Stock Market Development and Economic Growth: Ardl Causality in Pakistan

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Abstract

Contemporary economies of developing countries are changing due to rapid changes in the world economy. The emergence of international financial industry for worldwide network of transactions altered the role of international economy. Increased financial flows have altered the role of private capital and subsequently effect resource allocation. The economies of developing countries are witnessing changes in the composition of capital flows because world equity market is expanding rapidly. Foreign direct investment (FDIs) and stock market boom are the indicators of the changing world economic order. Earlier, most of the developing nations were facing serious liquidity problems thus compromising economic growth. Now, it is important to study how the changes in financial sector contributed in the overall growth of the economy.

This paper endeavors to investigate whether there is a relationship between stock market development and economic growth in case of developing economy such as Pakistan. The data set covers annual times series data from 1971 to 2006. We employed two new tests, i.e., DF-GLS, and Ng-Perron to find integrating order of the said variables of the study. To test long-run robustness, J-J Co-integration and ARDL bounds testing techniques are applied. To investigate long-run causal linkages and short-run dynamics, Engle-Granger causality and ARDL tests are applied respectively.

After finding order of integration, our findings suggested that there exist a very strong relationship between stock market development and economic growth. Engle-Granger-Causality estimation confirms in the long-run, there is bi-directional causality between stock market development and economic growth. However, for short-run, there exist only one-way causality, i.e., from stock market development to economic growth.

**Keywords:** Market Capitalization, Growth, Causality  
**JEL Classification Codes:** N2, E2, O16

1. Introduction

An organized and managed stock market stimulate investment opportunities by recognizing and financing productive projects that lead to economic activity, mobilize domestic savings, allocate capital
proficiency, help to diversify risks, and facilitate exchange of goods and services (Mishkin 2001; and Caporale et al, 2004). Undoubtedly, stock markets are expected to increase economic growth by increasing the liquidity of financial assets, make global and domestic risk diversification possible, promote wiser investment decisions, and influence corporate governance, i.e., solving institutional problems by increasing shareholders’ interest/value (Vector, 2005). In addition to above, stock markets are best indicator to forecast future economic activity and describe actual casual affect between future economic growth and stock prices. On the contrary, the relationship between stock market development and real economic growth can be explained as any change in stock market will eventually change the cost of rental capital. If the firm’s cost of borrowing will become high as compared to investment, it slows down the growth of the economy.

Furthermore, stock markets play an important role in allocation of capital to corporate sector that in turn stimulate real economic activity. Many countries were facing financial constraints particularly developing countries, where bank loans are restricted to some favorable groups of companies and personage investors. This limitation can also reflect constraints in credit markets (Mirakhor & Villanueva, 1990). Due to stagnant bank’s return from lending to specific groups of borrowers, these return does not increase as the interest rate to borrowers rises [Stiglitz & Weiss, (1981); and Cho, (1986)]. Efficient stock markets provide guidelines as a mean to keep appropriate monetary policy through the issuance and repurchase of government securities in the liquid market, which is an important step towards financial liberalization. Similarly, well-organized and active stock markets could modify the pattern of demand for money, and would help create liquidity that eventually enhances economic growth (Caporale et al, 2004).

In 19th and 20th century, academics such as Bagehot (1873) and Schumpeter (1911) had focused on the constructive assistance of financial sector to economic growth. Though the direction of causality between the higher growth in financial sector and country’s economic growth rate was not clear (Robinson, 1952 & Locus, 1988). Recent literature has paid much attention on banking sector reforms because there is a growing and mounting interest about stock market and economic growth nexus. According to Levine (1997) and Bencivenga (1991), more liquid markets can create long-term investment and hence economic growth through lower transaction cost. Likewise, Levine and Zervos (1998) remarked that stock markets liquidity positively predicts aggregate economic growth. Rajan and Zingales (1998) argued that stock market size is correlated to growth of financial dependent firms.

Traditional growth theorists believed that there is no correlation between stock market development and economic growth because of the presence of level effect not the rate effect. Similarly, Singh (1997) contended that stock markets are not necessary institutions for achieving high levels of economic development. Many viewed stock market as a agent that harm economic development due to their susceptibility to market failure, which is often manifest in the volatile nature of stock markets in many developing countries (Singh, 1997; Singh & Weis, 1999). So, the traditional assessment model of ‘stock prices’ and the ‘wealth effect’ provide hypothetical explanation for stock prices to be proceeded as an indicator of output (Cominicioli, 1996). According to wealth effect, however, changes in stock prices cause the variation in the real economy.

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1 A more difficult question arises with respect to whether the forward-looking nature of stock prices could be driving apparent causality between stock markets and growth. Current stock market prices should represent the present discounted value of future profits. In an efficient equity market, future growth rates will, therefore, be reflected in initial prices. This argues for using turnover (sales over market capitalization) as the primary measure of development, thereby purging the spurious causality effect because higher prices in anticipation of greater growth would affect both the numerator and the denominator of the ratio (Filer et al, 1999).

2 Stock markets help investors to cope with liquidity risk by allowing those who hit by liquidity shock to sell their shares to the investors who do not suffer from liquidity shock (Caporale et al, 2004).

3 Stock prices determined in exchanges, and other publicly available information help investors make better investment decisions. Better investment decisions by investors mean better allocation of funds among corporations and, as a result, a higher rate of economic growth. In efficient capital markets prices already reflect all available information, and this reduces the need for expensive and painstaking efforts to obtain additional information (Stiglitz 1994).

4 First time Gurley and Shaw (1955) efficient financial markets can enhance a borrower’s capacity and improve the efficiency of trade.

5 Bhide (1993) indicates that the volatility of stock market may reduce the ability of the public to supervise on a company’s investment efficiency. In addition, the public may increase investment returns by speculating in the stock market; thus, the stock market development may be unfavorable to the economic growth. Obstfeld (1994) indicates that high financial market liquidity may increase investment returns and thus decrease saving rate due to substitution effect and income effect, which is unfavorable to the economic growth.
Contrary to traditional view, there are evidences that support the hypothesis that there exist long-run correlation between stock market development and economic growth. But in literature the testing of this hypothesis is rare for developing countries. However, Pardy (1992) in his seminal work has argued that in less developed countries capital markets are able to mobilize domestic savings and allocate funds more efficiently. Spears (1991) reported that in the early stages of development, financial intermediation induced economic growth. Similarly, Atje and Jovanic (1993) concluded that stock markets have long-run impacts on economic growth and it was also found that stock markets manipulate economic growth through a number of channels that are liquidity, risk diversifications, acquisition of information about firms, corporate governance and savings mobilization (Levine & Zervos 1996). Luintel and Khan (1999) examined bi-directional causality between financial development and economic growth. Levine and Zervos (1998) measured stock markets development along with different magnitude and have suggested a strong statistically significant relationship between initial stock market development and subsequent economic growth. Filer et al. (1999) and Tunçer and AlovSat (2001) examined stock market-growth nexus and exhibited positive casual correlation between stock market development and economic activity. Chen et al (2004) elaborated that the nexus between stock returns and output growth and the rate of stock returns is a leading indicator of output growth. Similarly, Silverstovs and Duong (2006) revealed that the accounting for expectations has represented by the economic sentiment indicator in which stock market has certain predictive content for the real economic activity.

Paudel (2005) acknowledged that stock markets, due to their liquidity, enable firms to attain much needed capital quickly, hence facilitating capital allocation, investment and growth. Adjasi and Biekpe (2005) found a significant positive impact of stock market development on economic growth in countries classified as upper middle-income economies. Bahadur and Neupane (2006) concluded that stock markets fluctuations predicted the future growth of an economy and causality is found only in real variables. More specifically the causality runs from market capitalization to economic growth with significant feedback. Various studies such as Spears, (1991); Levine and Zervos, (1998); Atje and Jovanovic, (1993); Comincioli, (1996); Levine and Zervos, (1998); Filer et al, (1999); Tunçer and Aluvsat, (2001). Levine and Zervos (1995) and, Demirguc-Kunt (1994) has supported the view ‘stock markets promote economic growth.’ With well-functional financial sector or banking sector, stock markets can give a big boost to economic development (Rousseau & Wachtel, 2000; Beck & Levine, 2003).

Much of the confusion has been removed from literature review as in theoretical framework one may wonder that is there a case of stock market development and its affect on economic growth in both short-run and long-run. The current study would use ARDL testing technique to estimate long-run relationship between stock market development and economic growth. For short-run dynamics, Engle-Granger causality test has been used. Further, this study would also investigate the direction of causal relationship between two variables, i.e., stock market development and economic growth in case of Pakistan. Section B of the paper elaborated methodological framework of the study and data source, section C presents empirical and analytical interpretations of the findings and finally conclusion is presented in section D.

2. Methodological Framework & Data Source

In this study, we have used Augmented Dickey Fuller (ADF) test to test the stationarity of variables. For time series data, ADF test is a test for unit root. Strong negative numbers of unit root has rejected the null hypothesis that there is unit root at some level of confidence. Following equation check the stationarity of time series data used in the study:

\[ \Delta y_t = \beta_1 + \beta_2 t + \delta y_{t-1} + \alpha \sum_{i=1}^\infty \Delta y_{t-i} + \epsilon_t \]  

(1)

Where \( \epsilon_t \) is white noise error term,
\[ \Delta y_{t-1} = (y_{t-1} - y_{t-2}), \Delta y_{t-2} = (y_{t-2} - y_{t-3}) \]

These tests have determined that whether the estimates of \( \delta \) are equal to zero or not. Fuller (1976) provided cumulative distribution of the ADF statistics by showing that if the calculate-ratio (value) of the coefficient \( \delta \) is less than \( \tau \) critical value from Fuller table, then \( y \) is said to be stationary\(^6\).

However, this test is not reliable for small sample data set due to its size and power properties (Dejong et al, 1992 & Harris, 2003). For small sample data set, these tests seem to over-reject the null hypotheses when it is true and accept it when it is false. Two new tests, i.e., Dicky-Fuller Generalized Least Square (DF-GLS) and Ng-Perron could solve the problems of data size and power properties. The Dicky-Fuller Generalized Least Square (DF-GLS) has also called de-trending test that was developed by Elliot et al. (1996), and Ng-Perron test was developed by Ng-Perron in 2001.

The order of integration of variable \( X_t \) is calculated from de-trending procedure developed by Elliot et al. (1996) that enhanced the power of ADF test, and DF-GLS test that is based on null hypothesis \( H_0 : \delta^* = 0 \) in the regression:

\[ y_t = \beta_0 + \beta_1 t + \beta_2 X_t^d + \epsilon_t \]  \( (2) \)

Where \( X_t^d \) is the de-trended series and null hypotheses of this test is that \( X_t \) has a random walk trend, possibly with drift as follows.

\[ X_t^d = X_t - \bar{X} - \alpha t \]  \( (3) \)

Basically it proposed two hypotheses. Firstly, \( X_t \) is stationary about a linear time trend and it is stationary with a non-zero mean with no linear time trend. Considering the second hypotheses, DF-GLS test is performed by estimating the intercept and trend utilizing the generalized least square technique. This estimation is investigated by generating the following variables:

\[ Y_t^d = Y_t + \alpha T^d \]  \( (4) \)

\[ X_t^d = X_t - \bar{X} - \alpha T^d \]  \( (5) \)

\[ \Delta X_t^d = \lambda + \beta X_{t-1}^d + \sum_{j=1}^{k} \gamma_j \Delta X_{t-j}^d + \eta_t \]  \( (6) \)

Where “\( T \)” representing number of observation for \( X_t \) and \( \tilde{\alpha} \) is fixed\(^7\). While OLS estimation is followed by this equation:

\[ Y_t = \hat{\beta} X_t^d + \tilde{\mu} \]  \( (7) \)

OLS estimators \( \hat{\beta} \) and \( \tilde{\mu} \) are utilized for the removal of trend from \( X_t \) above. ADF test is employed on the transformed variable by fitting the OLS regression\(^8\):

\[ \Delta X_t^d = \lambda + \beta X_{t-1}^d + \sum_{j=1}^{k} \gamma_j \Delta X_{t-j}^d + \mu_t \]  \( (8) \)

---

\(^6\) ‘t’ ratio of coefficient \( \delta \) is always with negative sings.

\(^7\) The power of envelop curve is one-half at \( \alpha = -13.7 \) when the model has constant and trend term, and at \( \alpha = -7 \) when it has only constant term (see Elliot et al., 1996 for comprehensive study).

\(^8\) For the critical values see (Elliot et al., 1996) of null-hypothesis which is \( \rho = 0 \).
In second hypothesis, \( \tilde{\alpha} = -7 \) in the required equation of \( \tilde{\beta} \), and then calculate \( X_i^d = X_i - \varphi_i \). The ADF regression fitted on new transformed variables that are then employed to test the null hypothesis, i.e., \( \rho = 0 \).

In recent years, Ng-Perron (2001) developed four statistical tests by utilizing GLS de-trended data sets \( D_i^d \). The calculated values of these tests based on the forms of Philip-Perron (1988) \( Z_a \) and \( Z_t \) statistics, Bhargava (1986) \( R_1 \) statistics, Elliott, Rotherberg and Stock (1996) that created best optimal statistics. The terms are defined as following

\[
k = \sum_{i=1}^k (D_i^d)^2 / T^2
\]

While de-trended GLS tailored statistics are as given below:

\[
MZ_a^d = [T^{-1} (D_i^d)^2 - f_i] / (2k)
\]

\[
MZ_t^d = MZ_a \times MSB
\]

\[
MSB_d = (k / f_i)^{1/2}
\]

\[
MP_t^d = \left\{ \frac{1}{Ck} - C T^{-1} (D_i^d)^2 / f_i, \text{ and } Ck + (1 - Ck) T^{-1} (D_i^d)^2 / f_i \right\}
\]

If \( x_i = \{1\} \) in first case, and \( x_i = \{1, t\} \) in second.

Econometric literature has abundant econometric techniques to investigate co-integration relationships among macroeconomic variables. With regards to uni-variate co-integration technique, there are several examples including Engle-Granger (1987) and FMOLS procedures of Phillips and Hansen (1990). Many examples of multivariate co-integration technique of Johansen (1988); Johansen & Juselius (1990); and Johansen’s’s (1995) has provided full information for the maximum likelihood co-integration approach. Now the newly proposed autoregressive distributed lag (ARDL) approach (Pesaran and Shin, 1995, 1998; Pesaran et al., 1996; Pesaran et al., 2001). More recent studies have indicated that the ARDL approach to cointegration is preferable to other conventional cointegration approaches such as Engle and Granger (1987), and Gregory and Hansen (1996). One of the reasons for preferring the ARDL is that it is applicable irrespective of whether the underlying regressors are purely I(0), purely I(1) or mutually co-integrated. The statistic underlying this procedure is the familiar Wald or F-statistic in a generalized Dickey-Fuller type regression, which is used to test the significance of lagged levels of the variables under consideration in a conditional unrestricted equilibrium error correction model (ECM) (Pesaran, et al., 2001). Another reason for using the ARDL approach is that it is more robust and performs better for small sample sizes (such as in this study) than other cointegration techniques.

The ARDL approach involves estimating the conditional error correction version of the ARDL model for variable under estimation. The Augmented ARDL \( (p, q_1, q_2, \ldots, q_k) \) is given by the following equation (Pesaran and Pesaran, 1997; Pesaran and Shin, 2001):

\[
\alpha(L, p)y_t = \alpha_0 + \sum_{i=1}^k \beta_i(L, q)x_{it} + \hat{x}_iw_t + \epsilon_t
\]

where

\[
\alpha(L, p) = 1 - \alpha_1L - \alpha_2L^2 - \ldots - \alpha_pL^p
\]

\[
\beta_i(L,q) = \beta_{i0}L + \beta_{i2}L^2 + \ldots + \beta_{ik}L^k \forall i = 1, 2, \ldots, k
\]

\( y_t \) is an independent variable, \( \alpha \) is the constant term, \( L \) is the lag operator such that \( Ly_t = y_{t-1}, w_t \) is \( s \times 1 \) vector of deterministic variables such as intercept term, time trends, or exogenous variables with fixed lags. The log-run equation with respect to intercept and time trend can be written as follows:

\( \alpha = -7, \text{if } x_i = \{1\} \text{ and } c = -13.7 \quad \alpha = -7, \text{if } x_i = \{1, t\} \)
where: $\alpha = \sqrt{\frac{\gamma}{\lambda}}(1, p)$

The long-term elasticities are estimated by:

$$\phi_i = \frac{\hat{\beta}_i(1, q)}{\hat{\alpha}(1, p)} = \frac{\hat{\beta}_{1i} + \hat{\beta}_{2i} + \cdots + \hat{\beta}_{qi}}{1 - \hat{\alpha}_{1} - \hat{\alpha}_{2} - \cdots - \hat{\alpha}_{p}} \quad \forall i = 1, 2, \ldots, k$$

(13)

Where $\hat{p}$ and $\hat{q}_i, i = 1, 2, \ldots, k$ are the selected (estimated) values of $\hat{p}$ and $\hat{q}_i$, $i = 1, 2, \ldots, k$.

The long run coefficients are estimated by:

$$\pi = \frac{\hat{\lambda}(p, \hat{q}_1, \hat{q}_2, \ldots, \hat{q}_k)}{1 - \hat{\alpha}_{1} - \hat{\alpha}_{2} - \cdots - \hat{\alpha}_{p}}$$

(14)

Where $\hat{\lambda}(\hat{p}, \hat{q}_1, \hat{q}_2, \ldots, \hat{q}_k)$ denotes the OLS estimates of $\lambda$ in the equation (11) for the selected ARDL model.

The ARDL approach involves two steps for estimating long run relationship (Pesaran et al., 2001). The first step is to investigate the existence of long run relationship among all variables in the equation under estimation. The ARDL method estimates $(p + 1)k$ number of regressions in order to obtain optimal lag length for each variable, where $p$ is the maximum number of lags to be used and $k$ is the number of variables in the equation. The second step is to estimate the long-run relationship and short-run bi-directional causality between running actors. We run second step only if we find a long-run relationship in the first step (Narayan et al., 2005). This study uses a more general formula of ECM with unrestricted intercept and unrestricted trends (Pesaran et al., 2001):

$$\Delta y_t = c_t + c_1 t + \pi_{xy_t} y_{t-1} + \pi_{yx_t} y_{t-1} + \sum_{i=1}^{P-1} y_{i} \Delta y_{i-1} + w_{i} \Delta X_{i} + \mu_{t}$$

(15)

where $c_0 \neq 0$ and $c_1 \neq 0$. The Wald test (F-statistics) for the null hypothesis $H_0: \pi_{xy} = 0, H_0: \pi_{yx} = 0$, and alternative hypothesis $H_1: \pi_{xy} \neq 0, H_1: \pi_{yx} \neq 0$. Hence the joint null hypothesis of the interest in above equation is given by: $H_0 = H_0 \cap H_0$, and alternative hypothesis is correspondingly stated as: $H_1 = H_1 \cap H_1$.

The asymptotic distributions of the F-statistics are non-standard under the null hypothesis of no cointegration relationship between the examined variables, irrespective of whether the variables are purely $I(0)$ or $I(1)$, or mutually co-integrated. Two sets of asymptotic critical values are provided by Pesaran and Pesaran (1997). The first set assumes that all variables are $I(0)$ while the second set assumes that all variables are $I(1)$. If the computed F-statistics is greater than the upper bound critical value, and then we reject the null hypothesis of no cointegration and conclude that there exists steady state equilibrium between the variables. If the computed F-statistics is less than the lower bound critical value, then we cannot reject the null of no cointegration. If the computed F-statistics falls within the lower and upper bound critical values, then the result is inconclusive. After the discussion of theoretical model regarding the ARDL technique, we employed the Pesaran et al. (2001) procedure to investigate the existence of a long-run relationship in the form of the unrestricted error correction model for each variable as follows regarding our issues:

$$\Delta GNPC = \alpha_t + \alpha_1 t + \sum_{i=1}^{m} \alpha_1 GNPC_{i-1} + \sum_{i=0}^{m} \alpha_2 MC_{i-1} + \alpha_3 GNPC_{i-1} + \alpha_4 MC_{i-1} + \gamma_i$$

(16)

$$\Delta GNPC = \beta_t + \beta_1 t + \sum_{i=1}^{m} \beta_1 GNPC_{i-1} + \sum_{i=0}^{m} \beta_2 MC_{i-1} + \beta_3 GNPC_{i-1} + \beta_4 MC_{i-1} + \mu_i$$

(17)
Where GNPC is real income per capita (real GNP per capita), MC market capitalization as share of GDP\(^{10}\), \(t\) is time trend variable, while \(\eta\) & \(\mu\) are error terms in the models.

The first part of both equations with \(\alpha_2, \alpha_3\) and \(\beta_2, \beta_3\) represents the short-run dynamics of the models whereas the second part with \(\alpha_4, \alpha_5\) and \(\beta_4, \beta_5\) represent the long-run phenomenon. The null hypothesis in the equation (16) is \(\alpha_4 = \alpha_5 = 0\), which means the non-existence of the long-run relationship and vice versa, while the null hypothesis in the equation (17) is \(\beta_4 = \beta_5 = 0\), which means the non-existence of the long run relationship and vice versa.

The ARDL model testing procedure starts with conducting the bounds test for the null hypothesis of no Co-integration. The calculated \(F\)-statistic is compared with the critical value tabulated by Pesaran and Pesaran (1997) or Pesaran et al. (2001). If the \(F\)-test statistic exceeds the upper critical value, the null hypothesis of no long-run relationship can be rejected regardless of whether the underlying orders of integration of the variables are \(I(0)\) or \(I(1)\). Similarly, if the \(F\)-test statistic falls below the lower critical value, the null hypothesis is not rejected. However, if the sample \(F\)-test statistic falls between these two bounds, the result is inconclusive. When the order of integration of the variables is known and all the variables are \(I(1)\), the decision is made based on the upper bounds. Similarly, if all the variables are \(I(0)\), then the decision is made based on the lower bounds. The model can be selected using the lag length criteria like Schwartz-Bayesian Criteria (SBC) and Hannan-Quinn (HQ) information criterion\(^{11}\).

The third stage includes conducting standard Granger causality tests augmented with a lagged error-correction term. The Granger representation theorem suggests that there will be Granger causality in at least one direction if there exists co-integration relationship among the variables provided the variables are integrated order of one. Engle-Granger (1987) cautioned that if the Granger causality test is conducted at first difference through vector auto regression (VAR) method than it will be misleading in the presence of co-integration. Therefore, an inclusion of an additional variable to the VAR method such as the error-correction term would help us to capture the long-run relationship. To this end, an augmented form of Granger causality test is involved to the error-correction term and it is formulated in a bi-variate \(p\)th order vector error-correction model (VECM) which is as follows:

\[
\begin{bmatrix}
\Delta \text{GNPC}_t \\
\Delta \text{MC}_t 
\end{bmatrix} = \begin{bmatrix} k_1 \\ k_2 \end{bmatrix} + \sum_{i=1}^{p} \begin{bmatrix} d_{11}(L) & d_{12}(L) \\ d_{21}(L) & d_{22}(L) \end{bmatrix} \begin{bmatrix} \Delta \text{GNPC}_{t-i} \\
\Delta \text{MC}_{t-i} \end{bmatrix} + \begin{bmatrix} \gamma_1 \text{ECT}_{t-i} \\ \gamma_2 \text{ECT}_{t-i} \end{bmatrix} + \begin{bmatrix} C_1 \\ C_2 \end{bmatrix} + \begin{bmatrix} \eta_1 \\ \eta_2 \end{bmatrix} \tag{18}
\]

Where \(\Delta\) is a difference operator, ECT representing the error-correction term derived from long-run co-integrating friendship via ARDL model, \(C\) (\(i = 1, 2\)) is constant and \(\eta\) (\(i = 1, 2\)) are serially uncorrelated random disturbance term with zero mean. Through the ECT, the VECM provide new directions for Granger causality to appear. Long-run causality can be revealed through the significance of the lagged ECTs by \(t\) test, while \(F\)-statistic or Wald test investigate short-run causality through the significance of joint test with an application of sum of lags of explanatory variables in the model.

To ascertain the goodness of fit of the ARDL model, the diagnostic test and the stability test are conducted. The diagnostic test examines the serial correlation, functional form, normality and heteroscedasticity associated with the model. The stability test is conducted by employing the cumulative sum of recursive residuals (CUSUM) and the cumulative sum of squares of recursive residuals (CUSUMsq). Examining the prediction error of the model is another way of ascertaining the reliability of the ARDL model. If the error or the difference between the real observation and the forecast is infinitesimal, then the model can be regarded as best fitting.

Annual Data of the variables has been collected from International Financial Statistics (2006) and State Bank Monthly Statistical Bulletins for 1971-2006.

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\(^{10}\) Both variables are in logarithm form.

\(^{11}\) We decided about lag length on the basis of SIC.
3. Empirical Analysis
First unit estimation shows that both variables are having unit root problems at the level form and are stationary at 1st difference level. We relied on the stationarity evidence of DF-GLS, and Ng-Perron test statistics instead of ADF Test. DF-GLS and Ng-Perron are more powerful and suggestive tests than ADF test as already been explained in theoretical background. The statistics are given in Table-1. The lag–order has been selected on the both SIC & HQ and estimated results did not allow us to take more than one lag because of small sample data. After investigating order of integration of the said variables and lag selection, we employed both techniques. ARDL bound testing inspects the long-run relationship between stock markets and economic growth. To obtain optimal lag length for each variable, the ARDL method estimates 4 equations through regressions.

Table 1: Unit Root Estimation

<table>
<thead>
<tr>
<th>Variables</th>
<th>ADF-Test</th>
<th>DF-GLS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Level</td>
<td>1st Difference</td>
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<tr>
<td>GNPC</td>
<td>-1.369</td>
<td>-6.028*</td>
</tr>
<tr>
<td>MC</td>
<td>-2.801</td>
<td>-3.382**</td>
</tr>
</tbody>
</table>

Ng-Perron Test Statistics

<table>
<thead>
<tr>
<th>Variables</th>
<th>MZa</th>
<th>MZt</th>
<th>MSB</th>
<th>MPT</th>
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</thead>
<tbody>
<tr>
<td>GNPC</td>
<td>-8.911</td>
<td>-1.993</td>
<td>0.224</td>
<td>10.645</td>
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<tr>
<td>MC</td>
<td>-11.493</td>
<td>-2.384</td>
<td>0.207</td>
<td>7.997</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Variables</th>
<th>MZa</th>
<th>MZt</th>
<th>MSB</th>
<th>MPT</th>
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</thead>
<tbody>
<tr>
<td>GNPC</td>
<td>-17.524**</td>
<td>-2.959</td>
<td>0.169</td>
<td>5.208</td>
</tr>
<tr>
<td>MC</td>
<td>-16.339**</td>
<td>-2.777</td>
<td>0.170</td>
<td>6.056</td>
</tr>
</tbody>
</table>

Notes: *(**) shows significance at 1% (5%) level.

Table 2: Lag Order Selection

<table>
<thead>
<tr>
<th>Lag order</th>
<th>SIC</th>
<th>HQ</th>
<th>Log-Likelihood</th>
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</thead>
<tbody>
<tr>
<td>K= 1</td>
<td>1.2666</td>
<td>1.0891</td>
<td>-10.9534</td>
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<tr>
<td>K= 2</td>
<td>1.4322</td>
<td>1.1364</td>
<td>-6.7163</td>
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</tbody>
</table>

Table 3: Bound Testing for Co-integration

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>F-Statistic</th>
<th>Wald Test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Lag Order 1</td>
<td>Lag Order 1</td>
</tr>
<tr>
<td>GNPC MC</td>
<td>6.844*</td>
<td>6.111</td>
</tr>
<tr>
<td></td>
<td>7.609**</td>
<td>7.693</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Critical Value</th>
<th>Lower Bound Value</th>
<th>Upper Bound Value</th>
<th>Lower Bound Value</th>
<th>Upper Bound Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 %</td>
<td>8.74</td>
<td>9.63</td>
<td>10.150</td>
<td>11.230</td>
</tr>
<tr>
<td>5 %</td>
<td>6.56</td>
<td>7.30</td>
<td>7.080</td>
<td>7.910</td>
</tr>
<tr>
<td>10 %</td>
<td>5.59</td>
<td>6.26</td>
<td>5.915</td>
<td>6.630</td>
</tr>
</tbody>
</table>

*(**) Significant at 10 % (5%) level of significant according to Pesaran et al (2001).

Critical values are obtained from Pesaran et al (2001), Table CI (V): Unrestricted Intercept and Unrestricted Trend.

Critical values are obtained from Narayan P (2005), Table CI (V): Unrestricted Intercept and Unrestricted Trend, p.1990.

After careful estimations of F-statistics, one may conclude that there are two Co-integrating vectors between stock markets and economic growth indicating existence of long-run relationship between the variables. To investigate the robustness of long-run association, we also employed J-J Test, the results are presented in Table-4 that confirms the hypothesis of long-run correlation between economic growth and stock market development.

---

12 We utilize Pesaran et al (2001) critical values for long run relationship decision.
Table 4: Johansen First Information Maximum Likelihood Test for Co-integration

<table>
<thead>
<tr>
<th>Hypotheses</th>
<th>Likelihood ratio</th>
<th>5 % critical Value</th>
<th>Inst-value</th>
<th>Maximum Eigen values</th>
<th>5 % critical Value</th>
<th>Inst -value</th>
</tr>
</thead>
<tbody>
<tr>
<td>R = 0</td>
<td>38.780</td>
<td>18.397</td>
<td>0.0000</td>
<td>30.068</td>
<td>17.147</td>
<td>0.0004</td>
</tr>
<tr>
<td>R ≤ 1</td>
<td>8.712</td>
<td>3.841</td>
<td>0.0032</td>
<td>8.7125</td>
<td>3.841</td>
<td>0.0032</td>
</tr>
</tbody>
</table>

Granger causality Test results indicate that stock markets strongly influence the economic growth and the causation from economic growth to stock markets is significant at 7 percent in the case of Pakistan. Bi-variate causality has prevailed between stock market development and economic growth and the results are shown in Table-5.

Table 5: Engle-Granger Causality

<table>
<thead>
<tr>
<th>Dependent Variables</th>
<th>F-statistics*</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>GNPC</td>
<td>4.132 (0.050)</td>
<td>MC</td>
<td>3.459 (0.072)</td>
</tr>
<tr>
<td>GNPC</td>
<td></td>
<td>MC</td>
<td>4.132 (0.050)</td>
</tr>
</tbody>
</table>

*Prob-values are given in parentheses

While OLS representation shows that:

GNPC = 1.478 + 0.704GNPCt-1+ 0.055 MC

R² = 0.891 F-Stat = 130.3 D.W = 1.721

MC = -8.226 + 0.665 MCt-1+ 1.745 GNPC\textsuperscript{13}

R² = 0.887 F-Stat = 126.10 D.W = 2.41

The study has certain policy implications for Pakistan. The study has strongly contradicted the assumption that Pakistan’s stock markets are not vehicle of economic growth. Earlier, no attention has been made to understand stock market link with the overall growth of the economy because of agricultural based of the economy and weak financial sector especially the stock markets. The study has also shown the affect of financial liberalization on stock market development and hence the growth of economy. After 1990, the country has witnessed much needed financial liberalization that improves the efficiency of the banking system dramatically.

The analysis of the results shows that in long-run economic growth in Pakistan is strongly influenced from previous financial liberalization policies of respective governments. There exists significant and positive contribution of stock market in the overall growth of the economy for the period under consideration. The results have also shown that lagged of economic growth strongly effects the development of stock markets. The causality runs both ways for long-run relationship between stock market development and economic growth.

To estimate short-run dynamics and casual correlation between stock market development and economic growth, we have employed F-tests on lagged variables that show uni-variate causal correlation that runs from stock markets to economic growth significantly. This relationship is insignificant from economic growth to stock market development in short-run. Table 6 presents the estimated results that are as follows:

---

\textsuperscript{13} Variables are in logarithm for and their co-efficient are called elasticities.
Table 6: ARDL Short Run Causality

<table>
<thead>
<tr>
<th>Dependent Variables</th>
<th>GNPC</th>
<th>AMC</th>
<th>ECTt-1</th>
</tr>
</thead>
<tbody>
<tr>
<td>GNPC</td>
<td>-</td>
<td>3.231**</td>
<td>-0.659** (-2.161)</td>
</tr>
<tr>
<td>AMC</td>
<td>1.102</td>
<td>-</td>
<td>7.027** (2.032)</td>
</tr>
</tbody>
</table>

** Short Run Diagnostic Tests **
- Serial Correlation LM Test = 0.923(0.407)
- ARCH Test = 0.187(0.942)
- White Heteroskedasticity Test = 2.660 (0.051)
- Ramsey RESET Test = 1.717 (0.196)

** Represents significance at 5 % level of significance

4. Sensitivity Analysis
Diagnostic tests for serial correlation, autoregressive conditional heteroscedasticity, heteroscedasticity and functional form are conducted and the results are shown in Table-6. These tests show that short-run model passes through all diagnostic tests in the first stage. The results also indicated that there is no evidence of serial correlation among variables because functional form of model is well specified and there is no evidence for white heteroscedasticity. Autoregressive conditional heteroscedasticity is also not present in short-run model. Finally, we have examined the stability of the long-run parameters together with the short-run movements for the equations. For test, we relied on cumulative sum (CUSUM) and cumulative sum squares (CUSUMSQ) tests proposed by Borensztein, et al. (1998). The same procedure has been utilized by Pesaran and Pesaran (1997), Suleiman (2005) and Mohsen et al. (2002) to test the stability of the long-run coefficients. The tests applied to the residuals of the ECM model. The critical bounds are graphed in Figure-1. It can be seen from the figure that the plot of CUSUM stay within the critical 5% bound for all equations and CUSUMsq statistics does not exceed the critical boundaries that confirms the long-run relationships between financial variables and also shows the stability of co-efficient. (for details please see Appendix-I)

5. Conclusions
The present endeavors investigated dynamic relationship between stock market development and economic growth in case of Pakistan by using annual time series data from 1971-2006. We have employed two new tests, i.e., DF-GLS, and Ng-Perron, to find integrating order of the variables utilized in the study. For the robustness of long-run rapport, J-J Co-integration and ARDL bound testing techniques are applied along with Engle-Granger causality to investigate causal linkages in the long-run, and short-run dynamics are captured through ARDL Granger-Causality tests.

After finding order of integration, our findings suggested that there is a long-run relationship between stock market development and economic growth for Pakistan. The results are vigorous and robust that indicated that stock market development is an important wheel for economic growth. Engle-Granger-Causality estimation confirms the bi-directional causality between stock markets development and economic growth in case of Pakistan in long-run. But in short-run, the causality runs only one-way, i.e., from stock markets development to economic growth.
References


Appendix-I

Figure 1: Plot of Cumulative Sum of Recursive Residuals

![Cumulative Sum of Recursive Residuals](image1)

The straight lines represent critical bounds at 5% significance level.

Figure 2: Plot of Cumulative Sum of Squares of Recursive Residuals

![Cumulative Sum of Squares of Recursive Residuals](image2)

The straight lines represent critical bounds at 5% significance level.