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A causality analysis between trade and economic growth of Pakistan

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ABSTRACT
The present study core objective is to find the linkages between Pakistan's exports-imports and Gross Domestic Product (GDP), using data over the period 1981-2016. Unit root in each series is checked with the help of Augmented Dickey Fullers' (ADF) test. The Engle Grange approach is utilized to determine the long run relationship among variables of the study. Moreover, causality among the selected variables is tested by the methodology of Vector Error Correction Model (VECM). In results, we found that all selected variables are first difference stationary and causality run from GDP to exports and imports of the country. In both cases, the causality is positive and significant. No reverse causation was observed from exports-imports to GDP. Finally, the results demonstrate that the causal connection among GDP and imports is stronger than the GDP and exports.

Keywords
Imports, Exports, Economic Growth, Causality
JEL Classification
F14; F43

1. Introduction

Economic growth can be viewed as a shift in its production possibility frontier or an expansion in the country's total output or production. Many factors affect economic growth that also includes country's imports and exports. The exports growth has generally been associated with the economic growth. Exports represent higher demand for the country's products and to meet more demand there is an increase in prices and production of that particular commodity. Export-Led Growth (ELG) hypothesis states that an increase in exports enhances economic growth. Exports directly contribute to the gross domestic product (GDP). Exports allow a country to benefit from the large global markets or economies of scale (Helpman & Krugman, 1985). Rodrick (1988) stated that exports lead firm to large-scale production, technological change and an increasing rate of capital formation.

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When domestic output increases more than domestic demand, then the surpluses are exported to various markets. This further increases the demand, boosting the output and thus there is a direct relationship between economic growth and export growth (Sharma & Dhakal, 1994). Ramos (2001) examined the export-import and GDP growth relationship for Portugal economy. He found bidirectional relationship between GDP and imports as well as GDP and exports while no link between export and import was observed. Generally, literature emphasizes country's exports are the major source of economic growth. Exports play an important role in society's welfare by improving people' living standard through increase in per capita income. The advocates of economic growth view that the rate of economic growth can be accelerated with the help of exports. The empirical research has produced bi-directional results such as economic growth can be accelerated with increase in exports but the exports can also be encouraged with economic growth. Consequently, both the relationships that export leading to promote economic growth and growth leading to promote exports are possible.

Thus, it is important to estimate the relationship between the exports and economic growth of a country. Sharma et al. (1991) employed Granger Causality approach and identified positive relationship between economic growth and exports. Dodaro (1993) employing a country-wise time series data and using causality approach found weak support for the existence of ELG. He also found a weak support for the alternative augmented growth-led-export hypothesis too but somewhat stronger than the ELG. Hatemi (2002) on the other hand reported a bi-directional causality between economic growth and exports for the Japan.

Since the previous research has produced conflicting results such as positive, negative, unidirectional or bidirectional relationship while studying the exports and GDP growth relationship. Therefore, this research is undertaken with a view to revisit the country's data and explore the direction of relationship between Pakistan's exports and economic growth. This research paper uses Engle-Granger and Vector Error Correction Model (VECM) methods where the aim is to test for the existence of co-integration and causality relationships among the exports-imports and gross domestic product or economic growth of Pakistan. Previously, in case of Pakistan using the time series approaches, a bidirectional relationship has been found between economic growth and exports (Shirazi and Manap, 2004, and Iqbal et al., 2012). This research not only uses more recent larger data set but also investigates the imports and economic growth nexus as well.

2. Literature review

Exports and imports play a pivotal role in getting a high economic growth and economic development of a country. Examination of the impact of these two variables on economic growth has been studied both empirically and theoretically albeit with conflicting results. The mixed results from the previous research motivated this research. Some of the previous research is reviewed here with the aim to identify the gaps in the literature, get guidance in the development of both the theoretical and empirical models and finally compare the results. The relevant literature is outlined here as follows:

In literature, it has been found that either unidirectional or bidirectional GDP growth and exports nexus existed. Gibba and Molnar (2016) explored the economic growth and export relationship for Gambia using data for the period 1980-2010. They found that the export causes economic growth to grow. Oxley (1993) utilized Granger-Causality test over Portuguese data, 1983-1995, and failed to accept the hypothesis of export-led growth while favoured reverse causality that income growth causes export growth. Ram (1985) studied the export led growth relatively for large number of developing countries over the period of 1960-1977. Using Granger Causality test, found that exports performance did not seem important for economic growth, however, and the exports impact on economic growth was small in the low income developing countries as compared to the middle income developing countries. Furthermore, some studies found causality from growth rate to exports such as Shihab et al. (2014) and Findly (1984). Alkhateeb et al. (2016) analyzed the relationship between exports and economic growth for Saudi Arabia over the period 1980-2013 by utilizing co-integration approach and causality test where the study found bidirectional causality between GDP and exports.

Hussain and Afaf (2014) used both the causality test and co-integration approach to estimate the impact of exports and imports on Saudi Arabia economic growth over the period of 1990-2011. They found a statistically significant unidirectional causality running from exports to GDP growth but imports to GDP growth was not found to be statistically significant. Ajmi et al. (2015) tested the causal link between export and economic growth by applying the methodology of linear and non-linear Granger causality tests. This study used annual data for South Africa from 1911-2011. From linear Granger causality test, Ajmi et al. (2015) did not find significant evidence of causality between export and GDP for South Africa. However, with non-linear causality test found unidirectional causality from gross domestic output to exports. Asafu-Adjaye et al. (1999) also did not find causality relationship in the case of India. Therefore, the studies of the Ajmi et al. (2015) and Asafu-Adjaye et al. (1999) did not confirm the evidence of export-led growth hypothesis. Yuhong et al. (2010) found direct relationship between the economic growth and imports for China also between growth and imports. Achchuthan (2013) also concluded that as imports increases, economic growth also increases. The studies of Haseeb et al. (2014), Irwan et al. (2015), and Khan et al. (2016) tested causality between exports and economic growth relationships. The estimated results of all the above studies concluded that exports and growth are significantly positive correlated. Yuksel and Zengin (2016) analysed the export, import and growth causality relationships for six developing countries (i.e. Argentina, Brazil, China, Malaysia, Mexico and Turkey) using data for the period of 1961-2014. Using time series econometrics techniques to measure for causality and co-integration, it was found in this study that in case of Argentina, increase in exports lead to an increase in economic growth. However, in the case of China and Turkey, imports caused exports to grow in the country as well. The imports - economic growth relationship varied for the countries under study.

Due to the mixed results indicated in the studies reviewed above, we aim to investigate the casual relationships among economic growth, imports and exports. This is achieved by estimating the co-integration and causality between imports and GDP growth, exports and GDP growth for Pakistan economy over the period 1981-2016.

3. Research methods

3.1.Data

In this research we have employed annual data to test for possible relationship as well as to found the direction of causality between exports and economic growth of Pakistan. The data period is from 1981 to 2016. The data were collected from two major databases of International Financial Statistics (IFS) and Pakistan Economic Survey. All variables of the study are in nominal term and in millions of rupees. Moreover, these variables have been converted into natural logarithm.

3.2. Empirical model

Earlier empirical formulations tested the causality by having only the GDP growth and exports in the model (Emely, 1968). Other studies examined this relationship in the neoclassical framework (Balassa, 1978; Fosu, 1990). However, Guntukula (2018) examined the relationship among exports, imports and growth for different nations. We used the following specifications of the economic growth, exports and imports:

$$GDP = f(X, M) \tag{1}$$

The log-linear econometric form of Equation (1) can be represented as follows:

$$lnRGDP_t = a + \gamma lnRX_t + \delta lnRM_t + \varepsilon_t \tag{2}$$

Where RGDP stand for real gross domestic product, RX and RM stand for real exports and real imports respectively. The last term of equation ε_t is the white noise term. The parameters γ and δ represents the magnitude of change in dependent variable due to changes in the independent variables. The *ln* stands for natural logarithm which means that we get changes in percentage terms - we get elasticities.

3.3. Econometric analysis

3.3.1. Engle-Granger approach of co-integration

This study utilizes the Engle-Granger (EG) procedure of co-integration for long run analysis. Engle Granger analysis of co-integration requires that all the variables of model are stationary at same level of integration. The stationarity can be examined with the help of augmented dickey filler (ADF) test.

3.3.2. The vector error correction model (VECM)

Vector of Error Correction Model (VECM) is used to test the causal relationships among variables. The VECM is helpful for measuring the causality when variables are stationary at first order rather than level (Engle-Granger, 1987). the VECM model based on equation 2 can be written as follows:

$$\Delta lnRGDP_t = \alpha_0 + \sum_{i=1}^{m} \alpha_i \Delta lnRGDP_{t-i} + \sum_{i=1}^{n} \gamma_i \Delta lnRX_{t-i} + \sum_{i=1}^{p} \delta_i \Delta lnRM_{t-i} + \sigma EC_{t-1} + \varepsilon_t \quad (3)$$

Where Δ in equation 3 is the difference operator; the subscripts m, n, and p over summation are the numbers of lags. The EC represents the error correction term and can be obtained from the regression model of co-integration. The coefficient on the EC term needs to be negative and significant. It shows the correction of the disequilibrium adjustment towards the equilibrium. The rate at which this disequilibrium can be adjusted/corrected depends on the sign, magnitude and statistical significance of the error correction term.

4. Results and discussions

Use of time series data techniques require that the data is tested for stationarity and accordingly use the time series techniques as estimating the ordinary least squares (OLS) regressions on non-stationary data may produce spurious results. Therefore, prior to using co-integration, first we need to test for unit roots. For this we use Augmented Dickey Fuller (ADF) test. After that, we do co-integration analysis. The VECM will be used to test for the nature of causal relationships.

As stated, ADF test is used to check the stationarity of variables. The results of the ADF test are provided in table 1 as follows:

Table 1: ADF test results of unit root with constant and trend

Variable	**At level**		**At 1st difference**	
	t-test	Critical values at 5 %	t-test	Critical values at 5 %
RGDP	-2.332 (0.406)	-3.548	-4.414* (0.006)	-3.548
RX	-0.571 (0.974)	-3.548	-7.457* (0.000)	-3.548
RM	-2.201 (0.474)	-3.548	-6.371* (0.000)	-3.548

*The values in parenthesis are probability values. * indicates 1 percent level of significance.*

In table 1 we find that none of the data series is stationary at level since p-values in parenthesis are larger than the standard 5% and 1% level of significance and the absolute values of test-statistics (t-test) are smaller than its critical values. Therefore, fail to reject the null hypothesis and conclude that all the data series have unit roots at level. However, when the first difference of the data is taken, we find that all the data become stationary. Knowing that all the data is stationary at first difference, we can estimate the co-integration relationships.

We first estimate the model given in equation 2 using the ordinary least squares method, so as to get the estimated residuals which shall be utilized to test for the cointegration. Unit

root tests of ADF and Phillips-Perron (PP) are used to test for stationarity. Consequently, table 2 reports the ADF test and PP test results of an error term as following.

Table 2: Unit test results of residuals

Equation of regression	ADF test at level		Phillips Perron test at level	
GDP = f(X, M)	t-test	p-value	t-test	p-value
	-1.836	0.063	1.950	0.050

From above results, it can be seen that the residuals are stationary at level utilizing both the unit roots. We can conclude that variables in model are co-integrated or have long run relationship. Finally, the VECM is used for testing causality among the variables.

In order to run the VECM model to determine the causalities, we first specify the lag length using lag length criteria. The optimum lag length is calculated as one as indicated by esteric (*) in table 3 below on the basis AIC and SC.

Table 3: Results for lag order selection

Lag	FPF	AIC	SC	HQ
1	1.32e-07*	-7.331098*	-6.922959*	-7.193772*
2	1.40e-07	-7.279104	-6.462827	-7.004452
3	1.95e-07	-6.981379	-5.756964	-6.569401

**show lag order specification based on different criteria such as AIC, SC and HQ etc,*

After calculating the lag length, the VECM results are obtained and given in the table 4. Table 4, indicates the direction of causality. The *p-value* is less than 0.05 when causality direction is from GDP to exports and GDP to imports; it implies an existence of the casual relationship. However, no converse causal relationship either from exports or imports to GDP is observed. Therefore, there is unidirectional causality indicating that GDP stimulates exports and imports.

Table 4: Results of VECM for exports, imports and growth

Causality direction	Lag length	Chi-sq	P-value	Results
Exports →GDP	1	2.998	0.223	No causality relationship
Imports →GDP	1	2.500	0.286	No causality relationship
GDP →Exports	1	6.791	0.033	Causality relationship
GDP →Imports	1	8.006	0.018	Causality relationship

5. Conclusion

The main aim of this research was to explore the long and short run relationship between the economic growth, exports and imports. Owing to the mixed results obtained in previous research regarding the causality between the GDP growth and imports and GDP growth and exports, we undertook this study for Pakistan using the time series data from 1981-2016. First, we employed ADF test to check for the unit root and then applied Engle-Grange approach for co-integration and the VECM for exploring the causal relationships. The

Engle-Granger approach is performed to identify co-integration among exports, imports and economic growth. The Engle Granger result revealed that variables exhibited long-run relationship or had co-integration. The VECM of causality analysis was used to test the causality. We found a unidirectional causality. The estimation results lead to a confirmation of causality from GDP to exports and GDP to imports but not vice versa. The causal effect from GDP to exports as well as imports is positive and statistically significant. This implies that an increase in GDP leads to an increase in exports and imports in context of the Pakistan economy over the period of analysis. Further, we can conclude that contrary to the general expectations there is no evidence of ELG hypothesis for the Pakistan. The reason for this could be that Pakistan's exports are not very diversified and not a major contributor to the GDP. However, causality direction from exports to GDP growth is positive but not statistically significant. It is suggested that efforts may be made to increase the volume of GDP by mainting a healthy growth rate over a long period of time to increase the exports.

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