

Exchange Rate and Economic Growth Nexus: Evidence from Bangladesh

Abstract

This paper takes a close look at exchange rate and economic growth nexus in Bangladesh for a period of 1985-2012 using time series analysis, considering Exchange Rate, FDI, Trade Openness, and Portfolio Equity as explanatory variables and linkage with GDP. We employed Johansen-Juselius cointegration test, multivariate Granger Causality and ADF and PP stationary tests for this purpose. All the variables were found stationary after first differencing both with trend & intercept and no trend. The empirical result shows explanatory variables have significant impact on economic growth in Bangladesh. We also found unidirectional causality, exchange rate to GDP per capita, exchange rate to trade openness and trade openness to GDP per capita in short run. The accumulated response of GDP per capita to exchange rate (ER) and trade openness is positive and significant. So, policy makers in Bangladesh should pay special attention to these areas in order to support economic growth rates.

Keywords: FDI, Exchange rate, Trade openness, GDP growth, Cointegration.

1. Introduction

A country's economic growth is influenced by the real exchange rate of its cross-border trading; and it serves as an important tool in relative price signaling inter-sectoral growth in the long run (Bah and Amusa, 2003; Walters and De Beer, 1999). Edwards (1998b) suggest that real exchange rate has important effects not only on general economic performance and international competitiveness, but also on different sectors of the economy, foreign trade flows, balance of payments, employment, structure of production and consumption, external debt crisis and allocation of resources in a country (Edwards and Savastano, 1999; Joyce and Kamas, 2003). Highly fluctuating, distorted and virtually meaningless real exchange rates result in an immense misallocation of resources and a miscalculation of the countries' comparative advantages during central planning, which distort their economic development (Dornbusch, 1988).

The grade of trade openness is likely to influence the flows of international capital in a country and it has impact on economic growth as well exchange rate. The level of trade openness also specifies the degree of comparative advantage of a country in undertaking investment. This view basically focuses on the ‘transaction cost theory’ (Coase 1937, Williamson 1975a) that proposes a low transaction cost situation generates financial incentives (higher return on investment) for both the domestic and foreign players in supplying large amount of capital like FDI. Moreover, the economic growth of a country is significantly influenced by trade openness and trade openness has radical impact on exchange rate behavior which is vital for other variables in this study.

The portfolio equity and FDI is likely to influence exchange rate as well as economic growth of a country. Portfolio equity channels needed capital for investment in stock market and provides support to capital formation; trade openness facilitates the flows of international capital and redirects factor endowments to more productive sectors; a high level of capital formation ensures needed finance for the industries growth and development; and all of them jointly promote economic growth at large. From this point of view, the linkage between FDI, trade openness, portfolio equity, exchange rate and economic growth should be positive. Therefore, this nexus should be co-integrated in the long-run. However, a question arises whether this nexus works equally for all developing countries, particularly in Bangladesh.

Hence, the objective of this study to investigate the relationship between FDI, portfolio equity, trade openness, exchange rate and economic growth in Bangladesh. The findings of this study will deal with one of the emerging economies in South Asia that practices democracy and market oriented policies to enhance economic growth and government policy regarding exchange rate. A country specific study removes the country specific problem and skepticism about the robustness of economic results that are often linked with cross-section as well as a period of extensive economic and financial liberalization measures undertaken by the government to attract FDI and portfolio equity. So, it investigates the linkage between FDI, trade openness, portfolio equity, exchange rate and economic growth which is rarely studied in the context of Bangladesh.

The outline of this paper is as follows. The next section reviews the theoretical and empirical literature. Section 3 describes a standard growth equation and the data sources and definitions. Section 4 separately reports the estimation results for various measures. Section 5 concludes the paper and affirms the policy implications of the results.

2. Empirical literature

Empirical literature that exclusively appraises the effects of skewed exchange rate on output growth is limited as most of the past works focused on the effects of devaluation on various

macroeconomic variables (Krugman and Taylor, 1978; Solimano, 1986; Edwards, 1989). Cottani *et al.* (1990) identified a strong negative correlation between per capita GDP growth on the one hand and RER misalignment index and the measure of RER instability on the other hand. The study showed that while misalignment index affects growth through its correlation with investment capital-output ratio (ICOR), exchange rate volatility influences growth through its correlation with investment and trade openness.

Theoretically, the connection between foreign direct investments (FDI), trade openness, exchange rate, portfolio equity and economic growth have a tendency to be positive. A number of reasons can be drawn in support of this statement. FDI promotes economic growth in a capital limited economy by increasing volume as well as efficiency of physical investment that emphasized by the neoclassical and endogenous growth theories (Romer 1986, Lucas 1988, Grosman & Helpman 1991, Baro & Salai-I-Martin 1995). In addition, FDI supplies long-term capital with new technologies and marketing capabilities, which has impact on economic growth by creating employments, increasing managerial skills, spreading technologies and promoting innovations (Asiedu 2002). FDI can also facilitate ‘agglomeration economies’ through industry clustering and networking, and lowering costs for all producers in the market (Krugman 1991). Pugel (2007) reports that FDI increases technological spillover benefits, widens the scope of international competition and strengthens the supply side capabilities of a host country for producing and selling goods and services, which lead to higher economic growth.

Ghura and Grennes (1993) have found that persistent RER misalignment was a major source of slow growth in Africa and Latin America whereas sensible macroeconomic factors trade and exchange rate policies were behind the rapid growth experienced by Asia and south Asian region. In a study of the relationship between real exchange rate and macroeconomic performance in 33 Sub-Saharan African countries, the authors found a negative relationship between the RER misalignment and economic performance. Using three measures of RER misalignment, (PPP-based, black market-based and endogenous growth model-based) the authors concluded that while higher levels of misalignment are accompanied by higher levels of macroeconomic instability, both lower levels of RER misalignment and instability lead to better economic performance. Similarly, Domaç and Shabsigh (1999) employed the same measures in a study of the empirical relationship between RER misalignment and economic growth in Egypt, Jordan, Morocco and Tunisia and found that RER misalignment adversely affected growth. Thus, we see conflicting findings about the relationship between trade openness and economic growth. Besides Romer (1986) and Lucas (1988) in the context of internal growth theories, Dollar (1992), Barro and Sala-i Martin (1995), Sachs and Warner (1995), Edwards (1992, 1998) asserted that the effect of the openness on economic growth was positive, Levine and Renelt (1992), Harrison (1996), Rodriguez and Rodrik (1999) claimed the opposite of this idea.

In a study of 95 countries from African, Asian and Latin American countries in the period 1976-85, Dollar (1992) found that outward-oriented countries have enjoyed higher per capita growth rates than inward-oriented ones. By means of the “outward orientation” index constructed from PPP comparisons, the conclusion was that more stable and depreciating currencies were associated with higher per capita growth rates. The negative relationship between exchange rate overvaluation and per capita growth rates was also confirmed by Easterly (2001), Cavallo and Ghironi (2002).

The effects of FDI, trade openness, capital formation and economic growth rate in Bangladesh over a period of 1986-2008 by Adhikary, (2011), found FDI and level of capital formation have significant positive impact on changes in real GDP and trade openness has negative lessening influence on GDP growth rates. In another finding on Bangladesh, Manni and Afzal (2012), showed trade openness had favorable effect on economic development. Alam (2010) investigated link between real exchange rate and export earnings and found no casual link between real exchange rate depreciation and export earning in Bangladesh. Zakaria and Ghuri (2011) studied trade openness and real exchange rate on Pakistan and revealed significant positive effect of trade openness on real exchange rate. The real exchange rate can serve as a facilitating condition: it cannot sustain economic growth in and of itself, but an appropriate real exchange rate policy can be an important enabling condition for a country seeking to capitalize on opportunities for growth (Eichengreen, 2007). They also claimed that keeping the real exchange rate at competitive levels and avoiding excessive volatility are important for growth.

However, the evidence of a link between the exchange rate volatility (or variability) and economic growth is less definitive (Ghura and Grennes, 1993; Aghion et al., 2009). In addition, other studies focusing on the nexus between the exchange rate regime and growth (Levy-Yeyati and Sturzenegger, 2003), found that for developing countries, less flexible exchange rate regimes are associated with slower growth. For industrial countries, exchange rate did not appear to have any significant impact on growth. Andersen and Babula (2008) investigated openness and long run economic growth and concluded that positive relationship between economic growth and openness was present. In addition to the above discussion in this study the researcher tried to find out the link of exchange rate and economic growth nexus considering FDI, trade openness and portfolio equity on Bangladesh which is one of the fastest growing economies in South Asian region despite of having my limitations. A brief survey on empirical literature has given in the following table.

Table 1: A Brief summary of recent studies.

Author(s) and date (Reference)	Variable used	Country, coverage, and method	Findings
Edoumiekumo and	RGDP, exports, imports	Nigeria; annual data	1.Positive relationship exists

Opukri, 2013 [29]		(1981-2008); Johansen's co-integration test	between the variables, RGDP, export and import 2.Uni-directional relationship. Real GDP Granger cause export and import Granger cause RGDP and export
Adhikary, 2012 [4]	FDI, Trade Openness, Domestic Demand, and Exchange Rate, exports	Bangladesh: annual data 1980–2009; A VEC Approach	1.FDI is found to be an important factor in explaining the changes in exports both in the short run and long-run 2. Study does not trace any significant causal relationship for the cases of trade openness, domestic demand, and exchange rate
ADHIKARY, 2011[4]	FDI, Trade Openness, Capital Formation, and Economic Growth	Bangladesh; annual data (1986–2008); VECM	1. Strong long-run equilibrium relationship between GDP growth rates. 2.FDI and level of capital formation are found to have significant positive effect on changes in real GDP 3.Openness unleashes negative but diminishing influence on GDP growth rates
Chimobi and Uche, 2010 [19]	Gov't consumption, household consumption, real GDP, and export	Nigeria; annual data (1970–2005); VAR	(i) No long-run equilibrium relationship (ii) Export causes domestic demand (iii) Bilateral causality between export and household consumption
Prasanna, 2010 [54]	Inward FDI, total manufactured exports, high technology manufactured exports, and manufacturing value added	India; annual data (1991-92–2006-07); OLS	FDI significantly influences exports
Martinez-Martin, 2010 [49]	FDI, exports, domestic income, world income, and competitiveness	Spain; annual data (1993–2008); VECM	A positive Granger causality runs from FDI to exports in the long-run
Duasa, 2009 [28]	Volume of exports and imports, REER, and trade balance	Malaysia; annual data (1999–2006); TAR and M-TAR	A long-run asymmetric cointegration exists between REER and exports
Babatunde, 2009 [12]	Merchandise exports, REER, average tariff rate, exchange rate, and imports of raw material	Sub-Saharan Africa; annual data (1980–2005); panel-fixed effect and random effect	REER stimulates exports

Njong, 2008 [51]	Real exports, real GDP, REER, import over total international trade, export over total international trade, lag exports, and lag FDI stock	Cameroon; annual data (1980–2003); AR (p)	FDI and REER significantly influence exports
Wong, 2008 [64]	GDP per capita, exports, private consumption, government consumption, and investment	ASEAN 5; annual data (1960–1996); error correction, Granger causality	(i) A long-run relationship exists between variables (ii) Bidirectional Granger causality between exports and GDP; private consumption and GDP per capita
Mortaza and Narayan, 2007 [50]	FDI inflows, import and export over GDP, M2/GDP, literacy rate, and domestic investment and inflation	Bangladesh, India, Pakistan, Sri Lanka, and Nepal; annual data (1980–2004); VAR, panel-fixed effect, and random effect	Unidirectional relationship between FDI, trade liberalization and economic growth for Bangladesh and Pakistan
F. S. T. Hsiao and M. C. W. Hsiao, 2006 [47]	Real FDI inflows, real GDP per capita, and real exports	China, Korea, Hong Kong, Singapore, Taiwan, Malaysia, Thailand, and the Philippines; annual data (1986–2004); panel VAR	Bidirectional causality between exports and GDP
Sahoo, 2006 [60]	FDI, world income growth, infrastructure index, domestic demand, exports, REER, and GDP growth	Bangladesh, India, Pakistan, Sri Lanka, and Nepal; annual data (1975–2003); panel-fixed effect	FDI positively influences exports
Arize, 1995 [8]	Log real exports, log REER, and log real foreign income	USA; monthly data (1971 : 2–1991 : 3); error correction, ARCH, and linear moment	(i) A long-run equilibrium relationship exists. (ii) Exchange rates and exports are negatively associated

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3. METHODOLOGY AND EMPIRICAL RESULTS

3.1 The model and data

To conduct a study of empirical analysis and investigate the relationship between exchange rate, trade openness, FDI, portfolio equity and economic growth which required the following variables for the study on Bangladesh.

- *GDP per capita*(Y);
- Exchange rate;
- Trade openness;
- FDI inflows;
- Portfolio equity.

The researcher collected data from World Bank Development Indicators (WDI). The data are annual and cover the period 1985-2012 for Bangladesh. To empirically investigate the different models of time series all variables were transformed to natural logarithms.

We estimate Johansen cointegration and Granger casualty test to examine the long and short run relationship between GDP and other variables. To test data stationarity, we conduct two widely used unit root tests; Augmented Dicky Fuller test (ADF) and Phillips- Perron (PP) test. These tests are followed by Johansen (1988) and Johansen and Juselius (1990) likelihood ratio tests for cointegration. Once the respective variables are found to be cointegrated. Then, we check the cointegrating properties of our concerned variables before testing for Granger causality. A vector error correction model (VECM) offers a useful method of analyzing the impact of a given variable on itself and all other variables by using variance decompositions (VDCs) and impulse response functions (IRFs).

3.2 Descriptive Statistics

The variables under study are found to be normally distributed (Table 2). The mean-to-median ratio of each variable is single digits. The standard deviation is also low compared to the mean, showing a small coefficient of variation. The range of variation between maximum and minimum is also reasonable. The numeric of skewness of each variable is low and is mildly negatively and positively skewed. The Jarque-Bera test statistics also accept the null hypothesis of normal distribution of each variable. Thus, the normality of the distribution is ensured in the study.

Table 2. Descriptive statistics for Bangladesh: 1985-2012

	GDP_PER_CAPI TA	FDI_INFLOW	EXCHANGE_RA TE	PORTFOLIO_EQ UITY	TRADE_OPENN ESS
Mean	5.861500	16.37578	3.873946	-1390168.	17.50541
Median	5.803089	17.97611	3.870850	0.000000	17.59139
Maximum	6.392744	20.85246	4.405043	1.53E+08	18.26877

Minimum	5.544001	-1.203576	3.332011	-1.53E+08	16.77147
Std. Dev.	0.267740	5.414923	0.318570	53121472	0.461953
Skewness	0.531439	-2.197817	-0.060354	-0.033142	-0.166025
Kurtosis	2.013598	7.610288	1.711935	6.822759	1.754089
Jarque-Bera	2.453147	47.33908	1.952629	17.05419	1.939644
Probability	0.293296	0.000000	0.376697	0.000198	0.379151
Sum	164.1220	458.5217	108.4705	-38924708	490.1515
Sum Sq. Dev.	1.935485	791.6776	2.740137	7.62E+16	5.761821
Observations	28	28	28	28	28

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188 3.3 Stationarity results

189 Before testing for cointegration we tested for unit roots in order to investigate the stationarity
190 properties of the data, Augmented Dickey-Fuller (ADF) t-tests (Dickey & Fuller, 1979) and (PP)
191 Phillips & Perron (1988) test are used to each of the three time series real GDP, real exports and
192 real imports testing for the presence of a unit root. The lag length for the ADF tests was selected
193 to ensure that the residuals were white noise.

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$$195 \Delta x_t = \alpha + \delta t + \vartheta_t + \rho x_{t-1} + \epsilon_t; \quad \text{Where, } t=1,2,3,\dots,N \quad (1)$$

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197 The results of the Augmented Dickey Fuller (ADF) test with and without trend as recommended
198 by Engle and Granger (1987) and the Phillips and Perron (1988) test again with and without
199 trend are reported in Table3.

200 **Table 3. Unit Root Tests for Bangladesh: 1985-2012**

ADF (Augmented Dickey-Fuller)			PP (Philips-Perron)		
	<u>Trend & intercept</u>	<u>No trend</u>		<u>Trend & intercept</u>	<u>No trend</u>
GDP	test statistic (Prob)	test statistic (Prob)	GDP	test statistic (Prob)	test statistic (Prob)
Level:	-0.98(0.92)	1.60(0.96)	Level:	-1.56(0.77)	6.44(1.00)
1 st Diff:	- 5.40(0.00)*, **, ***	-0.18(0.60)	1 st Diff:	-5.46(0.00)*, **, ***	0.25(0.75)
Exchange Rate			Exchange Rate		
Level:	-4.11(0.01)** , ***	3.44(0.99)	Level:	-2.30(0.41)	5.95(1.00)

1 st Diff:	-3.67(0.04)**,**	-0.67(0.41)	1 st Diff:	-3.68(0.04)**,**	-3.34(0.00)**,**
Fdi Inflow			Fdi Inflow		
Level:	-2.87(0.18)	-0.76(0.37)	Level:	-2.97(0.15)	-0.76(0.37)
1 st Diff:	-4.52(0.00)**,**	-5.03(0.00)**,**	1 st Diff:	-4.06(0.01)**,**	-3.96(0.00)**,**
Portfolio equity			Portfolio equity		
Level	-4.91(0.01)**,**	-5.08(0.00)**,**	Level:	-5.86(0.03)**,**	-5.55(0.00)**,**
1 st Diff:	-6.47(0.00)**,**	-6.77(0.00)**,**	1 st Diff:	-11.93(0.00)**,**	-12.73(0.00)**,**
Trade Open			Trade Open		
Level:	-2.88(0.18)	2.70(0.99)	Level:	-2.88(0.18)	3.29(0.99)
1 st Diff:	-5.12(0.00)**,**	-4.08(0.00)**,**	1 st Diff:	-5.22(0.00)**,**	-4.08(0.00)**,**

201 Notes

202 * indicates statistical significance at the 1% level

203 ** indicates statistical significance at the 5% level

204 *** indicates statistical significance at the 10% level

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206 Table 3 shows that the null of unit root accepted and rejected for the five variables at level.
 207 However, the null of unit root is rejected for first differenced variables, indicating that all
 208 variables are first differenced stationary or integrated of order one, I (1).

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210 3.4 Co-integration Test Result

211 One of the research objectives is to investigate the long run dynamics relationship among the
 212 five variables i.e. GDP, exchange rate, trade openness, FDI, portfolio equity. The system can be
 213 represented as follows:

$$214 \quad GDP_t = \alpha + bER_t + cTrade\ open_t + dFDI_t + ePort\ Equity_t + \varepsilon_t; \quad (2)$$

215 Where, t=1,2,3,.....N

216 In implementing the tests for cointegration we use the likelihood ratio test due to Johansen
 217 (1988) and Johansen and Juselius (1990). The method involves estimating the following
 218 unrestricted vector autoregressive (VAR) model:

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$$220 \quad Y_t = A_0 + \sum_{j=1}^p A_j Y_{t-j} + \varepsilon_t \quad (3)$$

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Where t Y is an $n \times 1$ vector of non-stationary $I(1)$ variables, in our case $Y_t = (\text{GDP}, \text{ER}, \text{Trade openness}, \text{FDI and portfolio equity})$, n is the number of variables in the system, five in this case. A_0 is a 5×1 vector of constants, p is the number of lags, j A is a 5×5 matrix of estimable parameters, and ε_t is a 5×1 vector of independent and identically distributed innovations. If Y_t is cointegrated, it can be generated by a vector error correction model (VECM):

$$\Delta Y_t = A_0 + \sum_{j=1}^{p-1} \Gamma_j \Delta Y_{t-j} + \Pi Y_{t-1} + \varepsilon_t \quad (4)$$

Where

$\Gamma_j = -\sum_{i=j+1}^p A_i$ and $\Pi = \sum_{j=1}^p A_j - I$
 Δ is the difference operator, and I is an $n \times n$ identity matrix.

TABLE 4. Results of Johansen Maximum Likelihood Estimation: 1985-2012

<u>Null Hypothesis</u>	<u>Alternative Hypothesis</u>	<u>Critical Value at 5%</u>	<u>λ trace Statistic</u>
$r=0$	$r>0$	69.81	113.87*
$r \leq 1$	$r>1$	47.85	54.56*
$r \leq 2$	$r>2$	29.79	28.74
$r \leq 3$	$r>3$	15.49	9.13
$r \leq 4$	$r>4$	3.84	0.053

<u>Null Hypothesis</u>	<u>Alternative Hypothesis</u>	<u>Critical Value at 5%</u>	<u>λ max Statistic</u>
$r=0$	$r>0$	33.87	59.30*
$r \leq 1$	$r>1$	27.58	25.82
$r \leq 2$	$r>2$	21.13	19.60
$r \leq 3$	$r>3$	14.26	9.08
$r \leq 4$	$r>4$	3.84	0.05

Notes

* indicates statistical significance at the 5% level

Table 4 presents the result of Johansen co-integration test both at the trace and maximum eigenvalue levels. Accordingly, the trace statistics detects at most two cointegrating vectors

among the variables and maximum eigenvalue statistics detect one cointegrating relationship at the 5% level. In other words, these tests indicate the presence of a long-run equilibrium relationship among variables.

TABLE 5. Normalized Cointegrating Vector

GDP_PER_CAP	Exchange Rate	FDI Inflow	Portfolio Equity	Trade_ Open
1.000	0.127	-4.27	-2.175	0.33755

Table 5 presents the coefficients of normalized cointegrating vectors among the variables.

3.5 Multivariate Granger causality tests

Apart from the examination of the long-run co-movements of the five variables of interest, the researcher will explore the short-run dynamics by performing Granger causality tests for cointegrating systems. Such an exercise will provide an understanding of the interactions amongst the variables in the system and will shed light on the directions of the causality.

TABLE 6. Granger Causality Test (period of 1985-2012)

Null Hypothesis:	Obs	F-Statistic	Prob.
FDI_INFLOW does not Granger Cause EXCHANGE_RATE EXCHANGE_RATE does not Granger Cause FDI_INFLOW	27	1.24880 0.45938	0.2748 0.5044
PORTFOLIO_EQUITY does not Granger Cause EXCHANGE_RATE EXCHANGE_RATE does not Granger Cause PORTFOLIO_EQUITY	27	0.88245 0.01174	0.3569 0.9146
GDP_PER_CAPITA does not Granger Cause EXCHANGE_RATE EXCHANGE_RATE does not Granger Cause GDP_PER_CAPITA	27	1.33159 6.58713**	0.2599 0.0169
TRADE_OPENNESS does not Granger Cause EXCHANGE_RATE EXCHANGE_RATE does not Granger Cause TRADE_OPENNESS	27	2.47741 4.75492*	0.1286 0.0392
PORTFOLIO_EQUITY does not Granger Cause FDI_INFLOW FDI_INFLOW does not Granger Cause PORTFOLIO_EQUITY	27	0.02685 0.00522	0.8712 0.9430
GDP_PER_CAPITA does not Granger Cause FDI_INFLOW FDI_INFLOW does not Granger Cause GDP_PER_CAPITA	27	0.01164 0.04485	0.9150 0.8341
TRADE_OPENNESS does not Granger Cause FDI_INFLOW FDI_INFLOW does not Granger Cause TRADE_OPENNESS	27	0.46391 2.19716	0.5023 0.1513
GDP_PER_CAPITA does not Granger Cause PORTFOLIO_EQUITY PORTFOLIO_EQUITY does not Granger Cause GDP_PER_CAPITA	27	0.16033 0.46609	0.6924 0.5013

TRADE_OPENNESS does not Granger Cause PORTFOLIO_EQUITY	27	0.21480	0.6472
PORTFOLIO_EQUITY does not Granger Cause TRADE_OPENNESS		2.39203	0.1350
TRADE_OPENNESS does not Granger Cause GDP_PER_CAPITA	27	4.36424*	0.0475
GDP_PER_CAPITA does not Granger Cause TRADE_OPENNESS		2.14186	0.1563

Notes: (i) Due to small number of observation, lag length of 1 is chosen, (ii) Rejection of the Null Hypothesis (No Granger Causality) at 1% level is indicated by three asterisk (***) or, 5% level by two asterisk (**) or, 10 % level by one (*)

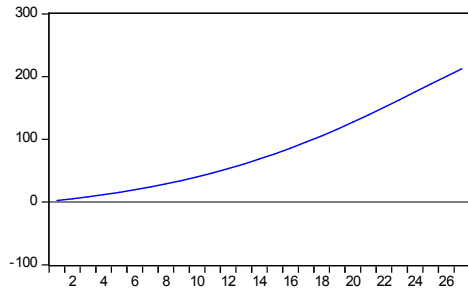
Table 6 demonstrates that the casual relationships among the variables, unidirectional causality found exchange rate to GDP per capita, exchange rate to trade openness and trade openness to GDP per capita. Whereas, no causality found FDI inflows to exchange rate, portfolio equity to exchange rate, portfolio equity to FDI inflows and GDP per capita to FDI inflows, trade openness to FDI inflows, GDP per capita to portfolio equity and trade openness to portfolio equity.

3.6 Impulse response and variance decomposition

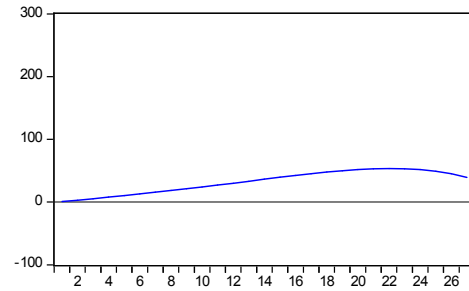
Figure 1. Impulse Responses of GDP per capita: 1985-2012

Accumulated Response to Generalized One S.D. Innovations

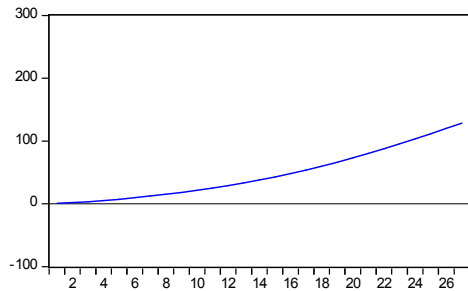
Accumulated Response of GDP_PER_CAPITA to GDP_PER_CAPITA



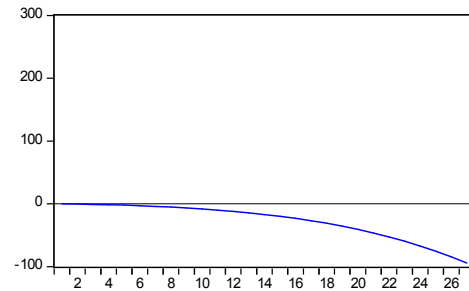
Accumulated Response of GDP_PER_CAPITA to FDI_INFLOW



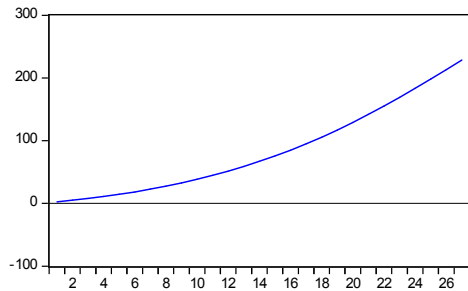
Accumulated Response of GDP_PER_CAPITA to EXCHANGE_RATE



Accumulated Response of GDP_PER_CAPITA to PORTFOLIO_EQUITY



Accumulated Response of GDP_PER_CAPITA to TRADE_OPENNESS



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275 From Figure 1, we see that the standard deviation of GDP per capita itself leads to positive
 276 increase in future economic growth in Bangladesh. The accumulated response of GDP per capita
 277 to exchange rate (ER) and trade openness is positive and significant. The response of GDP per
 278 capita to FDI inflow is positive but not significant. Finally, portfolio equity is found to be
 279 negative and significant to GDP per capita. And which is interesting in this study and indications
 280 might be found doing further research.

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282 **TABLE 7. Variance Decomposition of GDP per capita in Bangladesh: 1985-2012**

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Period	S.E.	GDP_PER_C APITA	FDI_INFLOW	EXCHANGE_ RATE	PORTFOLIO_ EQUITY	TRADE_OPE NNESS
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1	2.642044	100.0000	0.000000	0.000000	0.000000	0.000000
2	3.971321	89.65599	10.11279	0.025316	0.205672	0.000225
3	5.315981	82.40578	14.62082	0.138817	2.179458	0.655128
4	6.628420	78.86655	16.84807	0.798427	2.532680	0.954274
5	7.825498	79.14523	16.44349	1.199818	2.057231	1.154233
6	9.058262	79.22854	15.27632	2.036815	2.346302	1.112028
7	10.39699	79.29898	13.97859	2.862171	2.910536	0.949720
8	11.68471	80.83451	12.44888	3.012430	2.920571	0.783608
9	12.97592	82.28729	10.87841	3.077201	3.121663	0.635437
10	14.39453	83.00588	9.539008	3.316683	3.596052	0.542380
11	15.89579	83.84422	8.417951	3.462986	3.770075	0.504770
12	17.46693	84.58031	7.394143	3.582264	3.922048	0.521231
13	19.18119	84.76379	6.468619	3.850390	4.312099	0.605106
14	21.01100	84.87475	5.621647	4.114742	4.629359	0.759497
15	22.91383	85.00266	4.822128	4.307520	4.863030	1.004661
16	24.94304	84.74391	4.095788	4.552556	5.233362	1.374380
17	27.11081	84.21177	3.468380	4.820300	5.624110	1.875438
18	29.38357	83.54994	2.966915	5.035362	5.934014	2.513774
19	31.79330	82.51954	2.610467	5.258388	6.298057	3.313551
20	34.36848	81.08745	2.406967	5.509041	6.710683	4.285859
21	37.09074	79.35979	2.398819	5.730990	7.071054	5.439344
22	39.98131	77.20959	2.629771	5.933990	7.429670	6.796978
23	43.08168	74.55324	3.112227	6.142210	7.818532	8.373792
24	46.39994	71.44568	3.888877	6.322191	8.167362	10.17589
25	49.96561	67.84322	5.018258	6.458192	8.470677	12.20966
26	53.83978	63.69767	6.513010	6.563673	8.756456	14.46919
27	58.06919	59.07004	8.389153	6.622711	8.984564	16.93353

Note: Estimated by generalized variance decomposition. Due to non-zero covariance between the original shocks, the sum of the decomposition is not necessarily equal to one (Pesaran and Shin, 1998)

The variance decomposition outputs are reported in Table 7. We document that the variance of GDP growth rates is always caused by 100 per cent by itself in the first year. In the fifth year, the GDP growth variance is decomposed into its own variance (79.14%) followed by FDI (16.44%) and exchange rate (1.19%). However, in subsequent years that are up to twenty years, the share of GDP growth rates increased to approximately 81.08% followed by the exchange rate, portfolio equity and trade openness (5.50%, 6.71% and 4.28% respectively). On the other hand, the FDI inflow in explaining the variation of real GDP increases gradually from the second years onwards. In summary, the volatility of GDP growth rates is mainly caused by its own variation, as it always accounts for major portion (above 40%) of the fluctuations.

4. Conclusion

This study establishes a relationship between economic growth and its determinants in Bangladesh covering the data up to most recent year that is 2012. The multivariate cointegration test reveals at most two cointegrating vectors among the variables and maximum eigenvalue

statistics detect one cointegrating relationship among variables. Unidirectional causality was found for exchange rate to GDP per capita, exchange rate to trade openness and trade openness to GDP per capita. Whereas, no causality found FDI inflows to exchange rate, portfolio equity to exchange rate, portfolio equity to FDI inflows and GDP per capita to FDI inflows, trade openness to FDI inflows, GDP per capita to portfolio equity and trade openness to portfolio equity. Results from variance decomposition analysis are consistent with those of impulse response analysis. Based on findings from this investigation, it clearly indicates what the vital focus points are for further economic growth and income level of an emerging economy like Bangladesh. Bangladeshi policy making authorities and the experts can use the results to develop guidelines for their upcoming strategy formulation in this area.

5. Policy Implication

The policy implications of this study can be summarized by the following points. First, there exists a long-term link in the nexus of FDI, portfolio equity, exchange rate, trade openness, and economic growth of Bangladesh. This link indicates that the government of Bangladesh should utilize the above factors carefully on a long-run perspective to capitalize the benefits of the nexus properly. Second, FDI is an important factor in explaining the changes in exports. Thus, an FDI-led growth policy can be promoted to increase the country's overall investment and the rates of GDP growth as well. Third, trade openness tends to create positive impact on economic growth. Finally, government should be more focused on exchange rates to benefit from its positive influence on economic growth.

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