is the error correction term defined as:

$$ECM_t = \ln(SP)_t - \propto_1 - \sum_{i=1}^{p}\varnothing 1_i ln(SP)_{t-i} - \sum_{i=1}^{p}\beta 1_i ln(GDP)_{t-i} - \sum_{i=1}^{p}\gamma 1_i ln(FDI)_{t-i} - \sum_{i=1}^{p}\gamma 1_i ln(DCPS)_{t-i} \quad (5)$$

Where ϑ is an error term and φ represents the speed of adjustment.

When there is more than one coefficient of the short-run elasticity of a particular variable, then the Wald test is used to check their joint significance. To determine the best fit of the ARDL model, various diagnostics and model stability tests are performed. The diagnostics tests examine serial correlation, heteroscedasticity, Jarque-Bera normality and the correlogram of residuals to find the presence of autocorrelation at all lags. The structural stability of the model is evaluated by performing the Ramsey RESET test and CUSUM test proposed by Brown et al. (1975).

The robustness of the ARDL test is conducted by using Johansen and Juselius's (1990) maximum likelihood cointegration approach. The assessment of cointegration by using Johansen and Juselius can be performed by analyzing the trace statistics and maximum Eigen statistics. In their study, Cheung and Lai (1993) suggested that trace statistics is more powerful and robust as compared to maximum Eigen statistics. There should be at least one cointegrating vector that specifies the long-run relationship among the estimated variables in the model. The critical values are obtained from Osterwald-Lenum (1992) for the Johansen cointegration test.

3.4. Granger Causality Test

In his study, Granger (1988) suggested that, if there is evidence of cointegration among the estimated variables, then there should be either a one-way or bidirectional causality. Granger causality is determined under the framework of VECM including the ECM using the first difference of the estimated variables to capture the dynamics of the models. The coefficient of the ECT should be negative and in between 0 and 1, which implies the convergence of the system back to the equilibrium. In this case, the error correction system can be written as:

$$\Delta LSP = \delta_0 + \sum_{i=1}^{p}\lambda_{1i}\Delta LSP_{t-1} + \sum_{i=1}^{q}\lambda_{1i}\Delta LGDP_{t-1} + \sum_{i=1}^{r}\lambda_{1i}\Delta LDCPS_{t-1} + \sum_{i=1}^{s}\lambda_{1i}\Delta LFDI_{t-1} + \varphi_1 ECT_{t-1} + e_{1t}, \tag{6}$$

$$\Delta LGDP = \delta_0 + \sum_{i=1}^{q}\lambda_{1i}\Delta LGDP_{t-1} + \sum_{i=1}^{p}\lambda_{1i}\Delta LSP_{t-1} + \sum_{i=1}^{r}\lambda_{1i}\Delta LDCPS_{t-1} + \sum_{i=1}^{s}\lambda_{1i}\Delta LFDI_{t-1} + \varphi_2 ECT_{t-1} + e_{2t}, \tag{7}$$

$$\Delta LDCPS = \delta_0 + \sum_{i=1}^{r}\lambda_{1i}\Delta LDCPS_{t-1} + \sum_{i=1}^{q}\lambda_{1i}\Delta LGDP_{t-1} + \sum_{i=1}^{s}\lambda_{1i}\Delta LFDI_{t-1} + \sum_{i=1}^{p}\lambda_{1i}\Delta LSP_{t-1} + \varphi_3 ECT_{t-1} + e_{3t}, \tag{8}$$

$$\Delta LFDI = \delta_0 + \sum_{i=1}^{s}\lambda_{1i}\Delta FDI_{t-1} + \sum_{i=1}^{q}\lambda_{1i}\Delta LGDP_{t-1} + \sum_{i=1}^{r}\lambda_{1i}\Delta LDCPS_{t-1} + \sum_{i=1}^{p}\lambda_{1i}\Delta LSP_{t-1} + \varphi_4 ECT_{t-1} + e_{4t} \tag{9}$$

By using the above four equations, Granger causality can be estimated with the first difference in three different ways. (1) Asafu-Adjaye (2000) suggested that short-run or weak Granger causality can be determined by using the F-statistics or the sum of lagged coefficient equal to zero, (2) Another long-run causality was identified by Masih and Masih (1996) showing that ECT can be determined by using the significance of the T-statistics. The coefficient of ECT should be between 0 and 1 with a negative sign and statistically significant, (3) Asafu-Adjaye (2000) indicated the joint test or strong causality of both the short-run and long-run causal relationships, where the variables in the system reorganize themselves in the short-run to re-establish a long-run relationship following a short-run shock.

4. EMPIRICAL RESULTS AND ANALYSIS

4.1. Unit Root Test for Stationarity

It is not important to determine the order of integration in the ARDL model, as it is more flexible in terms of integration order. The ARDL model can be applied regardless of the integration order, but it must be ensured that none of the variables in a series is $I(2)$ and the dependent variable should be $I(1)$. In order to determine the correct order of integration, the selection of the unit root test to be applied is more complex. Enders (1995) recommended the use of both unit root tests, i.e., the PP test (1988) and the augmented Dickey fuller test (1981). The robustness of the augmented Dickey Fuller test is determined by the PP test.

Tables 1 and 2 show the results of the unit root tests for both ADF and PP, respectively. It is evident that the series contains a unit root that is non-stationarity at level but becomes stationary by taking the first difference. This means that the series identified in the equation are integrated of order 1, $I(1)$. The next step is to estimate the long-run cointegration by using the F-Statistics value in Equation 2. Table 3 shows the results of the F-Statistics along with the critical values obtained from Pesaran et al., 2001. The second row shows the optimum lag selection based on the Akaike information criterion (AIC) criterion. The Bounds test is estimated by using unrestricted intercept and no trend.

It can be seen from Table 3 that the estimated F-statistics value is more than both the upper and lower bounds critical values, even at 1%. This suggests strong evidence of cointegration among the estimated variables in the series. This implies that stock price, FDI, GDP, and DCPS, are cointegrated in the long-run and are moving together, following a random path. After the confirmation of cointegration, the long-run ARDL model can be estimated by using Equation 3.

Table 4 shows the results of the long-run ARDL model with the error correction. The elasticity of GDP is negative but it is statistically insignificant in explaining the change in the stock price. However, the negative sign of stock price with GDP was evident in the study by Morck et al. (2000), whereas the elasticity of *LFDI* is 8.2247, which is elastic and statistically significant at 1%. This suggests that if *LFDI* increases by 1%, then it will cause the stock price to increase by 8.22%. The sign of the FDI is positive as expected and in concordance with the studies conducted by Adam and Tweneboah (2009) and (Adam and Tweneboah, 2008) for Ghana. Interestingly, the elasticity of domestic credit to the private sector (*LDCPS*) is negative, elastic and statistically significant as well. This means that if financial development (*LDCPS*) increases by 1%, it will cause the stock price to decrease by 1%. The sign of domestic credit to private sector is negative, which is in concordance with the findings of the study conducted by Sukruoglu and Nalin (2014). The coefficient of the ECM is −0.18, which is negative and

Table 1: Augmented Dickey Fuller unit root test results for stationarity of variables

Country (sample period)	ADF		ADF	
China (1999Q1-2015Q1)	Level		First difference	
	Intercept	Intercept and trend	Intercept	Intercept and trend
LSP	−2.2870 (1)	−2.9688 (1)	−4.6631*** (0)	−4.6215*** (0)
LGDP	−1.5973 (1)	−1.4583 (1)	−13.023*** (0)	−13.0376*** (0)
LDCPS	−0.2667 (1)	−3.1697* (1)	−7.1027*** (0)	−7.0048*** (0)
LFDI	−1.5955 (0)	−0.3256 (0)	−6.2967*** (0)	−6.4388*** (0)

EViews 9 has been used for performing the unit root tests, the augmented Dickey Fuller unit root test was performed both at level and first difference (intercept, and both the trend and intercept), the figure in the parenthesis shows the lags used (SIC). *,***Represents significant at 10%, and 1%

Figure 1: (a and b) Plots of cumulative sum of recursive residuals and plot of cumulative sum of squares of recursive residuals using Equation 1

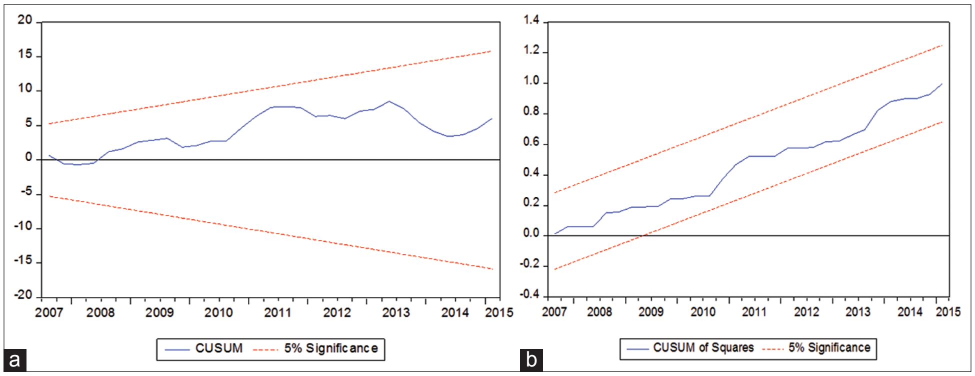

Table 2: Philips Perron unit root test results for stationarity of variables

Country (sample period)	PP		PP	
China (1999Q1-2015Q1)	Level		First difference	
	Intercept	Intercept and trend	Intercept	Intercept and trend
LSP	−2.3313 (3)	−2.4247 (3)	−4.6631*** (0)	−4.6215*** (0)
LGDP	−2.2344 (11)	−2.6576 (1)	−13.7590***(6)	−15.0753*** (9)
LDCPS	−0.9063 (0)	−2.8673 (2)	−7.1171*** (2)	−7.0235*** (2)
LFDI	−1.3431 (4)	−0.7794 (4)	−6.3709*** (3)	−6.4993*** (3)

EViews 9 has been used for performing the unit root tests with Newey-West using Bartlett kernel, the Phillips-Perron unit root test was performed both at level and first difference (intercept, and both the trend and intercept), the figure in the parenthesis shows the lags used. ***Represents significant at 1%

Table 3: Results of bound test of co-integration

Estimated model	F_{LSP} (*LSP/LGDP, LFDI, LDCPS*)			
Optimal lag length (AIC)		(1, 5, 9, 6)		
F-statistics (bound test)[2]		6.2452*		
Critical values	1%	2.5%	5%	10%
Lower bounds *I* (0)	4.29	3.69	3.23	2.72
Upper bounds *I* (1)	5.61	4.89	4.35	3.77
R^2	0.737			
Adjusted R^2	0.534			
F-statistics	3.6279***			

* and ***Represents significance level at 1%, and 10% level, respectively. The AIC criterion is used to determine the optimal lag. The critical values are determined from Pesaran et al., 2001. AIC: Akaike information criterion

Table 4: ARDL long-run results with ECM

Dependent variable: LSP			
Long-run results			
Variable	Coefficient	Standard error	t-statistics
LGDP	−0.3193	0.3074	−1.0385
LFDI	8.2247	3.2525	2.5287*
LDCPS	−17.3302	7.2301	−2.3969**
ECT_{t-1}	−0.1860	0.0355	−5.2343*
R^2	0.964	S.E of regression	0.0928
Adjusted R^2	0.937	Sum squared resid	0.2675
F-statistics	7.6710*	DW	1.29

*,**Represents significance level at 1%, 5% level respectively. ARDL: Autoregressive distributed lag, ECM: Error correction term

statistically significant at 1% confidence level. This implies that any deviation from the long-run equilibrium is corrected by 18% for each period, and it will take approximately six periods to converge the dynamics back to the equilibrium after a short-run shock. The negative sign of the ECM shows the convergence of the system back to the long-run equilibrium, which implies the stability of the system. The diagnostic tests of the long-run ARDL model have been presented in Table 5. The estimations have no problem of heteroscedasticity and serial correlation, while the residuals are normally distributed as demonstrated by Jarque-Bera and the corresponding P-values.

The correlogram of residuals are white noise showing no problems of serial correlation at any lag. The stability of the model was checked by using Ramsey RESET test and CUSUM. The CUSUM tests results are reported in Figure 1. Figure 1 showed that both the CUSUM and CUSUM of squares tests lies within 5% significance level, implying the stability of the estimated model that can be used for policy implications.

The robustness of the ARDL bounds test of cointegration was examined by using Johansen and Juselius's (1990) maximum likelihood cointegration approach. The results of Johansen and Juselius's (1990) cointegration have been shown in Table 6. The results show that trace statistics and maximum Eigen statistics are greater than the critical values at 5%, suggesting that the estimated variables

Table 5: Diagnostic tests (long-run)

Diagnostic test	SC (F-statistics probability)	HC (F-statistics probability)	Normality Jarque- Bera (probability)	AR (F-statistics probability)	Ramsey reset test (F-statistics probability)
China	2.7441 (0.0810)	0.6973 (0.8167)	0.4111 (0.8141)	0.0809 (0.7771)	0.2670 (0.6091)

SC, HC, normality, AR, are the lagrange multiplier values for serial correlation. The Breusch-Pagan Godfrey test for heteroscedasticity, normality, and arch tests for heteroscedasticity are based on the regression of squared residuals on squared fitted values, respectively. The numbers in the brackets are the corresponding P values

Table 6: Johansen and Juselius's maximum likelihood cointegration results (intercept and no trend)

Hypothesized number of cointegrating vectors	H_0	[a]Trace statistics	Critical values		Max Eigen	Critical values	
			5%	1%		5%	1%
None	R=0	51.71*	47.21	54.46	28.73*	27.07	32.24
At most one	R≤1	22.98	29.68	35.65	16.82	20.97	25.52
Normalized cointegrating equation: LSP=24.19+0.0222LGDP+1.9701LFDI−3.4807LDCPS							
			(0.1967) [−0.1130]		(0.5933) [−3.3202]	(1.1056) [3.1480]	

[a]The test statistics is the $\lambda_{maximum}$ value. *Show the significance at 5% level. The lag length was selected by using AIC. The autocorrelation LM tests was performed and found the absence of serial correlation problem. The value in the parenthesis, and square bracket represents the standard error for coefficients and T-statistics values respectively. The Critical values are obtained from Osterwald-Lenum (1992) for Johansen cointegration test

in the series are cointegrated. The Johansen and Juselius's (1990) maximum likelihood cointegration corroborates the results obtained from the ARDL model. The signs of all the long-run coefficients are the same as those obtained from the ARDL model, along with the level of significance. The next step is to find the causality among the estimated variables in the series by using Equations 6, 7, 8 and 9.

The results of the Granger causality tests are displayed in Table 7. Granger (1988) in his study suggested that, if there is cointegration among the estimated variables in the model then there should be causality among the estimated variables, either unidirectionally or bidirectionally.

1. Long-run Granger causality exists only for stock prices and the domestic credit to the public sector for Equation 6 and 8 in the form of a significant ECM. The long-run causality for Equation 6 confirms the results of the bounds test. The error correction represents the speed of adjustment that converges the dynamics back into the equilibrium position, implying the system stability.
2. There is a short-run unidirectional Granger causality that runs from stock prices to economic growth, which is in line with the study conducted by Van Nieuwerburgh et al. (2006). This suggests that stock prices are causing economic growth. This further indicates that the stock prices can be used to predict and forecast economic growth. Another short-run causality runs from economic growth to FDI, which is in accordance with the study by Pao and Tsai (2011). Furthermore, a bi-directional causality has been found between financial development and stock prices in the short-run as well in the joint short-run and long-run. These causality results are in concordance with the study conducted by Pradhan et al. (2014), who also found bidirectional causality between financial development and stock prices. Both stock prices and financial development are causing each other, validating and supporting the "demand-following" and "supply-leading views", which is consistent with the findings of Hassan et al. (2011), Ang (2008), and Calderón and Liu (2003).
3. A strong unidirectional causality has been found from FDI to stock prices, which is consistent with the study conducted by Arčabić et al. (2013) for Croatia. Another strong unidirectional causality has been found from GDP to stock prices, which is in concordance with the study findings by Tursoy and Faisal (2016) and specifies that growth is a good indicator in explaining stock prices, confirming the validity of the adoptive expectation model. A strong unidirectional causality exists that runs from financial development to FDI, which suggests that the increased impact of FDI on output in an economy can be further enhanced by adopting efficient policies that promote financial development. These findings are consistent with the study conducted by Ang (2009). As a result, the Chinese government can devise and plan efficient policies to attract more FDI to improve and promote their financial sector.

5. CONCLUSION

The study investigated the long-run and causal relationship among GDP, stock price, FDI and domestic credit to the public sector. For this purpose the ARDL bounds test was used to determine the long-run coefficients by using data from 1999Q1:2015Q1. The study findings indicated evidence of strong cointegration (long-run relationship) among the estimated variables in the model. The long-run elasticity indicated that the FDI has a positive and statistically significant impact on stock prices, while financial development has a negative impact. The results of the ARDL model were corroborated by using Johansen and Juselius's (1990) maximum likelihood cointegration approach. The results of the Granger causality test indicated a short-run unidirectional Granger causality that runs from stock price to economic growth and from economic growth to FDI. The former case is crafted in such a way that stock prices cause economic growth. Many bivariate studies have proved this relationship and the stock prices can even be used to predict economic growth. The latter case implies the absence of the FDI-led growth hypothesis. Likewise, a bi-directional causality has been found between financial development and stock prices. The overall results suggest that economic growth and financial development play key roles in improving the economy of China,

Table 7: Results of Granger causality tests

Dependent variable	F-statistics (probability) Weak Granger causality				Long-run Granger causality	Joint (short-run and long-run) F-statistics (probability) Strong Granger causality			
	ΔLSP (short-run)	ΔLGDP (short-run)	ΔLFDI (short-run)	ΔLDCPS (short-run)	ECT_{t-1} (t-statistics)	$\Delta LSP.ECT_{t-1}$	$\Delta LGDP.EC_{t-1}$	$\Delta LFDI.ECT_{t-1}$	$\Delta LDCPS.EC_{t-1}$
ΔLSP	-	1.9982 (0.1458)	0.0121 (0.9879)	4.0273 (0.0237)*	−0.1344 [−3.5150]*	-	5.2556 (0.0030)*	6.1817 (0.0011)*	5.4037 (0.0026)*
ΔLGDP	3.1593 (0.0507)*	-	1.0151 (0.3694)	0.1141 (0.8924)	−0.0002 [−0.0973]	2.1071 (0.1105)	-	0.9555 (0.4207)	0.0798 (0.9707)
ΔLFDI	2.1584 (0.1257)	3.2433 (0.0471)**	-	0.4933 (0.6134)	0.0525 [3.2908]*	4.6333 (0.0060)	5.6661 (0.0020)	-	4.7525 (0.0053)*
ΔLDCPS	2.7267 (0.0748)***	0.3933 (0.6768)	2.3471 (0.1057)	-	−0.0768 [−1.8662]***	2.8482 (0.0046)*	1.3669 (0.2631)	1.7378 (0.1707)	-

*,**,***Represents the significance level at 1% and 10% respectively. F-Statistics probabilities and t-ratios are given in parenthesis and square brackets, respectively. The optimal lag chosen is lag 2 based on the lag criteria estimated under the VAR model by AIC, SIC, FPE, LR criteria. The residuals are found to be white noise estimated via autocorrelation LM test. For serial correlation, the Godfrey LM tests have been applied and the estimation confirmed the absence of serial correlation in the ECM. ECM: Error correction term

which is currently the world's second largest economy in terms of GDP. The Chinese Government should play a positive role in attracting FDI that will in turn improve the financial development and economic growth and will enable these sectors to perform more efficiently and effectively.

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