Impact of Macroeconomic Variables on GDP of Bangladesh: An Empirical Analysis

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Abstract

Economies are not self-sufficient in the production of all kinds of goods and services. Each country has to import to meet its own demand. Bangladesh is no exception to this rule. Bangladesh is a developing country; its economy has been hit by a trade deficit since the beginning. Thus, this article examines the impact of exports, imports, and inflation on Bangladesh's GDP by applying the Augmented Dickey-Fuller (ADF) test, Johansen integration test, and Vector autoregressive model (VAR) analysis. To conduct this study annual time series data from 1982-2019 has been used. Exports, imports, and inflation are very potential macroeconomic factors for Bangladesh's economy. The results obtained concluded that the series was present and that the regression model was significant. Based on the results, exports had a positive but not significant relationship to GDP. Imports, on the other hand, had an insignificant and negative relationship to GDP. Inflation is a significant and positive relationship to GDP.

Keywords: *Exports, Import, Inflation and GDP*

JEL Classification: B22, B23, E24, E26, E31, J24, R23

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Introduction

Bangladesh is a developing country. It has enormous natural resources. The shortage of capital and technology, proper use of our natural resources is not utilized properly. As a result, we have to depend on foreign trade to import industrial products and raw materials to mitigate our demands. In this study, the prime focus is on examining the relationship between exports, imports, inflation, and GDP. As, GDP is one of the most important determinants of economic prosperity, thus the relationship between exports, imports, inflation, and GDP is a frequent topic of discussion when economists attempt to explain different levels of GDP.

The exports are one of the main sources of foreign exchange earnings, reducing the balance of payment pressures, and creating jobs. The argument about the role of exports as one of the main drivers of GDP is not new. It is rooted in the classical economic theories of Adam Smith and David Ricardo, who argued that international trade plays an important role in GDP. The neoclassical approach emphasizes the importance of competitive advantages in international trade. Each country maximizes its wealth through the most efficient action, given the scarcity of resources and factors of production in the economy. Imports are determined by both economic and non-economic factors. Imports are a potential instrument for Bangladesh's economic development and can play an important role in achieving the country's socio-economic goals, including poverty reduction goals. As a lower-middle-income country as Bangladesh, imports can be an important factor in increasing physical capital, developing production capacity, and integrating the national economy into the world economy. Inflation is defined as a continuous increase in the general price level. Inflation is a sign of GDP growth, but high inflation damages GDP and negatively impacts GDP. Even zero inflation is detrimental to other sectors of GDP as prices, profits, and employment fall.

1.1 Objectives of the Study

The main objective of this study is to investigate the impact of export, import, and inflation on GDP in Bangladesh. To achieve this, the specific objectives of this study are:

- Find out the relative importance of the determinants of import.
- Estimate an idea of the nature and relative importance of determinants of export.
- To identify the relative importance of the determinants of inflation.

1.2: Hypothesis

H1. Is there any significant relationship between export and GDP?

H2. Is there any significant relationship between imports and GDP?

H3. Is there any significant relationship between inflation and GDP?

2. Review of Literature

Usman, Ashfa, and Mushtaq (2015) analyze the effects of exports on Pakistan's GDP. This was an empirical analysis of the relationship between exports and GDP for more than 30 years (1980-2009). The results show that exports, inflation, and the real exchange rate have a strong positive and significant impact on GDP. Ogid, Mulok, Ching, Lily, Ghazali, and Loganathan (2011) examined the relationship between Malaysian GDP and imports between 1970 and 2007. The results show that there is no integration between GDP and imports., but GDP is bilateral causality.

Rahmaddi & Ichihashi (2011) used a causality approach based on a multivariate error correction model in this study. The study showed the importance of both exports and GDP for the Indonesian economy. In addition, the researchers found no evidence of a positive causal relationship between intermediate imports and GDP per capita.

Erbaykal and Okuyan (2011) examined the relationship between inflation and GDP in Turkey in the context of 1987: 1–2006: 2 data. In the long run, the existence between these two variables has been investigated by a developed binding test.

Yuhong Li (2010) conducted integration analyzes with import, export, and GDP data, and the results suggest that import growth strongly contributed to China's GDP, while export growth does the opposite. Ullah et al. (2009) analyzed export-led growth using econometric techniques using time series 1970–2008 to Pakistan. The results of this study show that export growth leads to GDP.

Saaed (2007) examined the relationship between inflation and GDP in Kuwait using data on the annual real GDP and consumer price index for 1985–2005. The estimated outcome of the ratio shows that there is a strong and long-term inverse relationship between the consumer price index and real GDP in Kuwait. Mubarik (2005) estimated Pakistan's inflation threshold on the basis of annual data from 1973–2000.

Malik and Chowdhury (2001) examined the short- and long-term dynamics of the relationship between inflation and GDP in four South Asian economies: Bangladesh, India, Pakistan, and Srilanka. Applying co-integration and error correction models to the International Monetary Fund

(IMF) annual financial statistics (IFS) data, they found two motivating results.

Faria and Carneiro (2003) looked at the relationship between inflation and GDP in Brazil, which until recently had to face persistently high inflation. Analyzing the two-variable time series model (i.e., vector auto-regression) with annual data for the period 1980-1995, they found that inflation and GDP.

Malla (2002) conducted an empirical analysis on a small sample of Asian countries and countries that are members of the Organization for Economic Co-operation and Development (OECD). Adjusted for labor and capital, the results suggest that there is a statistically significant negative relationship between GDP and inflation in OECD countries, including the first difference.

Barro (2000) examined the relationship between inflation and GDP using an extensive sample of more than 100 countries between 1960 and 1990. His empirical results show that there is a statistically significant negative relationship between inflation and GDP. Certain land characteristics (e.g., fertility rate, education, etc.) are considered constant.

Bruno and Easterly (1999) examined GDP drivers using annual consumer price inflation in 26 countries that experienced an inflation crisis from 1961–1992. According to their empirical analysis, the inflation rate is 40%. And more on the eve of the inflation crisis. In their view, the relationship between inflation and GDP is inconsistent or somewhat unclear below this threshold when countries with a high inflation crisis are excluded from the sample.

3. Data sources & Description

The data used in this study is time series of annual data covering the periods 1982-2019. The three economic variables included in the study are exports, imports and inflation. The selected data set consists of observations like GDP (in US dollars), Exports of goods and services (in US dollars), Imports of goods and services (in US dollars) and Inflation (as a percentage). All data sets are taken from world development indicators. From the online version of the World Databank.

4. Methodology

The estimation methodology employed in this study is the Co-integration and VAR modeling technique. The entire estimation procedure consists of three steps.

- Unit Root Test,
- Johansen Co-integration Test,
- Vector Autoregressive Model (VAR).

Augment Dickey-Fuller tests are using to examine the stationary of variables. Many macroeconomic variables in time series are not stationary. If a series is stationary, then the shock imposed on is the elimination, and variable returns to its long-term equilibrium. On the other hand, if the time series is non-stationary, the mean or variance or both are a function of time. And if the time is infinite, varying the variables will be infinite. Therefore, the variable will be diverging away from its path equilibrium.

Johansen Co integration Test is using because we do not know either those variables have a long-run association or short-run association. If those variables have a long-run association, we can run the Vector Error Correction Model (VECM). And if those variables have a short-run association, we can run the Vector Autoregressive Model (VAR).

Vector Autoregressive Model (VAR) is using to examine the independent variables are significant or not significant. That means they reject or accept the null hypothesis. The negative or positive relationship between the dependent and independent variables. The model is significant or not.

Formulation of General Model

The primary model showing the relationship among GDP, Export, Import, and inflation in Bangladesh can be specified thus:

$$GDP = \beta_1 + \beta_2 \text{ export} + \beta_3 \text{ import} + \beta_4 \text{ inflation} + \varepsilon$$

Where:

Dependent variable: GDP

Independent variable: Export, Import & Inflation.

Here, β_1 is the constant term and ε is the random error term assumed to be normal, identically, and independently distributed. Here, β_2, β_3, and β_4 represent the coefficient of regression.

The model can also be represented in thus format:

$$\ln GDP = \beta_1 + \beta_2 \ln \text{export} + \beta_3 \ln \text{import} + \beta_4 \ln \text{inflation} + \varepsilon \ln GDP = \beta_1 + \beta_2 \text{ export} + \beta_3 \text{ import} + \beta_4 \text{ inflation} + \varepsilon$$

$$GDP = \beta_1 + \beta_2 \ln \text{export} + \beta_3 \ln \text{import} + \beta_4 \ln \text{inflation} + \varepsilon$$

5. Empirical Analysis

5.1 Unit Root Test

Macroeconomic time series data are generally characterized by a stochastic trend which can be removed by differencing. Some variables are stationary on levels, others become stationary after one differentiation, and some may become stationary by more than one differentiation. For any econometrics analysis, it is most important to check the data stationary. To test for the stationary of the variables, the Augmented Dickey-Fuller (ADF) technique is

utilized. In case of the Dickey-Fuller Test, problem of autocorrelation can arise. To tackle the autocorrelation problem, Dickey-Fuller have developed a test called Augment Dickey-Fuller Test (three models).

1. Model One: Intercept Only
2. Model Two: Trend & Intercept
3. Model Three: No Trend & Intercept

In order to check whether variables have unit root or not which means stationary or not, there is also need to check all the three models arrive at the same decision. Otherwise, we need differentiation.

ADF test was applied to the series and the following findings were obtained. The 5% significance level was taken into account in the analysis. When the absolute value of test statics is more than the critical value, then null hypothesis is rejected. But when the absolute value of test statics is less than the critical value, the null hypothesis is accepted.

Table 1: Model One (Intercept Only)

Time variable: year, 1982 to 2019

Delta: 1 year

dfuller gdp, regress lags (0)

Dickey-Fuller test for unit root Number of obs. =34

	Test	1% Critical	5% Critical	10% Critical
Z(t)	8.608	-3.689	-2.975	-2.619

MacKinnon approximate p-value for Z (t) = 1.0000

Model Two (Trend & Intercept)

Time variable: year, 1982 to 2019

Delta: 1 year

dfuller gdp, trends regress lags(0)

Dickey-Fuller test for unit root

Number of obs. =34

	Test Statistics	1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	4.332	-4.297	-3.564	-3.218

MacKinnon approximate p-value for Z(t) = 1.0000

Model Three (No Trend & Intercept)

Time variable: year, 1982 to 2019

Delta:1 year

dfuller gdp, noconstant regress lags(0)

Dickey-Fuller test for unit root Number of obs. =34

	Test Statistics	1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	11.076	-2.646	-1.95	-1.604

MacKinnon approximate p-value for Z(t) = 1.0000

Model One

We find that the absolute value of test statics is 8.068 which is greater than the test critical value of 5%. So we can reject the null hypothesis which is the level (Intercept only) of GDP does not have unit root and conclude that the data is stationary.

Model Two

We find that the absolute value of test statics is 4.332 which is greater than the test critical value of 5%. So we can reject the null hypothesis which is the level (Trend &Intercept) of GDP does not have unit root and conclude that the data is stationary.

Model Three

We find that the absolute value of test statics is 11.076 which is greater than the test critical value 5%. So we can reject the null hypothesis which is the level (No Trend &Intercept) of GDP does not have unit root and conclude that the data is stationary.

Finally we say that all the three model came to same decision that GDP does not have unit root. That means the data is stationary.

5.2 Johansen Co-integration Test

We have to estimate the VAR model or VECM and we have four variables such as GDP, Export, and Import & Inflation. We should run the Johansen Co-integration Test because we do not know either those variables have a long-run association or short-run association. If those variables have a long-run association, we can run the Vector Error Correction Model (VECM). And if those variables have a short-run association, we can run the Vector Autoregressive Model (VAR).

When the absolute value of test statics is more than the critical value, we can reject the null hypothesis. That means there is co-integration, meaning that long-run association among those variables. But when the absolute value of test statics is less than the critical value, we cannot reject the null hypothesis. There is no co integration, meaning that short-run

association among those variables. That is always a guideline.

Table 2: Johansen tests for co-integration

Trend: constant Number of obs. = 32

Sample: 1985 - 2019 Lags = 3

Table 3: Johansen Co-integration Test

Maximum	parms	LL	Eigenvalue	Trace	5% Critical Value
0	36	-2181.6669	.	35.6199*	47.21
1	43	-2172.3889	0.44003	17.064	29.68
2	48	-2165.3645	0.35534	3.015	15.41
3	51	-2163.8588	0.08981	0.0037	3.76
4	52	-2163.8569	0.00012		

Table 4: Johansen Co-integration Test

Maximum Rank	parms	LL	Eigenvalue	Trace Statistic	5% Critical Value
0	36	-2181.6669	.	18.5559	27.07
1	43	-2172.3889	0.44003	14.049	20.97
2	48	-2165.3645	0.35534	3.0113	14.07
3	51	-2163.8588	0.08981	0.0037	3.76

Here the maximum rank 0 is the null hypothesis. We find that the value of test statics is 35.6199 which is less than the test critical value of 5%. So, we cannot reject the null hypothesis. There is no co-integration, meaning that short-run association among those variables.

Similarly, the value of max statics is less than the test critical value of 5%. So, we cannot reject the null hypothesis, meaning that there is no co-integration & short-run association among four variables such as GDP, Export, Import, and Inflation.

So, we can see that test statics and max statics, they are telling the same thing that variables are not co-integrated. So, we can run unrestricted Vector Autoregressive Model instead of Vector Error Correction Model.

5.3 Vector Autoregressive Model

We have seen that our four variables such as GDP, Export, Import, and Inflation are not co-integrated. So, we can run unrestricted Vector Autoregressive Model.

Table 5: Unrestricted Vector Autoregressive Model

Time variable: year, 1982 to 2019

delta: 1 year

. var gdp, lags(1/3) exog(Export-Import inflation)

Vector auto regression

Sample: 1985 - 2019 No. of obs. =35

Equation	Parms	RMSE	R-sq	chi2	P>chi2
gdp	7	2.60E+09	0.997	9524.92	0

Log likelihood =-735.6776 AIC=46.41735

FPE=8.50E+18 HQIC =46.52363

Det (Sigma_ml)=5.45E+18 SBIC=46.73798

Table 6: Vector Autoregressive Model

gdp	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]	
L1.	1.140824	0.1573635	7.25	0	0.8323971	1.449251
L2.	-0.4261484	0.231024	-1.84	0.065	-0.8789472	0.0266503
L3.	0.4362815	0.1720054	2.54	0.011	0.099157	0.773406
Export	1.079204	1.607883	0.67	0.502	-2.072189	4.230597
Import	-0.2759896	1.049644	-0.26	0.793	-2.333253	1.781274
inflation	3.94E+08	1.15E+08	3.44	0.001	1.69E+08	6.18E+08
_cons	-5.42E+09	1.28E+09	-4.22	0	-7.93E+09	-2.90E+09

Slope Coefficient: The slope coefficient of about 1.079 suggests that if the export goes up by $1, the GDP goes up, on about by $1.079. The slope coefficient of about -0.275 suggests that if the import goes up by $1, the GDP goes down, on about by $0.275. The slope coefficient of about 3.94 suggests that if the inflation goes up by $1, the GDP goes up, on about by $3.94.

Significant Test: Export is not significant because p-value 50.2% which is greater than 5% meaning that export is not a significant variable to explain GDP. Import is not significant because p-value 79.3% which is greater than 5%. It is not a significant variable to explain GDP. Inflation is significant because its p-value 0.1% which is greater than 5% meaning that inflation is a significant variable to explain GDP. There is a lack of research on the impact of export, import & inflation on economic growth in Bangladesh. This research shows the present scenario of the impact of Export, Import & Inflation on GDP. That is why this research is not so significant. This research found an alternative hypothesis is true for Export & Import. The null hypothesis is true for Inflation.

R Squared: The desired level for R -squared is 0.80. But in the regression analysis, I found R -squared = 0.9967. It is greater than the desired level. The

R -the squared value of about 0.99 means that 99% variation in GDP can be explained by our three independent variables such as export & import and inflation jointly. And the rest 1% of the variation in GDP can be explained by another variable that is not by export & import and inflation. This model is nicely-created. The data or variable is fitted well.

5.4 Regression Model is Good Fit: The probability value is 0.000 which is less than 0.05. So, we say that it is significant meaning that export, import, and inflation jointly can influence GDP in the population. Also, according to the R -the squared value we say that the model is a good fit and thus we may reject the null hypothesis.

6. Conclusion

In the literature, **t**he yearly data was used in very few studies that investigate the relationship between Export, Import, Inflation, and GDP. To best of the author's knowledge for the first time, this work has been carried out by using the STATA test based on the yearly data reported by the period of 1982-2019. From our empirical results, it is seen that the paper tested the series for stationary using the ADF test, and the variable proved to be integrated of the order one and found that the series is stationary at the level and some are stationary after one differentiate.

From the unrestricted Vector Autoregressive Model (VAR), we found that export has a positive & insignificant effect on the GDP of Bangladesh. Importance has a negative and insignificant effect on the GDP of Bangladesh. And inflation has a positive & significant effect on that. The model is a good fit and thus I reject the null hypothesis and accept the alternate hypothesis.

As this research covers four variables only, there is a scope to cover more variables in the future. When we investigated the impact of export, import & inflation on GDP in Bangladesh, we expected that Export is positive, significant and import is negative & insignificant. Moreover, the finding of the research shows Export & Imports are insignificant but Inflation is significant for the economic growth of Bangladesh. So there is a scope for further research on this topic.

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