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Economic Growth and Macroeconomic Fundamentals: Evidence from Bangladesh

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I. Introduction

There are many macroeconomic variables that can affect economic growth. Sometimes in long term perspective and sometimes in short run perspective. This study is with four macroeconomic variables namely; interest rate, real exchange rate, money supply and trade openness. Like Bangladesh, the developing countries are very much affected by these macroeconomic variables. Exchange rate has momentous impact on economy. Because exchange rate appreciation and depreciation maintains an economy's inflow and outflow of funds and affect every transactions to some extent. Basically balance of payment is affected by exchange rate fluctuation. It may be positively affected or negatively. Another macroeconomic variable is interest rate. It is a vital part of an economy. Interest rate affects the investment, which in turn affect the economy's growth. Lower interest rate demotivated the foreign investors to invest with this lower compensation. For this lower compensation foreign investment from a country may flight. Thus, investment may reduce, which reduces the employment and income as well. Money supply (M2) is another macroeconomic variable. Increasing money supply may increase inflation or price level of the economy if reasonable production may not happen at that period. And M2 is the proxy of money supply. It is broad money. Money supply, to some extent, may be good when economic production is in reasonable. Another macroeconomic variable used in this study is trade openness or trade liberalization. From the very primitive era it is known to all that no one good at everything. He who good at what, he should produce that. By this procedure the world can increase their total output. In narrow mind by removing trade barriers with other countries, an economy may achieve their goal easily with effortless manner. Basically trade openness is needed to run after considering local traders interest.

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II. Objectives of the Study

a) General Objectives

The main objectives of this study will be to explore the relationship between some macroeconomic variables namely; Interest rate, Real exchange Rate, Money supply, Trade Openness and economic growth in Bangladesh.

b) Research Objectives

Our study aims to address the following objectives:

a) To identify whether there have long run relationship among Interest rate, Real exchange Rate, Money supply, Trade Openness and economic growth in Bangladesh.
b) To identify whether there have short run relationship or casual relationship among Interest rate, Real exchange Rate, Money supply, Trade Openness and economic growth in Bangladesh.

c) Research Questions

In order to achieve the above-mentioned research objectives, some answers are required for the following:

a) Is there any short run impact of the changes of interest rate on economic growth?
b) Is there any long run impact of the changes of interest rate on economic growth?
c) Is there any short run impact of the changes of money supply on economic growth?
d) Is there any long run impact of the changes of money Supply on economic growth?
e) Is there any short run impact of the changes of real exchange rate on economic growth?
f) Is there any long run impact of the changes of real exchange rate on economic growth?

g) Is there any short run impact of the changes of trade Openness on economic growth?
h) Is there any long run impact of the changes of trade Openness on economic growth?

III. Literature Review

The literature review consists of four parts. These are given below.

a) Relationship between Exchange Rate and Economic Growth

The larger the exchange rate, the poorer will be the condition of the importing country and vice versa. In such a case, there is no doubt to say that exchange rate has a direct effect on the economic growth of any country(Kendal, 2004).Depreciation of the currency leads to increase in real output. There has been a significant correlation between inward FDI in the United States and the US real exchange rates since1970.(Rosengren, 1992). When exchange rate drops by 1%, the stock market will react with less than 1%drop. US should maintain policy to strengthen return through appreciate currency value(Anokye & George, 2007). However, investor responds more heavily during a decrease in the exchange rate losses than an increase in the exchange rate profits (Jevando , Lius, 2004). Sometimes perhaps all developing economy like South Asian countris are wholly dependent on exchange rate.

(Chong & Tan, 2007). Real exchange rate affect relative cost of production and relative exchange rates affect the relative wealth significantly across countries and relative wealth significantly affects foreign direct investment in the united states and the effects of real wages have little impact on Foreign direct investment(Arizonan, 1992).

Exchange rate fluctuations have momentous implications for economic performance in Bangladesh. This is why fluctuation in exchange rate brings about changes in trade balance by influencing the country's export and import. Exchange rates may reason the price level to change and, as a consequence, it may change the income and wealth distribution of the economy.(Jaher, 2007)

Export-import-led growth for Bangladesh in both the long run and short run by using a dynamic panel data analysis, that existence of having co-integration, that is, stable long-run relationship between trade balance of Bangladesh and its determinants (Jakir, 2006).

b) Relationship between Interest Rate and Economic Growth

According to traditional economic perspective, interest rate has negative effect on Economic growth. When the interest rate is high, investors tries to swing their money from stock market to savings or fixed deposit accounts. Because stock market become higher risk sector, Which lead to effect on economic growth negatively(Mahmudul & Gazi, 2009).In the Long-run, interest rate has negative effect on the Economic growth in Japan(Mukherjee & Naka, 1995). Using daily data showed that the stock returns are heavily sensitive to interest rate and exchange rate changes(Joseph & Vezos , 2006).Higher interest rate encourage the foreign investors to invest, which in turn lead to economic growth(Liow & Huang, 2006).

Cointegrating relationship between two variables: interest rate and GDP (Nikiforos, 2010). On the other hand, there is insignificant relationship between Japanese economic growth and interest rate, especially the domestic interest rate. This is because the interest rate in Japan has implemented unprecedented monetary easing, falling the interest rate to almost zero, thus interest rate can affect the economic growth at all (Kurihara & Nezu , 2006). In therefore plan and control the interest rate to help the growth of economy(Ologunde, 2007).

c) Relationship between Money supply and Economic Growth

The probability of using M2 to target the quarterly rate of growth of nominal GDP in their paper in 1994. The study manifested that the Federal Reserve could perhaps make use of M2 that diminishes both the long-term average inflation rate and the fluctuation of annual GDP growth rate(Liu & shrestha, 2008).Money supply has positive long run relationship with the economic development(Ramin & Chuin, 2005).

d) Relationship between Trade Openness and Economic Growth

It is showed that trade openness and exchange rate has a significantly positive impact on economic growth (Sacha & Diamond, 2016). There is a significant positive relationship between openness and productivity growth (Iqbal, 1998). A positive relationship between openness and economic growth(Abdullah, 2013).

A multiple regression framework to investigate macroeconomics determinants of growth in pakistan including openness. The results suggest that openness has a beneficial effect on economic growth(Zahid, 2007). Open trade regimes force greater dependence on the market. Empirical evidence on the positive impact of liberalization on growth is quite abundant (Dollar, 2005).

IV. Data and Methodology

a) Sample Description

The study uses annual time series data for Bangladesh during 1987–2017. The data are collected from Bangladesh Bank and World Bank. All these sources of data are recognized, accepted and the provided information that has been used widely in the

country. So data and information of the sources incorporated in this analysis are reliable.

b) Variables

The study is completed with the help of some dependent and independent variables. Here the dependent variable is Real GDP taken as a proxy of economic growth. Whereas, the independent variables are real interest rate taken as a proxy of interest rate in Bangladesh, M2 is taken as a proxy of Money supply. Besides these, there have another two independent variables. These are Real exchange rate and Trade openness.

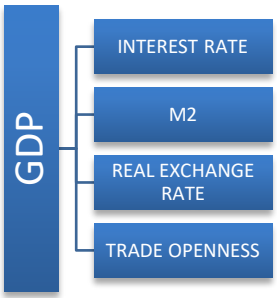


Figure 1

i. *Real Interest Rate*

A real interest rate refers to an interest rate that has been adjusted to remove the effects of inflation to reflect the real cost of funds to the borrower and the real yield to the lender or to an investor. The real interest rate of an investment is measured as the amount by which the nominal interest rate is higher than the inflation rate:

Real Interest Rate= Nominal Interest Rate- Inflation (Expected or Actual).

ii. *Money Supply*

In any economic system, the definition of something as seemingly straightforward as "money" can be surprisingly elusive. "Money" likely has very different meanings for an individual investor, a large financial firm, and a central bank or government, for instance. From the perspective of the study of economics, the money supply of a particular economy is equal to the total value of all monetary assets available within that economy. Central banks watch carefully over the money supply of a country to guard against issues like long-term price inflation, which often comes about as a result of rapid growth of the money supply of a country.

Measuring the money supply of an economy is a challenging proposition. Due to the complexity of the concept of "money," as well as the size and level of detail of an economy, there are multiple ways of measuring a money supply. These means of measuring a money supply are typically classified as "M"s and fall along a spectrum from narrow to broad monetary aggregates. Typically, the "M"s range from M0 to M3, with M2 typically representing a fairly broad measure.

iii. *Trade Openness*

Trade openness refers to the outward or inward orientation of a given country's economy. Outward orientation refers to economies that take significant advantage of the opportunities to trade with other countries. A common measure is the openness index, which adds imports and exports in goods and services and divides this sum by GDP. The larger the ratio, the more the country is exposed to international trade. For small economies that cannot produce everything they need, more trade has to be external.

iv. *Real Effective Exchange Rate*

Exchange rates of Taka for inter-bank and customer transactions are set by the dealer banks, based on demand-supply interaction. Bangladesh Bank (BB) is not in the market on a day-to-day basis, and undertakes USD purchase or sale transactions with dealer banks at prevailing inter-bank exchange rates only as needed to maintain orderly market conditions.

Inter-bank exchange rates are also used by BB for purchase and sale transactions with the Government and different International Organizations. The USD/BDT buying and selling rates below are highest and lowest inter-bank exchange rates at Dhaka. The cross rates of BDT with other foreign currencies are based on NY and Dhaka closing exchange rates.

The real effective exchange rate (REER) is the weighted average of a country's currency in relation to an index or basket of other major currencies, adjusted for the effects of inflation. The weights are determined by comparing the relative trade balance of a country's currency against each country within the index. This exchange rate is used to determine an individual country's currency value relative to the other major currencies in the index, such as the U.S. dollar, Japanese yen and the euro. The real effective exchange rate (REER) is used to measure the value of a specific currency in relation to an average group of major currencies. The REER takes into account any changes in relative prices and shows what can actually be purchased with a currency. This means that the REER is normally trade-weighted .The REER is derived by taking a country's nominal effective exchange rate (NEER) and adjusting it to include price indices and other trends. The REER, then, is essentially a country's NEER after removing price inflation or labor cost inflation. The REER represents the value that an individual consumer pays for an imported good at the consumer level. This rate includes any tariffs and transaction costs associated with importing the good. A country's REER can also be derived by taking the average of the bilateral real exchange rates (RER) between itself and its trading partners and then weighing it using the trade allocation of each partner. Regardless of the way in which REER is calculated, it is an average and considered in equilibrium when it is overvalued in relation to one

trading partner and undervalued in relation to a second partner.

v. *Gross Domestic Product*

Economic growth is the increase in the inflation-adjusted market value of the goods and services produced by an economy over time. It is conventionally measured as the percent rate of increase in real gross domestic product, or real GDP. To calculate annualized GDP growth rates, start by finding the GDP for 2 consecutive years. Then, subtract the GDP from the first year from the GDP for the second year. Finally, divide the difference by the GDP for the first year to find the growth rate. Remember to express your answer as a percentage. An economy producing below its potential GDP most often results from A High prices of production inputs. B corrupt government policies that stifle economic growth. low consumer demand for goods and services in the economy. An economy producing below its potential GDP most often results from A High prices of production inputs. B corrupt government policies that stifle economic growth. Economists traditionally use gross domestic product (GDP) to measure economic progress. If GDP is rising, the economy is in good shape, and the nation is moving forward. If GDP is falling, the economy is in trouble, and the nation is losing ground.

Variables	Description in short	Sources: World Bank Indicator, Bruegel Datasets & Bangladesh Bank.
GDP	Gross domestic product of Bangladesh.	
INT	Real Interest rate of Bangladesh.	
M2	Money supply.	
REER	Realeffective exchange rate in Bangladesh.	
TRD	Trade openness in Bangladesh.	

c) *Model Specification*

To examine the relationship between some macroeconomic variables (Interest rate, Real exchange Rate, Money supply, Trade Openness) and economic growth in Bangladesh, we have specified following econometric model. The independent variables are interest rate, M2, Real exchange Rate and Trade Openness, while the dependent variable is GDP growth as a proxy of economic growth.

The model is stated as follows:

Sometimes it is needed to convert the time series data into logarithm .The purpose of log-linear (L) is because of the value of some variables such as gross domestic product in US Dollars, while the Real interest rates are in percentage. There was therefore the use of logarithm in the model to bring the variables to the same base since the variables were measured in different ways. Using Schwarz Information Criterion (SIC), the lag length is selected automatically by *Eviews10* software.

$$GDP=F(INTEREST,M2\ ,REER,\ TRD)$$

$$L\_GDP = \alpha + \beta1(L\_INT) + \beta2(L\_M2) + \beta3(L\_REER) + \beta4(L\_TRD) + \varepsilon I$$

Where:

L=Log.

GDP=Gross domestic Product.

M2= Money supply.

INT= Real Interest Rate.

REER= Real Exchange rate.

TRD= Trade openness.

β1 is the co-efficient for interest rate.

β2 is the co-efficient for Money supply.

B3 is the co-efficient for Exchange rate .

B4 is the co-efficient for Trade openness.

εi is error terms.

The study uses different tools such as Augmented dickey fuller test, Phillips Perron Test, Johansen Cointegration Test, Vector Error Correction Model, Wald Test and Regression Analysis with the help of *EVIEWS10.*

Augmented Dickey Fuller Test And Phillips Perron Test.	It is used to test Whether the data are stationary or not.
OLS Regression Model -Diagnostic Tests.	It helps to determine the coefficients of different variables.
Johansen Cointegration Test	Cointegration analysis helps to identify long-run economic relationships between the variables.
Vector Error Correction Model	If cointegration has been detected between series we know that there exists a long-term equilibrium relationship between them so we apply VECM in order to evaluate the short run properties of the cointegrated series.But if do not happen so ,we will use unrestricted VAR.
Wald Test -Diagnostic Tests	To check whether an independent variable is significant or not to explain dependent variable.

i. *The Unit Root Test*

The empirical analysis begins with the stationary test of variables of the model where we have applied the standard ADP (Augmented Dickey-Fuller) test to conduct a check whether a variable is stationary or non-stationary manner. It may reflect spurious regression to regress a time series variable on another time series variable applying OLS estimation. Therefore, we need to examine stationarity test prior to apply econometric methodology. Stationary is called when a series is found with time invariant mean and variance. On the other hand a series with time dependent mean is called non-stationary. ADF Unit Root Test is based on the following three regression forms:

Without Constant and Trends: $\Delta Y_t = \delta Y_{t-1} + u_t$ .....(3)

With Constant: $\Delta Y_t = \alpha + \delta Y_{t-1} + u_t$ .....(4)

Without Constant and Trend $\Delta Y_t = \alpha + Bt + \delta Y_{t-1} + u_t$ .....(5)

The Hypothesis is H_0: $\delta = 0$ (Unit Root)

H_1: $\delta \neq 0$

ii. *Johansen Cointegration Test*

This test is performed to know if there is long run relationship or association ship among Interest rate, Real exchange Rate, M2, Trade Openness and economic growth in Bangladesh. Cointegration analysis helps to identify long-run relationship or association ship among the variables. When two series has the same stochastic trend, they are said to be cointegrated. Johansen Cointegration (1988) test depends on his Maximum Likelihood (ML) estimator of the parameters of the following VEC model of two cointegrating variables. Cointegration analysis helps to identify long-run economic relationships among the variables.

Once a unit root has been definite for a data series, the next step is to scrutinize whether there exists a long-run equilibrium relationship or association ship among variables. The presence of long-run equilibrium (stationary) relationships among economic variables is referred to in the literature as cointegration which is very significant to avoid the risk of spurious regression. The basic idea behind cointegration is that if, in the long-run, two or more series move closely together, even though the series themselves are trended, the difference between them is constant. It is possible to regard these series as defining a long-run equilibrium relationship, as the difference between them is stationary (Hall and Henry, 1989). A lack of cointegration suggests that such variables have no long-run relationship: in principal they can wander arbitrarily far away from each other (Dickey et. al., 1991). We employ the VAR based on co-integration test using the methodology developed in Johansen (1991, 1995).

But if cointegrating equation is found, then the VECM will be run to detect casual relationship among the variables.

To determine the number of co-integration vectors, Johansen (1988, 1989) and Johansen and Juselius (1990) suggested two statistic tests, viz., the trace test statistic, and the maximum eigenvalue test statistic.

Trace Test Statistics

The trace test statistic can be specified as:

In the trace test, the null hypothesis assumes that the number of distinct cointegrating vector(s) be less than or equal to the number of cointegration relations (r).

Maximum Eigenvalue Test

The maximum eigenvalue test examines the null hypothesis of exactly r cointegrating relations

against the alternative of $r+1$ cointegrating relations with the test statistic. So, firstly, it is needed to ensure a VECM model is fitted to the time series data. In order to find this, data should have maintained two conditions. (1) The data should be non stationary at level. But they will become stationary at first difference. (2) It is well known fact that Johansen's cointegration test is very much sensitive to the lag length. So an appropriate lag structure is needed to find out. The Akaie Information Criterion (AIC), Schwarz Criterion (SC) and the Likelihood Ratio (LR) test are used to find the optimum number of lags required in the cointegration test.

iii. *Vector Error Correction Model*

There have long run relationship between two series in a bivariate relationship if each series is integrated of the same order or have the same stochastic trend. If cointegration has been detected between series we know that there have exists a long-term equilibrium relationship between them. so we apply Unrestricted VECM in order to evaluate the short run properties of the series. Then we may precede to Wald Test under VECM environment to establish causal links among the variables.

d) Emperical Analysis Framework

Sometimes it is needed to convert the time series data into logarithm .The purpose of log-linear (L) is because of the value of some variables such as Gross Domestic Product in US Dollars, while the Real interest rates are in percentage. There was therefore the use of logarithm in the model to bring the variables to the same base since the variables were measured in different ways. Using Schwarz Information Criterion (SIC), the lag length is selected automatically by *Eviews10* software. The null hypothesis of ADF and Phillips Perron test states that a variable is nonstationary and the null hypothesis of non-stationary is rejected if the calculated ADF statistics is less than the critical value. My next step is to determine whether the variables have a stable and non spurious cointegrating relationship among themselves. With a view to testing Cointegration, I have chosen the Johansen cointegration (1979) procedure., it is needed to ensure a VECM model is fitted to the time series data. In order to find this, data should have maintained two conditions. (1) The data should be non stationary at level. But they will become stationary at first difference. (2) It is well known fact that Johansen's cointegration test is very much sensitive to the lag length. So an appropriate lag structure is needed to find out. The Akaie Information Criterion (AIC), Schwarz Criterion (SC) and the Likelihood Ratio (LR) test are used to find the optimum number of lags required in the cointegration test. If there have one cointegrating relationship among the variables, then the Vector error correction model will run. Then we will precede to Wald block Test under VECM environment to establish causal links between variables.

V. Result and Description

a) Descriptive Statistics

After incorporating log in each variables, the data conditions can be overviewed with the help of descriptive statistics. With descriptive statistics, it is possible to know about the variables regarding Mean, Median, Standard Deviation and so on.

Table 1: Results of Descriptive Statistics

Descriptive	L GDP	L REER	L INT	L M2	L TRD
Mean	24.85	4.75	1.56	40.60	3.39
Median	24.71	4.74	1.27	41.50	3.35
Maximum	26.12	5.07	2.45	65.87	3.87
Minimum	23.91	4.58	.027	20.81	2.81
Std. Dev.	0.63	0.106	0.101	15.72	0.32
Skewness	0.40	1.186	1.22	0.223	-0.19

b) Testing for Sationarity

Time-series data are often assumed to be non-stationary and thus it is necessary to perform a pretest to ensure there is a stationary cointegrating relationship among variables in order to avoid the problem of spurious regression. To do so, this study adopted the Augmented Dickey – Fuller (ADF) test.

Table 2(a): Results of ADF Test at level

Variables	ADF				
	Test Statistics	1%	5%	10%	P-value
L_GDP	-2.58	-3.67	-2.96	-2.63	0.1067
L_INT	-1.50	-3.67	-2.96	-2.63	0.5183
L_M2	-1.44	-3.67	-2.96	-2.63	0.5473
L_REER	-1.02	-3.67	-2.96	-2.63	0.7313
L_TRD	-1.78	-3.67	-2.96	-2.63	0.3851

Table 2(b): Results of ADF Test with 1st difference

Variables	ADF				
	Test Statistics	1%	5%	10%	P-value
D.L_GDP	-5.06	-3.71	-2.98	-2.63	0.004
D.L_INT	-5.13	-3.71	-2.96	-2.63	0.003
D.L_M2	-8.30	-3.67	-2.96	-2.63	0.009
D.L_REER	-3.62	-3.67	-2.96	-2.63	0.011
D.L_TRD	-5.27	-3.67	-2.96	-2.63	0.002

Table 3(a): Results of PHILLIPS PERRON Test at level

Variables	PHILLIPS PERRON TEST				
	Test Statistics	1%	5%	10%	P-value
L_GDP	-2.37	-3.68	-	-2.63	0.1568
L_INT	-	-3.68	-	-2.63	0.3889
L_M2	-	-3.68	-	-2.63	0.7343
L_REER	-	-3.67	-2.96	-2.63	0.9304
L_TRD	-1.85	-3.67	-2.96	-2.63	0.3486

Table 3(b): Results of PHILLIPS PERRON Test with 1st difference

Variables	PHILLIPS PERRON TEST				
	Test Statistics	1%	5%	10%	P-value
D. L_GDP	-9.87	-3.67	-2.96	-2.63	0.0000
D. L_INT	-5.13	-3.67	-2.96	-2.63	0.0003
D. L_M2	-6.56	-3.67	-2.96	-2.63	0.0009
D.L_REER	-3.63	-3.67	-2.96	-2.63	0.01123
D.L_TRD	-5.27	-3.67	-2.96	-2.63	0.0002

To test the stationarity, ADF and PHILLIPS PERRON are used. Where, Null hypothesis: There has a unit root or nonstationarity. And Alternative Hypothesis: There has not unit root or stationarity. According to the p value of all columns in table-2(a), at level, exceed 5%. And the guideline is, when the p value is less than 5%, we can reject the null hypothesis. So the null hypothesis cannot be rejected. That means, the variables are non stationary at level. But at the first difference the p values become less than 5%, leads to stationary variables in table- 2(b).In case of Phillips Perron Test, The results exactly similar to ADF test in table 3(a) and 3(b). Variables are non stationary at level .But when the all the variables are converted into first difference, then they will become stationary.

c) Testing for Cointegration

In order to determine whether there exists long-run equilibrium relationship or long run associationship among the variables of the study. To do so, the Johansen cointegration test was used. This test identifies the number of long-run relationship that exists among the group of integrated variables. Before test the johansen cointegration, there should have needed to assume two conditions.

(1) The data should be non stationary at level. But they will become stationary at first difference. (2) It is well known fact that Johansen's cointegration test is very much sensitive to the lag length. So an appropriate lag structure is needed to find out. The Akaie Information Criterion (AIC), Schwarz Criterion (SC) and the Likelihood Ratio (LR) test are used to find the optimum number of lags required in the cointegration test.

i. *Stationarity Test*

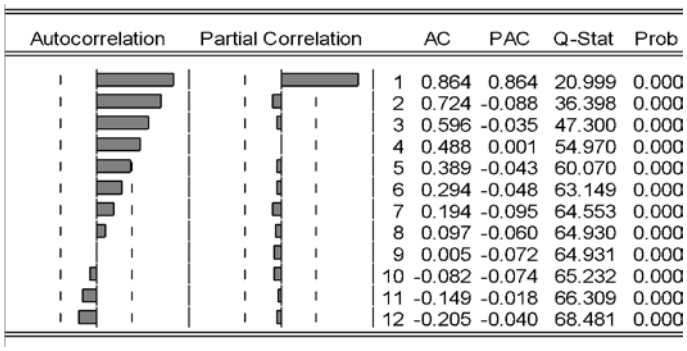
Our five variables are nonstationary at level. But when we covert all these five variables into first difference, then they become stationary. Meaning that, our 5 variables are integrated of same order .Then we can run the error correction model. Here,

HO: Variable is stationary.

H1: Variable is not stationary.

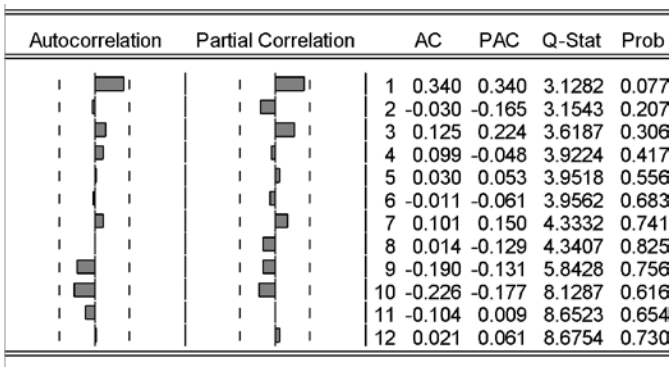
GDP Stationarity test

At level



Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	0.864	0.864	20.999	0.000
		2	0.724	-0.088	36.398	0.000
		3	0.596	-0.035	47.300	0.000
		4	0.488	0.001	54.970	0.000
		5	0.389	-0.043	60.070	0.000
		6	0.294	-0.048	63.149	0.000
		7	0.194	-0.095	64.553	0.000
		8	0.097	-0.060	64.930	0.000
		9	0.005	-0.072	64.931	0.000
		10	-0.082	-0.074	65.232	0.000
		11	-0.149	-0.018	66.309	0.000
		12	-0.205	-0.040	68.481	0.000

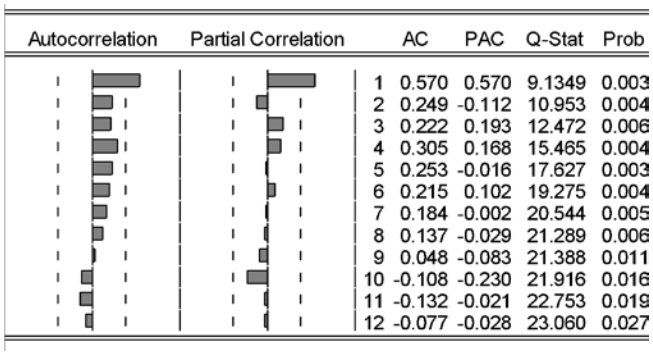
At first difference



Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	0.340	0.340	3.1282	0.077
		2	-0.030	-0.165	3.1543	0.207
		3	0.125	0.224	3.6187	0.306
		4	0.099	-0.048	3.9224	0.417
		5	0.030	0.053	3.9518	0.556
		6	-0.011	-0.061	3.9562	0.683
		7	0.101	0.150	4.3332	0.741
		8	0.014	-0.129	4.3407	0.825
		9	-0.190	-0.131	5.8428	0.756
		10	-0.226	-0.177	8.1287	0.616
		11	-0.104	0.009	8.6523	0.654
		12	0.021	0.061	8.6754	0.730

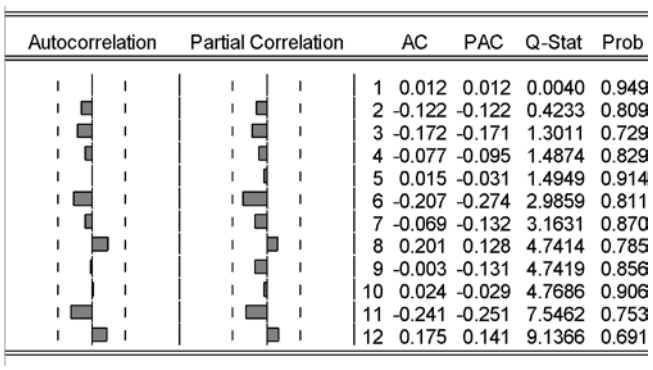
L INT Stationarity Test

At level



Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	0.570	0.570	9.1349	0.003
		2	0.249	-0.112	10.953	0.004
		3	0.222	0.193	12.472	0.006
		4	0.305	0.168	15.465	0.004
		5	0.253	-0.016	17.627	0.003
		6	0.215	0.102	19.275	0.004
		7	0.184	-0.002	20.544	0.005
		8	0.137	-0.029	21.289	0.006
		9	0.048	-0.083	21.388	0.011
		10	-0.108	-0.230	21.916	0.016
		11	-0.132	-0.021	22.753	0.019
		12	-0.077	-0.028	23.060	0.027

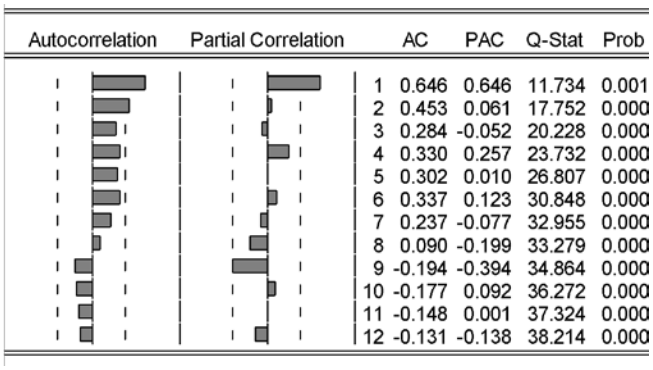
At first difference



Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	0.012	0.012	0.0040	0.949
		2	-0.122	-0.122	0.4233	0.809
		3	-0.172	-0.171	1.3011	0.729
		4	-0.077	-0.095	1.4874	0.829
		5	0.015	-0.031	1.4949	0.914
		6	-0.207	-0.274	2.9859	0.811
		7	-0.069	-0.132	3.1631	0.870
		8	0.201	0.128	4.7414	0.785
		9	-0.003	-0.131	4.7419	0.856
		10	0.024	-0.029	4.7686	0.906
		11	-0.241	-0.251	7.5462	0.753
		12	0.175	0.141	9.1366	0.691

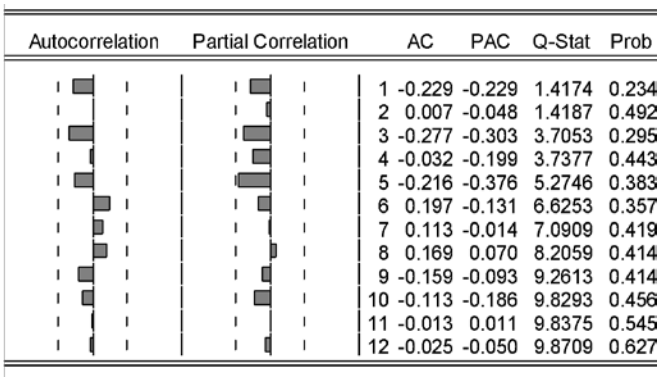
L M2 Stationarity Test

AT level



Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	0.646	0.646	11.734	0.001
		2	0.453	0.061	17.752	0.000
		3	0.284	-0.052	20.228	0.000
		4	0.330	0.257	23.732	0.000
		5	0.302	0.010	26.807	0.000
		6	0.337	0.123	30.848	0.000
		7	0.237	-0.077	32.955	0.000
		8	0.090	-0.199	33.279	0.000
		9	-0.194	-0.394	34.864	0.000
		10	-0.177	0.092	36.272	0.000
		11	-0.148	0.001	37.324	0.000
		12	-0.131	-0.138	38.214	0.000

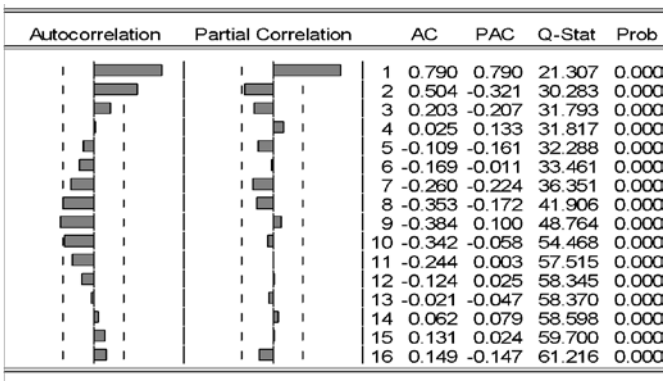
At First Difference



Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	-0.229	-0.229	1.4174	0.234
		2	0.007	-0.048	1.4187	0.492
		3	-0.277	-0.303	3.7053	0.295
		4	-0.032	-0.199	3.7377	0.443
		5	-0.216	-0.376	5.2746	0.383
		6	0.197	-0.131	6.6253	0.357
		7	0.113	-0.014	7.0909	0.419
		8	0.169	0.070	8.2059	0.414
		9	-0.159	-0.093	9.2613	0.414
		10	-0.113	-0.186	9.8293	0.456
		11	-0.013	0.011	9.8375	0.545
		12	-0.025	-0.050	9.8709	0.627

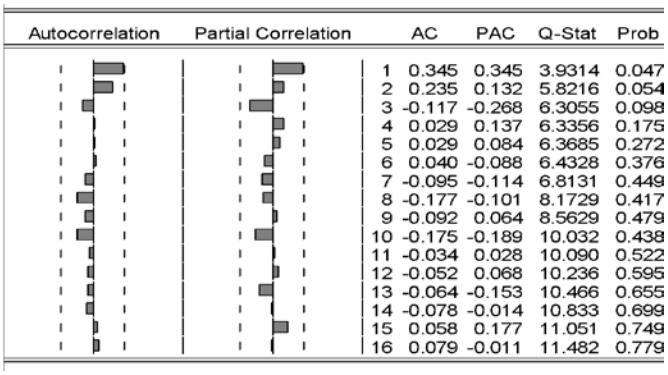
L_REER Stationarity Test

AT level



Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	0.790	0.790	21.307	0.000
		2	0.504	-0.321	30.283	0.000
		3	0.203	-0.207	31.793	0.000
		4	0.025	0.133	31.817	0.000
		5	-0.109	-0.161	32.288	0.000
		6	-0.169	-0.011	33.461	0.000
		7	-0.260	-0.224	36.351	0.000
		8	-0.353	-0.172	41.906	0.000
		9	-0.384	0.100	48.764	0.000
		10	-0.342	-0.058	54.468	0.000
		11	-0.244	0.003	57.515	0.000
		12	-0.124	0.025	58.345	0.000
		13	-0.021	-0.047	58.370	0.000
		14	0.062	0.079	58.598	0.000
		15	0.131	0.024	59.700	0.000
		16	0.149	-0.147	61.216	0.000

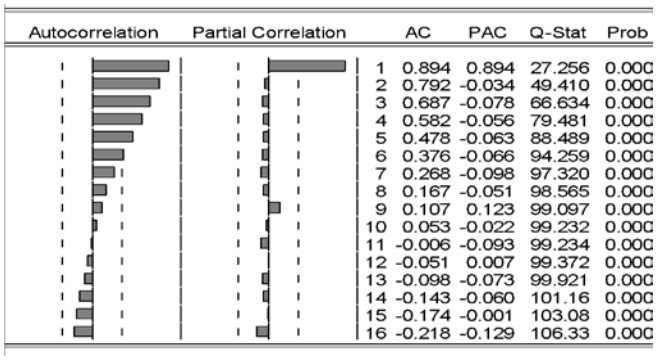
At First Difference



Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	0.345	0.345	3.9314	0.047
		2	0.235	0.132	5.8216	0.054
		3	-0.117	-0.268	6.3055	0.098
		4	0.029	0.137	6.3356	0.175
		5	0.029	0.084	6.3685	0.272
		6	0.040	-0.088	6.4328	0.376
		7	-0.095	-0.114	6.8131	0.449
		8	-0.177	-0.101	8.1729	0.417
		9	-0.092	0.064	8.5629	0.479
		10	-0.175	-0.189	10.032	0.438
		11	-0.034	0.028	10.090	0.522
		12	-0.052	0.068	10.236	0.595
		13	-0.064	-0.153	10.466	0.655
		14	-0.078	-0.014	10.833	0.699
		15	0.058	0.177	11.051	0.749
		16	0.079	-0.011	11.482	0.779

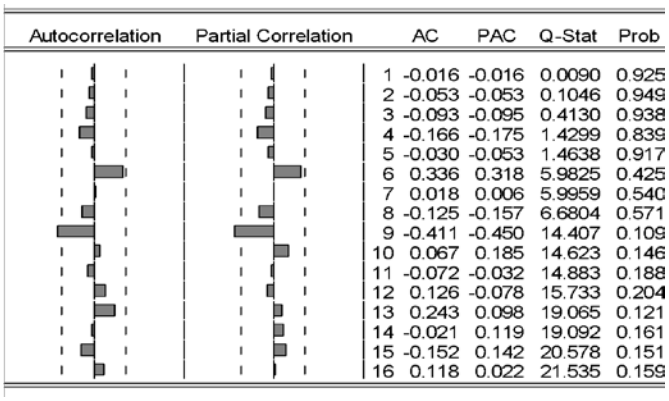
L TRD Stationarity Test

AT level



Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	0.894	0.894	27.256	0.000
		2	0.792	-0.034	49.410	0.000
		3	0.687	-0.078	66.634	0.000
		4	0.582	-0.056	79.481	0.000
		5	0.478	-0.063	88.489	0.000
		6	0.376	-0.066	94.259	0.000
		7	0.268	-0.098	97.320	0.000
		8	0.167	-0.051	98.565	0.000
		9	0.107	0.123	99.097	0.000
		10	0.053	-0.022	99.232	0.000
		11	-0.006	-0.093	99.234	0.000
		12	-0.051	0.007	99.372	0.000
		13	-0.098	-0.073	99.921	0.000
		14	-0.143	-0.060	101.16	0.000
		15	-0.174	-0.001	103.08	0.000
		16	-0.218	-0.129	106.33	0.000

At First Difference



Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	-0.016	-0.016	0.0090	0.925
		2	-0.053	-0.053	0.1046	0.949
		3	-0.093	-0.095	0.4130	0.938
		4	-0.166	-0.175	1.4299	0.839
		5	-0.030	-0.053	1.4638	0.917
		6	0.336	0.318	5.9825	0.425
		7	0.018	0.006	5.9959	0.540
		8	-0.125	-0.157	6.6804	0.571
		9	-0.411	-0.450	14.407	0.109
		10	0.067	0.185	14.623	0.146
		11	-0.072	-0.032	14.883	0.188
		12	0.126	-0.078	15.733	0.204
		13	0.243	0.098	19.065	0.121
		14	-0.021	0.119	19.092	0.161
		15	-0.152	0.142	20.578	0.151
		16	0.118	0.022	21.535	0.159

To test the stationarity, correlogram is used.

Where, Null hypothesis: Variable is stationary.

And Alternative Hypothesis: Variable is not stationary.

According to the p value of all tables (at level) are below 5%.And the guideline is, when the p value is less than 5%, we can reject the null hypothesis. So the null hypothesis(variable are stationary) is rejected. That means, the variables are non stationary at level. But at the first difference the p values become greater than 5%, leads to stationary variables.

Variables are non stationary at level. But when the all the variables are converted into first difference, then they will become stationary. And if it is happen, then the study can incorporate Johansen Cointegration Test.

ii. *Lag selection*

The number of lags are used to run Johansen Cointegration test and VAR are determined by VAR lag order selection criteria.

Table 4: Results of VAR lag exclusion criteria.

Chi-squared test statistics for lag exclusion:
Numbers in [ ] are p-values

	L INT	L GDP	L SMCR	L TRD	L REER	Joint
Lag 1	15.91155 [0.0071]	4.511234 [0.4784]	1.472899 [0.9162]	20.57232 [0.0010]	32.15146 [0.0000]	84.07532 [0.0000]
Lag 2	4.880070 [0.4307]	1.874871 [0.8662]	3.168901 [0.6740]	2.034168 [0.8444]	3.770461 [0.5829]	16.43950 [0.9011]
df	5	5	5	5	5	25

Null: Not Optimum lag.

Here, VAR lag criteria assumes 2 lags as a default. But Chi-squared Lag exclusion criteria excludes Lag 2. Since the null hypothesis is accepted in case of lag 2.

Table 5: Results of VAR lag order selection criteria

VAR lag order selection criteria

Endogenous variables: L GDP, L INT, L REER, L M2, L TRD

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-4806.030	NA	2.90e+10	43.95461	44.06294	43.99836
1	-4751.646	104.7944	**2.76e+10****	**43.90544****	**44.77206****	**44.25544****
2	-4682.387	129.0310	2.30e+10	43.72043	45.34533	44.37668

* indicates lag order selected by the criterion

LR: sequential modified LR test statistic (each test at 5% level)

FPE: Final prediction error

AIC: Akaike information criterion

SC: Schwarz information criterion

HQ: Hannan-Quinn information criterion

According to the five criteria (LR, FPE, AIC, SC and HQ) are asking to take 1 lag by the sign (*). So, optimum lag would be 1. And the study uses this 1 lag in Johansen Cointegrated test and in the VECM. After selecting the lag the study uses Johansen Cointegrated Test to determine whether there exists long-run equilibrium relationship among the variables of the study.

d) Testing for Cointegration

In order to determine whether there exists long-run equilibrium relationship or long run associationship among the variables of the study. To do so, the Johansen cointegration test was used. This test identifies the number of long-run relationship that exists among the group of integrated variables.

Johansen Cointegration Test

Table 6: Johansen Co-integration Result

No. of CE(s)	Trace Statistics	Max Eigen Statistics	Critical Values (5%)		Critical Values (5%)	
			Trace	P-value	Max-Eigen	P-Value
None***	82.32	34.93	69.81	.0036	33.87	.0373
At most 1	47.38	26.23	47.85	0.055	27.58	.0737
At most 2	21.15	13.69	29.79	.347	21.13	.3902
At most 3	7.45	7.44	15.49	.5249	14.26	.4384
At most 4	.0179	0.0179	3.84	.8933	3.84	.8933

Trace Test and Max Eigen Test indicates 1 co-integrating equ(s) at .05 level.

****Denotes rejection of the hypothesis at the .05 level.*

Trace test indicates there is 1 cointegration at level .05. From table-6, the trace statistic of 82.32 clearly exceed the critical value of and 69.81 at 5 percent confidence interval. hence, we reject the null hypothesis and conclude that there is 1 cointegrating relationship and therefore, there is long run relationship exists among the variables. Since the guideline is; when trace statistics is greater than critical value, we can reject the null hypothesis. The null hypothesis is no cointegration.

The Eigen value test also supported this claim of having long run relationship among the variables. The maximum eigen value statistics of 34.13 exceed the critical values of 33.87 at 95 percent confidence level. Thus, we reject the null hypothesis of no cointegrating relationships among the variables.

Since the variables are cointegrated or have long run associationship, the study can use VECM model.

e) Vector Error Correction Model

Table 7: Results of Vector Error Correction Model

Cointegrating Eq:	CointEq1				
L_GDP(-1)	1.000000				
L_INT(-1)	-0.001359 (0.00550) [-0.24713]				
L_REER(-1)	-1.185382 (0.13469) [-8.80058]				
L_M2(-1)	-0.022501 (0.00171) [-13.1271]				
L_TRD(-1)	-0.874889 (0.08674) [-10.0867]				
C	-15.32085				
Error Correction:	**D(L_GDP)**	**D(L_INT)**	**D(L_REER)**	**D(L_M2)**	**D(L_TRD)**
CointEq1	-0.446184 (0.11088) [-4.02418]	26.52043 (8.10137) [3.27358]	-0.060724 (0.15665) [-0.38764]	9.396479 (6.51283) [1.44276]	0.645887 (0.25621) [2.52097]
D(L_GDP(-1))	0.253224 (0.18890) [1.34054]	18.33916 (13.8022) [1.32871]	0.415010 (0.26688) [1.55504]	1.157256 (11.0958) [0.10430]	-0.510578 (0.43649) [-1.16972]
D(L_INT(-1))	0.000594 (0.00230) [0.25865]	-0.321687 (0.16789) [-1.91611]	0.004447 (0.00325) [1.36993]	-0.007551 (0.13497) [-0.05594]	-0.005964 (0.00531) [-1.12326]
D(L_REER(-1))	0.157713 (0.16425) [0.96021]	-16.63896 (12.0012) [-1.38644]	0.121212 (0.23206) [0.52234]	1.801876 (9.64797) [0.18676]	-0.162609 (0.37954) [-0.42844]
D(L_M2(-1))	-0.011973 (0.00498) [-2.40314]	0.449615 (0.36404) [1.23509]	-0.004111 (0.00704) [-0.58399]	0.551293 (0.29265) [1.88377]	0.013473 (0.01151) [1.17029]
D(L_TRD(-1))	-0.194531 (0.09558) [-2.03522]	-4.679116 (6.98393) [-0.66998]	-0.118812 (0.13504) [-0.87981]	1.486852 (5.61450) [0.26482]	0.139316 (0.22087) [0.63077]
C	0.080513 (0.01924) [4.18422]	-1.905099 (1.40597) [-1.35501]	-0.010857 (0.02719) [-0.39936]	0.573531 (1.13028) [0.50742]	0.041374 (0.04446) [0.93051]
R-squared	0.602663	0.617143	0.287007	0.172764	0.348896
Adj. R-squared	0.489138	0.507755	0.083294	-0.063589	0.162866
Sum sq. resids	0.028924	154.4176	0.057735	99.79743	0.154440
S.E. equation	0.037112	2.711682	0.052433	2.179968	0.085757
F-statistic	5.308637	5.641794	1.408882	0.730958	1.875485
Log likelihood	56.52392	-63.63466	46.84719	-57.52341	33.07191
Akaike AIC	-3.537423	5.045333	-2.846228	4.608815	-1.862279
Schwarz SC	-3.204372	5.378384	-2.513177	4.941866	-1.529228
Mean dependent	0.075711	-0.159354	0.010967	1.585364	0.027288
S.D. dependent	0.051924	3.864988	0.054764	2.113796	0.093729
Determinant resid covariance (dof adj.)		3.14E-07			
Determinant resid covariance		7.46E-08			
Log likelihood		31.10774			
Akaike information criterion		0.635162			
Schwarz criterion		2.538311			
Number of coefficients		40			

Since, we have one cointegrating equation, VECM automatically convert the variables into the first difference. Here, every variable has one lag. In the upper line (table-7) L GDP, L INT, L M2, L REER, L TRD with first difference are dependent variables. So there are five models. One is with L GDP, second one is L INT third one is L M2, fourth one is L REER, and last one is L TRD. Firstly, we will concentrate on L GDP model. Here, L GDP is a Dependent variable in this model. And L GDP(-1) is the independent variable. Since The Var lag selection criteria selects 1 lag. (-1) is this lag. Similarly, In L GDP model, L GDP(-1), L M2(-1),L INT(-1), L REER (-1) and L TRD(-1) are independent variables. And c is constant. This is so happen in all five cases. To check whether L INT(-1) is significant variable or not to explain L GDP. Like this, Whether L M2(-1) is significant variable or not to explain L INT and so on. There (table-6) have no probability value (p value) to explain. To check this, needed to run Wald Test. For this, the study should have performed system equation. The system equation of Vector Error Correction Model is given below

Table 8: Results of system equation of VECM.

D(L_GDP) = C(1)*(L_GDP(-1) - 0.00135898056896*L_INT(-1) - 1.18538209208*L_REER(-1) - 0.0225011395815*L_M2(-1)-0.874888896764*L_TRD(-1) - 15.3208548463) + C(2)*D(L_GDP(-1)) + C(3)*D(L_INT(-1)) + C(4)*D(L_REER(-1))+ C(5)*D(L_M2(-1)) + C(6)*D(L_TRD(-1)) + C(7)

D(L_INT) = C(8)*(L_GDP(-1) - 0.00135898056896*L_INT(-1) - 1.18538209208*L_REER(-1) - 0.0225011395815*L_M2(-1)-0.874888896764*L_TRD(-1) - 15.3208548463) + C(9)*D(L_GDP(-1)) + C(10)*D(L_INT(-1)) + C(11)*D(L_REER(-1))+ C(12)*D(L_M2(-1)) + C(13)*D(L_TRD(-1)) + C(14)

D(L_REER) = C(15)*(L_GDP(-1) - 0.00135898056896*L_INT(-1)-1.18538209208*L_REER(-1) - 0.0225011395815*L_M2(-1)-0.874888896764*L_TRD(-1) - 15.3208548463) + C(16)*D(L_GDP(-1)) + C(17)*D(L_INT(-1)) + C(18)*D(L_REER(-1))+ C(19)*D(L_M2(-1)) + C(20)*D(L_TRD(-1)) + C(21)

D(L_M2) = C(22)*(L_GDP(-1) - 0.00135898056896*L_INT(-1) - 1.18538209208*L_REER(-1) - 0.0225011395815*L_M2(-1)-0.874888896764*L_TRD(-1) - 15.3208548463) + C(23)*D(L_GDP(-1)) + C(24)*D(L_INT(-1)) + C(25)*D(L_REER(-1))+ C(26)*D(L_M2(-1)) + C(27)*D(L_TRD(-1)) + C(28)

D(L_TRD) = C(29)*(L_GDP(-1) - 0.00135898056896*L_INT(-1) - 1.18538209208*L_REER(-1) - 0.0225011395815*L_M2(-1)-0.874888896764*L_TRD(-1) - 15.3208548463) + C(30)*D(L_GDP(-1)) + C(31)*D(L_INT(-1)) + C(32)*D(L_REER(-1))+ C(33)*D(L_M2(-1)) + C(34)*D(L_TRD(-1)) + C(35)

There have five model. One is L GDP. Second one is L M2, Third one is L INT, Fourth one is L REER and Last one is L TRD.

In the first model L GDP, C(1) is the coefficient. C(2) is the coefficient and so on. C(7) is the constant.

Since 1st model end with C(7, second model will begin with C(8). Because it is system equation model. They are linked with each other.

These will happen in case of all the five models.

The last value is C(35). So, it can estimate 35 coefficients and 35 p values. To estimate all the coefficient, the study uses system equation with the help of Ordinary Least square Metheod.

Among the Five models in the system equation, the study will concentrate on only D.L_GDP. Because this is the dependent variable of this analysis. So, we have to run this system equation model {D(L_GDP) = C(1)*(L_GDP(-1) - 0.00135898056896*L_INT(-1)-1.18538209208*L_REER(-1) 0.0225011395815*L_M21) 0.874888896764*L_TRD(-1)-15.3208548463)+ C(2)* D(L_GDP(-1)) + C(3)*D(L_INT(-1)) + C(4)*D(L_REER(-1)) + C(5)*D(L_M2(-1)) + C(6)*D(L_TRD(-1)) + C(7)} with regression in below.

i. *Long Run Causality*

Table 9: Results of system equation regression of VECM.

Included observations: 29 after adjustments

D(L_GDP) = C(1)*(L_GDP(-1) - 0.00135898056896*L_INT(-1) - 1.18538209208*L_REER(-1) - 0.0225011395815*L_M2(-1) - 0.874888896764*L_TRD(-1) - 15.3208548463) + C(2)*D(L_GDP(-1)) + **C(3)***D(L_INT(-1)) **+ C(4)***D(L_REER(-1)) + **C(5)***D(L_M2(-1)) + **C(6)***D(L_TRD(-1)) + C(7)

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.417127	0.109387	-3.813311	0.0009
C(2)	0.275274	0.189997	1.448828	0.1615
C(3)	0.000321	0.002311	0.138799	0.8909
C(4)	0.175823	0.165289	1.063728	0.2990
C(5)	-0.010852	0.004947	-2.193599	0.0391
C(6)	-0.204901	0.096200	-2.129942	0.0446
C(7)	0.078770	0.019390	4.062367	0.0005

R-squared	**0.585857**	Mean dependent var	0.077249
Adjusted R-squared	0.472909	S.D. dependent var	0.051656
S.E. of regression	0.037503	Akaike info criterion	-3.522283
Sum squared resid	0.030943	Schwarz criterion	-3.192246
Log likelihood	58.07311	Hannan-Quinn criter.	-3.418920
F-statistic	5.186967	Durbin-Watson stat	2.211752
Prob(F-statistic)	**0.001850**		

Here, C1= Speed of adjustment toward equilibrium. Now, there are two issues the study have to discuss:

The guideline is, if the C(1) is negative in sign and significant, then we can say that , there is long run causality running from independent variables to dependent variable. And in practice, the coefficient of C1 with negative sign and probability value is 0.0009. Meaning that, There is long run causality from L INT, L REER, L M2, L TRD to L GDP.

ii. *Short Run Causality*

C(3)=0, C(4)=0 , C(5)=0 and C(6) =0

If these coefficients are zero , there is no short run causality running from from L INT, L REER, L M2, L TRD to L GDP.

How to check it?

It can check through using WALD TEST.

Table 10(a): Results of Wald Test

	WALD TEST
	Null Hypothesis: C(3)=0
Test Statistics	Probability
Chi-square	.8896

Here,

Null: L INT(-1) can not cause L GDP.

Alt: L INT(-1) can cause L GDP.

In table-8,

L INT(-1)= C(3) coefficient.

According to p value .8896, we cannot reject the null. Rather we accept null. That means, Coefficients C(3) in table-8 cannot affect dependent variable L GDP. There is no short run causality from L INT to L GDP.

Table 10(b): Results of Wald Test

	WALD TEST
	Null Hypothesis: C(4)=0
Test Statistics	Probability
Chi-square	.2875

Here,

Null: L REER (-1) can not cause L GDP.

Alt: L REER (-1) can cause L GDP.

In table- 8,

L REER(-1)= C(4) coefficient.

According to p value .2875, we cannot reject the null. Rather we accept null. That means, Coefficients C(4) in table-8 cannot affect dependent variable GDP. There is no short run causality from L REER to L GDP.

Table 10(c): Results of Wald Test

	WALD TEST
	Null Hypothesis: C(5)=0
Test Statistics	Probability
Chi-square	.0289

Here,

Null: L M2(-1) can not cause L GDP.

Alt: L M2(-1) can cause L GDP.

In table-8,

L M2(-1)= C(5) coefficient.

According to p value .034, we can reject the null. That means, C(5) in table-8 , can affect dependent variable L GDP. There is short run causality from L M2 to L GDP.

Table 10(d): Results of Wald Test

	WALD TEST
	Null Hypothesis: C(6)=0
Test Statistics	Probability
Chi-square	.0332

Here,

Null: L TRD(-1) can not cause L GDP. Alt: L TRD(-1) can cause L GDP.

In table-8 ,

L TRD(-1)= C(6) coefficient.

According to p value .034, we can reject the null. That means, C(6) in table-8 , can affect dependent variable L GDP. There is short run causality from L TRD to L GDP.

Summary of Wald Test

There is short run causality running from Money supply and Trade openness to Economic Growth. And There is no short run causality running from Interest rate and Exchange Rate to Economic Growth.

f) Diagonistic Tests

i. *Test of Heteroskedasticity*

According to the classical linear regression model (CLRM) assumption, the residuals should be homoscedastic in nature. Here, Null Hypothesis: There is homoscedasticity. And alternative hypothesis: There is no homoscedasticity.

Table 11(a): Results of Heteroskedasticity Test.

Heteroskedasticity Test: Breusch-Pagan-Godfrey
Null hypothesis: Homoskedasticity

F-statistic	1.437427	Prob. F(10,18)	0.2414
Obs*R-squared	12.87609	Prob. Chi-Square(10)	0.2307
Scaled explained SS	4.232359	Prob. Chi-Square(10)	**0.9363**

Since the Prob.chi-square is more than 5%. That is why, the null hypothesis cannot be rejected. So there is no Heteroskedasticity. This is desirable.

ii. *Serial correlation LM Test*

Table 11(b): Results of Serial Correlation Test.

Breusch-Godfrey Serial Correlation LM Test:
Null hypothesis: No serial correlation at up to 2 lags

F-statistic	0.691672	Prob. F(2,20)	0.5123
Obs*R-squared	1.876085	**Prob. Chi-Square(2)**	**0.3914**

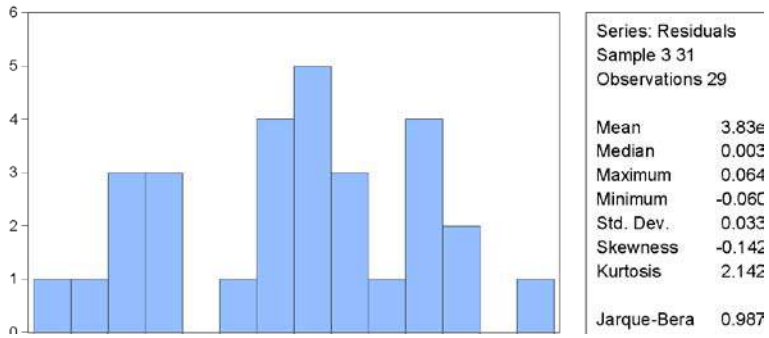
Here, the null hypothesis: there is no serial correlation in the residuals. And Alternative hypothesis: There is serial correlation in the residuals.

Since the probability value of chi-square .3914, which is less than 5%. So, we cannot reject the null hypothesis, leads to there is no serial correlation. This is desirable.

iii. *Normality Test*

Residuals should be normally distributed. To test the normality of the residuals, the study uses Histogram Normality Test. In histogram test, The Jarque-Bera Probability is more than 5%. That means, we accept the Null hypothesis, Residuals are normally distributed. This is desirable.

Table 11(c): Results of Histogram Normality Test.



g) Regression Analysis

The regression results reveal that market Real interest rate, Real effective exchange rate, M2 and Trade openness as explanatory variables have explained the variations in the economic growth (GDP) of Bangladesh.

Dependent Variable: L GDP

Table 12: Results of Regression Analysis.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	15.10695	0.982074	15.38270	**0.0000**
L_INT	**-0.008565**	0.005614	-1.525591	0.1397
L_REER	**1.333104**	0.174983	7.618475	**0.0000**
L_M2	**0.022138**	0.002829	7.824896	**0.0000**
L_TRD	**0.756725**	0.135209	5.596724	**0.0000**

R-squared	**0.980640**	Mean dependent var	24.85685
Adjusted R-squared	0.977542	S.D. dependent var	0.633339
S.E. of regression	0.094912	Akaike info criterion	-1.720720
Sum squared resid	0.225208	Schwarz criterion	-1.487187
Log likelihood	30.81080	Hannan-Quinn criter.	-1.646011
F-statistic	316.5754	Durbin-Watson stat	1.338312
Prob(F-statistic)	**0.000000**		

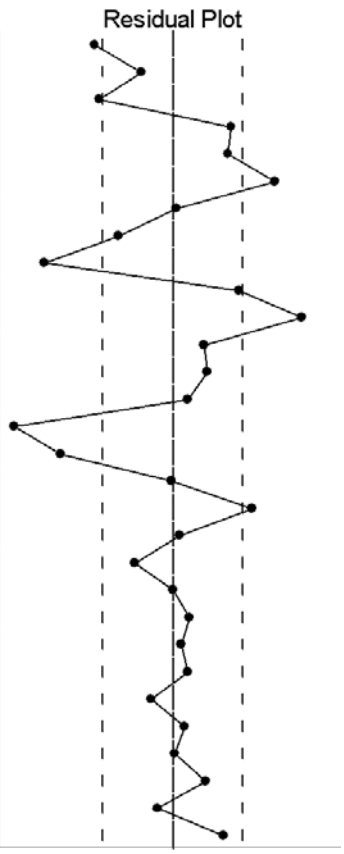
L_GDP=15.1069-0.0085L_INT+1.333L_REER+0.0221L_M2+0.7567L_TRD

In this regression model, R^2=.980, This is desirable. More than 60% of the R-squared value indicates the model is nicely fitted. That means, this regression model is nicely fitted with .996 R-Squared value. Besides this, probability value of F-statistics is less than 5%, which implies L INT, L REER, L M2 and LTRD are jointly good to explain the dependent variable. Through diagnostic checking, it is known that this regression model is beyond the existence of serial correlation and Heteroscedasticity. And the residuals are normally distributed. In short, all good attributes have in this model. In (table-), there are four independent variables. These are L INT, L REER, L M2 and L TRD. And all the independent variables become significant except L INT, since the p values are less than 5%. Table 10 shows that if interest rate is increased one unit, economic growth (GDP) is decreased by 0.0085 units. Again if Real exchange rate is increased by one unit, economic growth (GDP) is increased by 1.333 unit. Similarly, if Money supply and trade openness are increased by one unit, then the GDP increased by .0221 and .756 respectively. This implies that all independent variables except interest rate will have a long run positive impact on economic growth (GDP). Interest Rate has negative impact on GDP.

i. *Residuals*

The observations residual conditions are given below;

obs	Actual	Fitted	Residual
1	23.9136...	24.0189...	-0.1053...
2	24.0033...	24.0465...	-0.0431...
3	24.0830...	24.1829...	-0.0999...
4	24.1763...	24.0989...	0.07745...
5	24.1558...	24.0808...	0.07500...
6	24.1798...	24.0429...	0.13692...
7	24.2248...	24.2188...	0.00591...
8	24.2427...	24.3157...	-0.0729...
9	24.3592...	24.5335...	-0.1742...
10	24.5613...	24.4717...	0.08967...
11	24.5995...	24.4259...	0.17358...
12	24.6349...	24.5929...	0.04204...
13	24.6603...	24.6134...	0.04696...
14	24.7005...	24.6808...	0.01963...
15	24.7120...	24.9282...	-0.2161...
16	24.7255...	24.8773...	-0.1518...
17	24.8202...	24.8227...	-0.0024...
18	24.8993...	24.7909...	0.10841...
19	24.9637...	24.9538...	0.00987...
20	24.9974...	25.0492...	-0.0518...
21	25.1004...	25.1000...	0.00038...
22	25.2410...	25.2183...	0.02267...
23	25.3529...	25.3425...	0.01037...
24	25.4706...	25.4506...	0.01997...
25	25.5802...	25.6101...	-0.0298...
26	25.6162...	25.5996...	0.01665...
27	25.7338...	25.7306...	0.00318...
28	25.8758...	25.8321...	0.04371...
29	25.9966...	26.0195...	-0.0228...
30	26.1233...	26.0550...	0.06826...



ii. *Serial correlation LM Test*

Table 13(a): Results Serial Correlation LM Test.

Heteroskedasticity Test: Breusch-Pagan-Godfrey
Null hypothesis: Homoskedasticity

F-statistic	0.829290	Prob. F(4,25)	0.5192
Obs*R-squared	3.514293	Prob. Chi-Square(4)	0.4757
Scaled explained SS	2.724699	**Prob. Chi-Square**(4)	**0.6049**

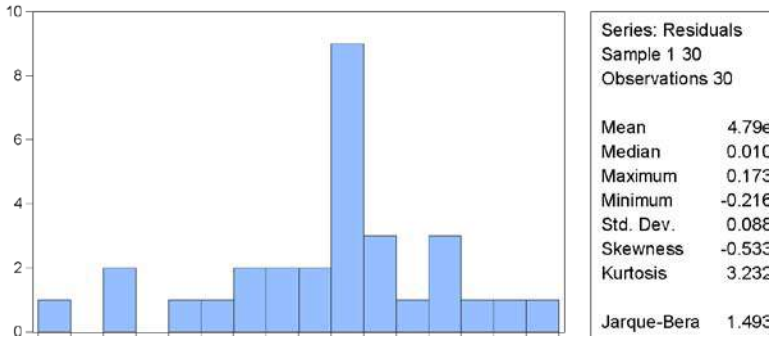
Here, the null hypothesis: there is no serial correlation in the residuals. And Alternative hypothesis: There is serial correlation in the residuals. Since the probability value of chi -square .0231, which is less than 5%. So, we can reject the null hypothesis, leads to there is serial correlation. The existence of serial correlation in the model is not desirable. Now we have to remove the serial correlation from the model.

This is possible through creating a variable that is one period lag of the dependent variable(L_GDP). The new variable become Lag_L_GDP. That means, Lag_L GDP=L_GDP(-1).

iii. *Normality Test*

Residuals should be normally distributed. To test the normality of the residuals, the study uses Histogram Normality Test. In histogram test, The Jarque-Bera Probability is more than 5%. That means, we accept the Null hypothesis, Residuals are normally distributed. This is desirable.

Table 13(b): Results of Histogram Normality Test.



VI. Limitation of the Study

A time constraint during conducting of the study was the major limitation of the study. The time available to finish the whole project was very limited especially with this kind of studies which involve complexity. No previous knowledge about research is another limitation of this study. The research is prepared on the secondary data, that is another limitation of this study. At the same time sample size is not enough due to lack of availability of the data.

VII. Conclusion

This study empirically explores the present relationship among Interest Rate, Money supply, Real Exchange Rate, Trade openness and economic growth in the context of Bangladesh. The empirical evidence demonstrates that there have long run positive relationship coming from Real exchange rate, Money supply and Trade openness to economic growth, except interest rate. Besides this, there have casual short term relationship coming from Trade openness and Money supply to economic growth in Bangladesh,.

VIII. Recommendations

- Since M2 has significant positive impact on GDP. This implies that if the money supply increases in considered that price level of goods and services will be increased in Bangladesh. That's why, for supplying money in the market Bangladesh bank should focus on price level and production condition of the economy.
- Interest Rate has negative long run relationship with Economic growth. So, policy makers should focus on interest rate, as possible as to the extend, lower interest rate. And make sure that not disencourage the foreign investment.
- Trade openness has long run and short run positive relationship with economic growth. So, as possible as to make the Bangladesh trade barrier free with sovereign. And making sure that the potential local traders are protected.
- Real exchange rate should be measurable. Because it's goodness depends on balance of payment. Sometimes appreciation of the exchange rate may harm the country's economic growth, when account's payables are higher than receivables.

References Références Referencias

1. Abdullah, I. (2013). nature of trade openness and its relationship with GDP growth. *IOSR Journal of Economic and Finance, 23*, 40-49.
2. Anokye, & George. (2007). Foreign direct investment (FDI) and stock market development: Ghana evidence. *IJEFM, 12(4)*, 276-311.
3. Arizonan. (1992). Exchange rate and economic development and FDI. *International Journal for Business and Economics*, 566-588.
4. Babalola, Oladapo, & Paul. (2015). Inflation, Interest Rates and Economic Growth in Nigeria. *European Journal of Business and Management, 7*.
5. Chong, & Tan. (2007). Stock Market index Development. *Internatinal Journal for Finance and Economics, 33*, 129-`145.
6. Dollar, R. (2005). Trade Liberlization and economic growth. *IQRJ*, 154-167.
7. Iqbal, J. (1998). Inflation, Interest Rates and Economic Growth in Nigeria. *European Journal of Business and Management, 7*.
8. Jaher, T. (2007). Exchange rate fluctution and economic growth. *JSOR International Journal*, 112-134.
9. Jakir. (2006). Trade Balance detderminants. *International Journal of Economics*, 433-456.
10. Jevando, Lius. (2004). Profitability and Exchange rate. *Journal for Business and Management.*, 137-178.
11. Joseph, & Vezos. (2006). Sensitivity of Interest Rate. *International Journal Economics, 32(3)*, 212-231.
12. Kendal. (2004). A Study on the Relationship between economic growth Foreign Exchange Markets. *International journal for Finance and Management, 35(3)*, 117-175.

13. Kim, & Choi. (2012). A Study on the Relationship between Korean Stock Index Futures and Foreign Exchange Markets. *International journal for Finance and Management, 35(3)*, 117-175.
14. Kurihara, & Nezu. (2006). sensitiviy of interest rate. *KuJL international journal, 23*, 133-245.
15. Liow, H. K., & Huang. (2006). Interest rate risk and time-varying excess returns for Asian property stocks. *Journal of Propery Investment & Finanance, 24(3)*, 188-210.
16. Liow, H. K., & Huang. (2006). Interest rate risk and time-varying excess returns for Asian property stocks and economic growth. *Journal of Propery Investmen & Finane, 24(3)*, 188-210.
17. Liu, & shrestha. (2008). Analysis of the long-term relationship between macro-economic variables and the Chinese stock market using heteroscedastic cointegration. *International journal of Economics, 56(5)*, 744-755.
18. Mahmudul, & Gazi. (2009). Relationship between Interest Rate and economic growth. *International Journal of business and Management*, 23-47.
19. Mahmudul, & Gazi. (2009). Relationship between Interest Rate and Stock Price. *International Journal of business and Management*, 23-47.
20. Mukherjee, & Naka. (1995). Dynamic relations between macroeconomic variables and the Japanese economic growth: an application of a vector error correction model. *Journal of Financial Research, 28(2)*, 223-237.
21. Nikiforos. (2010). Dynamic linkages between monetary policy and the stock market. *Review of Quantative Finance and Accounting, 35(3)*, 271-293.
22. Ologunde. (2007). *Interest Rate & Stock Market.* Newyork: NCH.
23. Ramin, & Chuin. (2005). Relationship among macroeconomic variables and economic growth. *UKM Journal of Management, 24*, 566-577.
24. Rosengren, E. (1992). Real exchange rate and economic growth. *International Journal for Economics and Management., 23(1)*, 122-165.
25. Sacha, & Diamond. (2016). The impact of interest rate on economic growth example of Nigeria. *African Journal of Social Science, 6(2)*, 51-64.
26. Zahid, I. (2007). Economic Development and Trade openness. *IJSR, 34*, 234-256.