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A Dynamic Econometric Study of GDP, Market Capitalization and Inflation: Evidence from Bangladesh

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Abstract

The paper attempts to find out empirical validity of the contribution of capital market to stimulate the nominal GDP, by conducting an analysis of two aspects: (a) the nature of the relationship, if one exists and (b) the direction of causality, between nominal GDP and market capitalization of DSE. An empirical assessment for Bangladesh has been acquired through Co-integration and Vector Error Correction Model (VECM) and Granger Causality test. DF, ADF and PP unit root test are employed to check for stationary. The analysis finds statistically significant positive relationship between nominal GDP and market capitalization in the long run. Granger Causality test ensures that although market capitalization has no cause and effect in nominal GDP, yet nominal GDP has a cause and effect in market capitalization in the short run. Further CUSUM and CUSUMsq tests confirm the unstable relationship between these two variables.

Keywords: GDP, Market Capitalization, Cointegration, Granger-Causality
JEL Classification: C32, C51, E01 G30.

Introduction

The capital market of Bangladesh is the third largest one in South Asia and one of the smallest in Asia. There are two full-fledged automated stock exchanges: Dhaka Stock Exchange (DSE) and Chittagong Stock Exchange (CSE).
Capital market development plays an important role for economic growth in the developed and developing countries. The question remains about the causality; does capital market development affect GDP or does GDP leads to more capital market development or both.

The objective of this paper is to examine the empirical relationship between market capitalization of capital market and nominal GDP of Bangladesh and study whether capital market development has caused economic growth or economic growth has caused the market capitalization in Bangladesh or both. In this study market capitalization has been used as an indicator of capital market development and nominal GDP has used as an indicator of economic development.
The market capitalization refers to the sum that derived from the current stock price per share times with the total number of shares outstanding. Although the market capitalization of a company indicates the value of that company, yet it is only a temporary metric based on the

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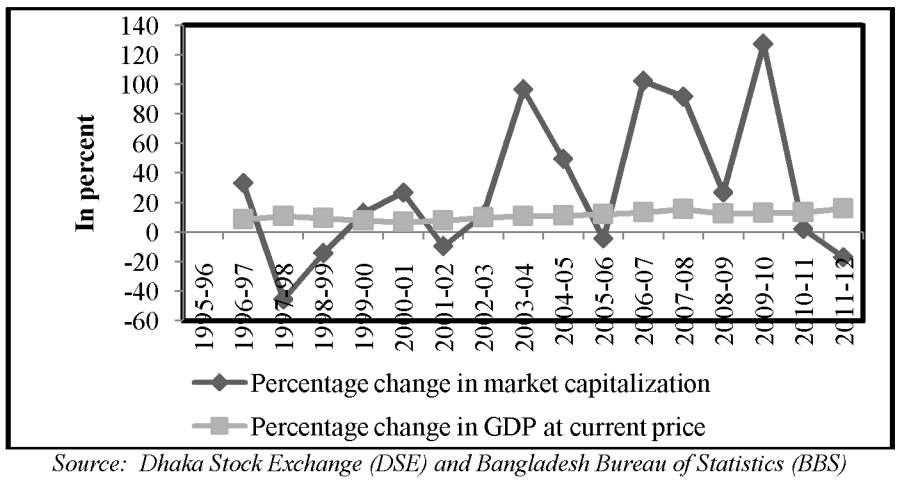
current stock market. In terms of economic significance, the assumption behind market capitalization is that market size is positively correlated with the ability to mobilize capital and diversify risk on an economy in a wide basis. (Agarwal 2001).

In January 2013 total market capitalization of DSE was Tk.184545.2 crore, a less of 4.5 percent than that of previous fiscal year of 2011-12. In FY 2010-11, the market capitalization was Tk. 232701.6 crore. In FY 2009-10, the turning year, saw the market capitalisation increased by 127.31 percent from the previous year and reached from Tk. 100143.3 crore in FY 2008-09 to Tk. 227640.8 crore in FY 2009-10. The increasing trend of market capitalization till FY 2011-12 states that the volume of the value of capital stock has followed a positive trend, but after the crush the market capitalization starts to go down.

The market capitalization to nominal GDP ratio can be used as an indicator of capital market development. In graphical form there is no significant correlation existing between nominal GDP and market capitalization. That means the size of market capitalization does not bear any significant relations with the growth of the economy.

Figure I: Percentage change in market capitalization and nominal GDP



Source: Dhaka Stock Exchange (DSE) and Bangladesh Bureau of Statistics (BBS)

The percentage change in GDP at current price illustrates a smooth shape whereas the percentage change in market capitalization demonstrates an erratic trend of ups and downs. In FY 1996-97, the rate of growth in market capitalization was 33.26 percent whereas the rate of growth in GDP at current price was 8.64 percent. Again in FY 2001-02, the market capitalization witnessed a negative growth by 9.82 percent whereas the percentage change of GDP at current price was 7.75 percent. In FY 2010-11, the percentage change of market capitalization was 2.22 percent whereas the percentage change in GDP at current price was 13.42 percent. Finally in FY 2012-13, the percentage change in GDP at current price was 16.16 percent whereas, the percentage changes in market capitalization faced a negative growth, reaching at 16.95 percent.

This paper is organized as follows: Section II reviews the empirical evidence on the relationship between capital market development and economic development; section III discuses the methodology and data; section IV contributes on empirical results analysis and discussion and finally section V concludes the overall sectional discussions.

Literature Review

A large number of theoretical and empirical works have been done in order to understand the strong positive linkage between stock market development and economic growth. Most studies suggest that the macroeconomic environment has an important effect on the stock market capitalization rate such as gross domestic product, exchange rates, interest rates, current account and money supply (Kurihara, 2006; Ologunde et al., 2006). On the other hand, a number of economists have suggested that the existence of stock market has little relevance to real economic activity. (Stigliz 1989; Mayer 1989).

Deb and Mukherjee (2008) have found a bi-directional causality between real GDP growth rate and real market capitalization ratio in the Indian economy.

Beck and Levine (2004) have used panel econometric techniques to assess the relationship between stock markets, banks and economic growth over the period 1976-1998 in a panel of 40 countries. They specifically examine whether measures of stock market and bank development each have a positive relationship with economic growth.

Arestis, Demetriades and Luintel (2001) demonstrate that while stock markets may be able to contribute to long-term output growth their influence is at best a small fraction of that of the banking system. Utilizing time-series methods and data from five developed economies, the study examines the relationship between stock market development and economic growth after controlling the effects of banking system and stock market volatility.

Levine and Zervos (1998) argue that banking development, stock market liquidity, and stock market capitalization are good predictors of economic growth whereas stock market volatility is insignificantly correlated with economic growth.

Singh (1997) argues that stock market development is unlikely to help in achieving quicker industrialization and faster long-term economic growth in most developing countries.

Levine and Zervos (1996) considered the relationship between stock market development and economic growth without considering the role of the banking sector. The study uses pooled cross-country time series regressions considering the data on 41 countries over the period 1976-1993. Using the instrumental variable method of estimation the study observes that the stock market development is positively correlated with economic growth even after controlling for other factors associated with long-run growth.

Atje and Jovanovich (1993) have concluded that there is a strong positive correlation between the level of financial development and the stock market development and economic growth.

Atje and Javanovie (1989) compare the impact of the level of stock market development and bank development on subsequent economic growth. They find a large effect of stock market development as measured by the valued traded divided by the GDP on subsequent development.

Methodology

The paper is based on the secondary time series data from FY1995-96 to FY2011-12. These data are collected from Bangladesh Bureau of Statistics (BBS) and Dhaka Stock Exchange (DSE). After collection and classification; the data have been analyzed by employing econometric techniques of cointegration and vector error correction mechanism to identify the short and long run dynamic relationship between nominal GDP and market capitalization. The econometric programmes, STATA - version 10 and Eviews have been used to analyze the data. To test the dynamic relationship between these two variables, the following procedures are employed:

Unit Autoregressive Root Tests

In order to test for the short run dynamics and the long run relationship among time series variables, the properties of each variable are estimated by the unit autoregressive tests to understand whether a time series variable is stationary. Here three procedures are used: (i) the Dickey-Fuller (DF) Test (Dickey and Fuller, 1979), (ii) the Augmented Dickey-Fuller (ADF) Test (Dickey and Fuller, 1981) and (iii) the Phillips-Perron (PP) Test (Phillips and Perron 1988). These unit root tests are based on both Unit Root Test with Drift and Unit Root Test without Drift around a Stochastic trend to get robust outcomes.

The Dickey-Fuller (DF) Test

In the DF test the regression models take the following form
Random walk with drift:

$$\Delta LNNGDP_t = \beta + LNNGDP_{t-1} + u_t$$
$$\Delta LNMC_t = \alpha + LNMC_{t-1} + \varepsilon_t$$

Random walk with drift around a stochastic trend:

$$\Delta LNNGDP_t = \beta_1 + \beta_2 t + \beta LNNGDP_{t-1} + u_t$$
$$\Delta LNMC_t = \alpha_1 + \alpha_2 t + \alpha LNMC_{t-1} + \varepsilon_t$$

where t is the time or trend variable. In each case, the hypothesis is that $\beta = 0;\ \alpha = 0$, that is there is a unit root - the time series is nonstationary. The alternative hypothesizes are $< 0;\ \alpha < 0$, that is the time series is stationary.

The Augmented Dickey-Fuller (ADF) Test

The ADF test for a unit autoregressive tests for the following regressions is to be carried out with a view to test the hypothesis $H_0: \delta = 0;\ H_0: \gamma = 0$ against the alternative hypothesis $H_1: \delta < 0;\ H_1: \gamma < 0$

$$LNNGDP_t = \beta_1 + \beta_{2t} + \delta \sum_{i=1}^{n} \Delta LNNGDP_{t-i} + u_t$$

$$\Delta LNMC_t = \alpha_1 + \alpha_{2t} + \gamma \sum_{i=1}^{n} \Delta LNMC_{t-i} + \varepsilon_t$$

where u_t and ε_t are pure white noise error terms and where $\Delta LNNGDP_{t-1} = (LNNGDP_{t-1} - LNNGDP_{t-2})$ and so on; in case of inflation $\Delta LNMC_{t-1} = (LNMC_{t-1} - LNMC_{t-2})$ and so on.

The number of lagged difference terms to be included is often determined empirically. The idea is to include enough terms so that the error terms of the described models is serially uncorrelated.

The Phillips-Perron (PP) Test

The results are also verified by Phillips and Perrron test. The test regressions are following:

$$LNNGDP_t = \beta_0 + \delta_t + \gamma_1 LNNGDP_{t-1} + \sum_{j=1}^{\rho} \gamma_j \, \Delta LNNGDP_{t-j} + u_t$$

$$LNMC_t = \propto_0 + \theta_t + \sigma_1 LNMC_{t-1} + \sum_{j=1}^{\rho} \sigma_j \, \Delta LNMC_{t-j} + \varepsilon_t$$

The PP tests are correct for any serial correlation and heterosecdasticity in the error terms u_t and ε_t by directly modifying the test statistics $t_\pi = 0$ and $T\hat{\pi}$. The hypothesis testing procedure is the same asymptotic distributions as the ADF test.

Cointegration Test

Johansen (1988) has introduced maximum likelihood approach to identify a long run equilibrium relationship among time series variables. Econometrically speaking two variables will be cointegrated if they have a long term or equilibrium relationship between them. In this case the regressions models take the following form:

$$LNNGDP_t = \beta_1 + \beta_2 LNMC_t + u_t$$
$$LNMC_t = \alpha_1 + \alpha_2 LNNGDP_t + \varepsilon_t$$

Johansen recommends two different likelihood ratio tests to find out the significance of the canonical correlations - the trace test and maximum Eigen value test. Through this test the time series variables of nominal GDP and market capitalization of DSE are tested to investigate the long run relationship among the variables.

Vector Error Correction Model (VECM)

The cointegration between the variables solely exhibits a long run equilibrium relationship. Vector Error Correction Model (VECM) is to be developed to investigate the short run dynamics between the time series variables.

$$\Delta LNNGDP_{i,t} = \delta_0 + \sum_{j=1}^{\rho} \theta_k \Delta LNNGDP_{i,t-j} + \sum_{j=1}^{\rho} \eta_k \, \Delta LNMC_{i,t-j} + \lambda\left[LNNGDP_{i,t-1} - \hat{\beta}_0 - \hat{\beta}_1 LNMC_{i,t-j}\right] + \varepsilon_{i,t}$$

$$\Delta LNMC_{i,t} = \delta_0^{'} + \sum_{j=1}^{\rho} \theta_k^{'} \Delta LNMC_{i,t-j} + \sum_{j=1}^{\rho} \eta_k^{'} \Delta LNNGDP_{i,t-j} + \lambda^{'}\left[LNMC_{i,t-j} - \hat{\beta}_0^{'} - \hat{\beta}_1^{'} LNNGDP_{i,t-1}\right] + \varepsilon_{i,t}^{'}$$

where Δ is the first difference operator, λ and λ'depict the speed of adjustment from short run to long run equilibrium, ε_t and ε_t' are purely white noise terms.

Pair wise Granger Causality Tests

The Granger causality test assumes that the information relevant to the prediction of the respective variables, LNNGDP and LNMC, is contained solely in the time series data of these variables. The test involves estimating the following pair of regressions:

$$LNNGDP_t = \sum_{i=1}^{n} \alpha_i LNMC_{t-j} + \sum_{j=1}^{n} \beta_j LNNGDP_{t-j} + u_t$$

$$LNMC_t = \sum_{i=1}^{n} \gamma_i LNNGDP_{t-i} + \sum_{j=1}^{n} \delta_j LNMC_{t-j} + \varepsilon_t$$

where it is assumed that the disturbances u_t and ε_t are uncorrelated. Since there are two variables, they are being dealt with bilateral causality.

Empirical Results and Discussion

The unit root test results of DF, ADF and PP that are based on with drift and drift with a stochastic trend are shown in Tables I and II

Table I: Unit Root Test with Drift

	DF Test			ADF Test		
Variable	Level	D(I)	D(II)	Level	D(I)	D(II)
LNNGDP	5.626	-0.885	-3.408***	1.635	-0.730	-3.411***
LNMC	0.376	-2.913***	-5.567***	0.098	-2.761***	-5.074***

Note: *, ** and *** denote rejection of the hypothesis of unit root test at 10%, 5% and 1% respectively.

TableII: Unit Root Test with Drift around a Stochastic Trend

	DF Test			ADF Test			PP Test		
Variable	Level	D(I)	D(II)	Level	D(I)	D(II)	Level	D(I)	D(II)
LNNGDP	0.394	-2.024	-3.439**	-0.631	-3.560**	-3.258*	0.114	-2.109	-3.443**
LNMC	-2.011	3.323*	-5.843***	-3.285*	-2.469	-5.654***	-2.009	-3.367*	-6.484***

Note: *, ** and *** denote rejection of the hypothesis of unit root test at 10%, 5% and 1% respectively.

Table I & II report that all the variables are stationary in the second difference series. The results provide the basis for the test of long run relationship between nominal GDP and market capitalization of DSE in Bangladesh.

Table III: Johansen and Juselius Cointegration Result

Hypothesis	γ_{trace}		γ_{max}	
Null	$r = 0$	$r \leq 1$	$r = 0$	$r \leq 1$
Alternative	$r = 1$	$r = 2$	$r = 1$	$r = 2$
Results	16.579**	2.325	14.255**	2.325

Note: * and ** denote rejection of hypothesis at 1% and 5% significance level significantly.

The Johansen-Juselious Cointegration results show that the hypothesis is of no cointegration, i.e., $r = 0$ is rejected for both nominal GDP and market capitalization of DSE in Bangladesh. This is because either γ_{trace} and γ_{max} is larger than the critical values at least at the 5% significant level. These results provide evidence that there is at least one cointegrating factor in each case and have given conclusion that the nominal GDP and the market capitalization of DSE in Bangladesh have a long run relationship.

Table IV: Short-Run Dynamics (VECM model)

	DLNNGDP	DLNMC
Adjustment Parameter (α)	-0.007	1.773***
DLNNGDP (-1)	0.773***	7.771**
DLNMC (-1)	0.011	0.231
Constant	0.022	0.000
R^2	0.98	0.71
χ^2	923.859***	26.356***

Note: *, **, and *** denote rejection of the hypothesis at 10%, 5%, and 1% significance level respectively.

Table IV implies that the coefficient of the error correction term is statistically insignificant while nominal GDP depends on market capitalization at first equation, which implies that changes in market capitalization does not hold causally affect on nominal GDP in short run but it shows statistically significant while market capitalization depends on nominal GDP at first equation, which implies that changes nominal GDP holds causal affect on market capitalization in the short run.

Table V: Conintegrating coefficient: Long- Run Coefficients Estimates

	Cointegrating coefficient Long-Run coefficients estimates	
	LNMC	Constant
LNNGDP	-0.394***	-9.238
χ^2	46.412***	

Note: *, **, and *** denote rejection of the hypothesis at 10%, 5%, and 1% significance level respectively.

Table V shows the results of long run coefficients estimates, which shows a positive relationship between nominal GDP and market capitalization with high level of significance. The significant chi-square value also makes a robust statistical relationship.

Table VI: Pair wise Granger Causality Tests Result

Hypothesis:	F-Statistic	Probability	Decision
LNNGDP does not Granger Cause LNMC	8.279	0.007	Reject
LNMC does not Granger Cause LNNGDP	0.396	0.682	Do not reject

The Granger Causality Tests suggest that there is no independence in relationship between nominal GDP growth and market capitalization. Independence is suggested when the sets of LNGDP and LNMC coefficients are not statistically significant in both regressions. Granger Causality test ensures that although market capitalization has no cause and effect in nominal GDP yet nominal GDP has a cause and effect in market capitalization of DSE in Bangladesh in the short run.

The coefficient of the error correction term and Granger Causality Tests both confirm that although nominal GDP of Bangladesh could not be explained by the market capitalization, yet market capitalization could be explained by the nominal GDP which perhaps postulates that people invest a portion of their income in capital market which in turns accelerates the market capitalization of Bangladesh.

Stability Check

The cumulative sum (CUSUM) and the cumulative sum of squares (CUSUMsq) tests are performed to examine the stability of the long-run and short run parameters (Pesaran, Shin and Smith, 2001). The CUSUM test takes the cumulative sum of recursive residuals and plots its value against the upper and lower bounds of the 95% confidence interval at each point. If the plots of statistics for both tests lie within the critical bounds set for the 5 per cent level, the hypothesis, "the regression equation is correctly specified," is not rejected (Bahmani-Oskooee and Nasir, 2004).

Figure II: Plot of Cumulative Sum of Recursive Residuals

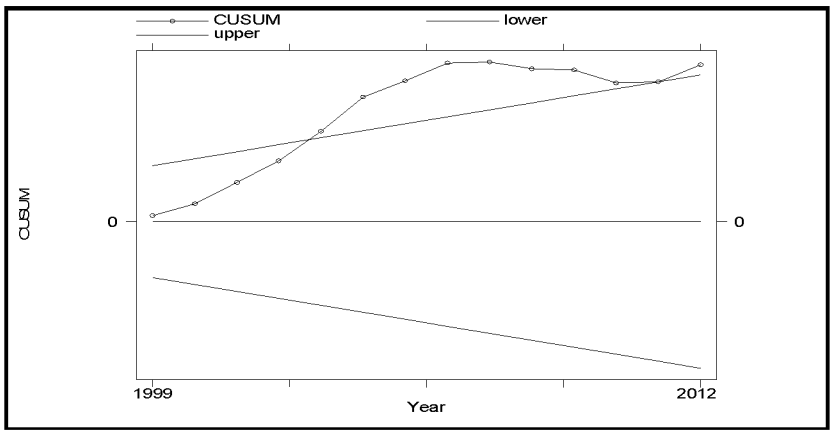
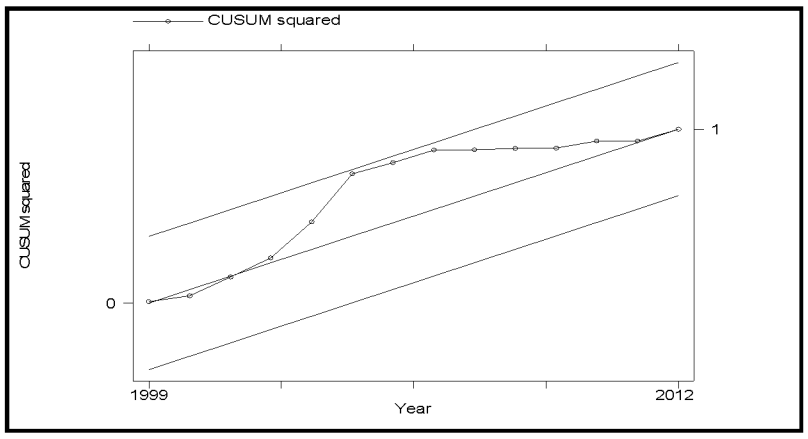


Figure III: Plot of Cumulative Sum of Squares of Recursive Residuals



Note that the straight lines represent critical bounds at 5% significance level.The plots of both CUSUM and CUSUMsq (Figures 1 and 2) are suggesting that the relationship between nominal GDP and market capitalization of DSE is unstable because they are both not lying within the 5% critical bounds.

Conclusions

The research has applied cointegration, vector error correction and Granger causality tests to explore the nature of the relationship and the direction of the causality between the nominal GDP and the market capitalization of DSE in Bangladesh. The results show that the two variables are cointegrated, indicating that there is a stable long-term relationship between these two. The long run cointegrating coefficients suggest that nominal GDP has statistically positive relationship with market capitalization. The coefficient of the error correction term is statistically insignificant while nominal GDP depends on market capitalization at first equation, which implies that changes in market capitalization does not hold causally affect on nominal GDP in the short run but it shows statistically significant while market capitalization depends on nominal GDP at first equation, which implies that changing nominal GDP holds causally affect on market capitalization in the short run. The CUSUM and the CUSUMsq tests confirm the unstable relation between these two.

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