Exports, Imports and Economic Growth Nexus: Time Series Evidence from Pakistan

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Abstract: This study uses the Granger causality and co-integration tests to examine the long-run correlation among economic growth, exports and imports of Pakistan taking time series data for the time period 1972-2009. The results based on Error-Correction Model show the existence of long-run correlation among exports, imports and economic growth. Both exports and imports are considered an essential part for economic growth of Pakistan. Moreover, economic growth has an important impact on exports and imports. A successful and sustained economic growth requires growth of both exports and imports. The results of this research have important implications for macroeconomic policies of the nation.

Key words: Economic growth • Exports • Imports • Pakistan • Co-integration and Granger causality tests

INTRODUCTION

Development is the main aim of any economy. The basic of economic development is economic growth. Trade plays a key role in economic prosperity along with exports of the economy. In order to promote economic growth, export-led growth is considered as the key to accelerate the returns of all factors of production. It also raises new investment channels due to higher level of saving correlated with high rate of income, which promotes growth of various economic sectors. The role played by exports to promote the growth of an economy occupies the main stage in the development literature where export promotion and increased trade openness have gradually replaced import substitution along with economic growth. The trade openness shifts the trade policies from being highly import substituting as well as government controlled to become deregulated and more liberalized.

Several past studies have examined the export-led growth hypothesis with reference to Pakistan [1-4]. Previous Study [1] concluded bi-directional long-run causality between exports and gross national product (GNP) as well as between manufactured exports and gross national product (GNP). The results also concluded uni-directional long-run causality from GNP growth to exports of primary goods. They also found short-run bi-directional causality between exports and GNP, between manufactured exports and GNP and between primary exports and GNP. [3] also reveals bi-directional causality between output growth and exports. Previous research [2] examined evidence which give support to export-led growth hypothesis both in the long-run and in the short-run using annual data of Pakistan for the period 1970-2000. They do not find evidence of co-integration between Pakistan’s real exports and real GDP [5]. Their results also have not demonstrated evidence of causality between these two variables.

[6-10] analyzed the performance of economic growth within a neo-classical framework by using the ordinary least squares (OLS) method on cross-sectional data. Researchers considered the export as an essential ingredient in the determination of economic growth. [11] conducted study of seventy developing countries for the time period 1960-1981. They found that growth rate of export and changes observed in ratio (export/GDP), which are closely related to growth rate of GDP. [12] found huge productivity in the export sector as to compare with the non-export sectors [13] used the ordinary least square (OLS) of data taken from seventy countries by rejecting the export-led growth hypothesis.

Recently deep attention has been given to the time series analysis to conduct the long-run relation between economic growth and export and the direction of causality between them. It has been observed that investigations consist of LDCs have applied the econometric approach of co-integration and did not link correlation between these variables as present in the long-run [14]. Some of the researchers found the long-run correlation while many others studies have criticized the hypothesis of the export-led growth.
[15-18] examined that the countries which are exporting a huge output result faster growth than other economies. The export growth has a significant impact on technological improvements as well as other externalities. [19, 20] concluded that due to international trade the number of specialized inputs will be improve which lead to increase in economic growth rate as environment for international trade become favorable.

Increasing GDP often correlates to expansion in trade, unless resources of growth and condition of trade remain the same [21]. Recently, the product life cycle hypothesis has also gained a considerable attention among the international theorists like [22, 23] who have taken the hypothesis of life cycle as a basis to analyze trade between the firms and the industries illustrate the productivity innovation in the north.

This study has explicitly incorporated imports of the economy to analyze their role in the export growth and economic growth relationship. The literature on economic development and trade has emphasized the export to accelerate growth of the economy. It is argued that exports are help full in economic growth process through different channels e.g. economies of scale, efficient allocation of economic resources, enhanced capacity utilization, improved productivity of factors of production and diffusion of innovation and technological knowledge. Export oriented policies have taken key place among different policies of so many countries of the world.

MATERIALS AND METHODS

The Data: The basic theme of the study is to explore the relation among exports, imports and growth of Pakistan’s economy. This study uses time series data of Pakistan for the period 1972-2009 taken from World Bank [24]. It uses GDP measured at constant 2000 US$ (GDP), exports of goods and services measured at constant 2000 US$ (EXP) and imports of goods and services at constant 2000 US$ (IMP).

Gross Domestic Product (GDP): Real GDP is the monetary value of all finally produced goods and services, in the economy during a specific time period e.g. year. This study uses GDP measured at constant 2000 US$.

Exports (EXP): Exports represent goods and services that are produced domestically and sold to buyers of other countries. This study uses exports of goods and services measured at constant 2000 US$.

Imports (IMP): Imports can be defined as commodities, i.e. goods and services brought into one nation from another country for trade purpose. Imports of goods normally require involvement of the custom authorities in both the country and are often subject to import quotas, tariffs and agreements. This study uses imports of goods and services measured at constant 2000 US$.

Unit Root Tests: The purpose of unit root test is to check whether the data is stationary or not. The data is said to be stationary if its mean, variance and covariance remain constant over time. Consider the following AR (1) model:

\[ Y_t = \phi Y_{t-1} + \epsilon_t \]  

(1)

The stationary condition is \( \phi < 1 \).

Case 1: \( \phi < 1 \) the data is stationary.
Case 2: \( \phi > 1 \) the series explodes.
Case 3: \( \phi = 1 \) this case shows unit root and non-stationary.

This paper uses both the Augmented Dickey-Fuller (ADF) and the Phillips-Perron (FP) tests to examine the data set for stationarity. These are used to eliminate the problem of autocorrelation. The determination of lag length is based on Akaike Information Criterion (AIC) and Schwartz Bayesian Criterion (SBC). Three possible forms of these tests are as under:

\[ \Delta Y_t = \gamma Y_{t-1} + \sum_{i=1}^{p} \beta_i \Delta Y_{t-i} + \epsilon_t \]  

(2)

\[ \Delta Y_t = \alpha_0 + \gamma Y_{t-1} \sum_{i=1}^{p} \beta_i \Delta Y_{t-i} + \epsilon_t \]  

(3)

\[ \Delta Y_t = \alpha_0 + \gamma Y_{t-1} + \alpha_1 \Delta Y_{t-1} + \sum_{i=1}^{p} \beta_i \Delta Y_{t-i} + \epsilon_t \]  

(4)

Where \( \alpha_0 \) is constant, \( \alpha, \beta, \gamma \), are slope coefficients, \( t \) is a linear time trend and \( \epsilon_t \) is the error term. The null hypothesis can be expressed as: \( H_0: \gamma = 0 \). On the other hand, alternative hypothesis is as: \( H_1: \gamma < 0 \).

The Akaike Information Criterion (AIC) criterion is defined as:

\[ \text{AIC (p)} = T \ln (\text{RSS}/n-p) + 2p \]

Where

\[ T = \text{Total sample size} \]

\[ \text{RSS} = \text{Residual sum of square} \]

\[ N = \text{Lag length} \]

\[ P = \text{Total no of estimated parameters} \]
**Co-Integration Test:** The Johansen co-integration test is applied to check the long-run relation among three variables. The variables which have the same order of integration could be checked for co-integration mentioned by previous study [5]. Therefore, three variables are examined for the co-integration. The Johansen co-integration test shows the long-run properties of the variables [25, 26]. The test is based on the maximum likelihood estimation of the K-dimensional Vector Auto regression (VAR) having order p. Both the trace eigenvalue statistic and the maximum eigenvalue statistic are used [25, 27]. If the trace eigenvalue test and the maximum eigenvalue test do not give the same results then the results obtained from the maximum eigenvalue test are used. The power of the maximum eigenvalue test is more than the trace eigenvalue test, explained by previous study [27].

**Granger Causality Test Based on VECM:** The order of Vector Auto regression (VAR) of order p in the error-correction model is determined by minimizing the Akaike information criterion (AIC) and Schwartz Bayesian criterion (SBC). The Granger causality test is used to check the causality among the variables. The Granger causality test is based on the following Vector Error Correction Models (VECMs):

\[
\Delta GDP_t = \delta_1 + \sum_{i=1}^{n-1} a_{1i} \Delta GDP_{t-i} + \sum_{i=0}^{n-1} \beta_{1i} \Delta EXP_{t-i} + \sum_{i=0}^{j-1} \gamma_{1i} \Delta IMP_{t-i} + \phi_{1}ECT_{t-1} + \omega_{1t}
\]

\[
\Delta EXP_t = \delta_2 + \sum_{i=0}^{n-1} a_{2i} \Delta GDP_{t-i} + \sum_{i=0}^{n-1} \beta_{2i} \Delta EXP_{t-i} + \sum_{i=0}^{j-1} \gamma_{2i} \Delta IMP_{t-i} + \phi_{2}ECT_{t-1} + \omega_{2t}
\]

\[
\Delta IMP_t = \delta_3 + \sum_{i=0}^{n-1} a_{3i} \Delta GDP_{t-i} + \sum_{i=0}^{n-1} \beta_{3i} \Delta EXP_{t-i} + \sum_{i=0}^{j-1} \gamma_{3i} \Delta IMP_{t-i} + \phi_{3}ECT_{t-1} + \omega_{3t}
\]

Where

\[\Delta\] = Difference operator,

\[ECT_{t-1}\] = One period lagged value of the error correction term.

The significant error correction term is interpreted as the long-run causal effects.

**RESULTS AND DISCUSSION**

**Unit Root Tests:** The stationary properties of the variables are checked by using the Augmented Dickey-Fuller (ADF) and the Phillips-Perron (PP) tests before conducting tests for co-integration and granger causality. These tests were applied to determine the order of integration on level as well as on first difference. Stationarity of all the variables are tested at intercept and then at intercept and trend. The results obtained both from the ADF and the PP tests are given in Table 1. The results concluded that the real GDP, real exports and real imports are stationary at first difference. All the variables are integrated of the same order i.e. I(1).

**Co-Integration Test:** Since all the variables are integrated of the same order i.e. I(1), the hypothesis of co-integration is examined by the Johansen co-integration test. The results of the Johansen co-integration test are given in Table 2. Both the Trace statistics and the Max-Eigen values are greater than the critical value at 5% significance level. Therefore, the null hypotheses of no co-integrating vector (r = 0; r ≥ 1; r ≥ 2) against the alternative hypotheses (r = 1; r = 2; r = 3) can not be accepted. Hence both of the test statistics indicate three co-integrating vectors. Thus there is the long-run equilibrium relation among economic growth exports and imports.

**Granger Causality Test Based on VECM:** As there is co-integration among the variables, the final step is to check the causality among variables by using the vector error correction model (VECM). The presence of co-integrating vectors allow for the vector error correction model for the purpose of causality. The results of the Granger causality test are shown in Table 3.

When economic growth is taken as a dependent variable, both exports and imports does not granger cause growth in the short-run. It also gives that GDP is not in equilibrium in the long-run and it corrects 0.2 percent disequilibrium every year. When export is taken as a dependent variable, both economic growth and import do not Granger cause export growth in the short-run. It gives that export is in equilibrium in the long-run and it corrects 60 percent disequilibrium every year. Similarly when import is taken as a dependent variable, both economic growth and export do not Granger cause import in the short-run. It shows that imports are in equilibrium in the long-run. It corrects 67 percent disequilibrium per annum.
Table 1: Unit Root Tests

<table>
<thead>
<tr>
<th>Variables</th>
<th>Augmented Dickey-Fuller Test</th>
<th>Phillips-Perron Test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Intercept</td>
<td>Intercept and trend</td>
</tr>
<tr>
<td>LGDP</td>
<td>-2.106627 (0.2433)</td>
<td>-0.983553 (0.9339)</td>
</tr>
<tr>
<td>ΔLGDP</td>
<td>-4.360225 (0.0014)*</td>
<td>-4.618759 (0.0038)*</td>
</tr>
<tr>
<td>LEXP</td>
<td>-0.612793 (0.8556)</td>
<td>-2.236328 (0.4565)</td>
</tr>
<tr>
<td>ΔLEXP</td>
<td>-6.202281 (0.0000)*</td>
<td>-6.115315 (0.0001)*</td>
</tr>
<tr>
<td>LIMP</td>
<td>-1.056354 (0.7225)</td>
<td>-3.197326 (0.1006)</td>
</tr>
<tr>
<td>ΔLIMP</td>
<td>-6.055213 (0.0000)*</td>
<td>-5.942214 (0.0001)*</td>
</tr>
</tbody>
</table>

Figures without parenthesis indicate t-statistics and in parenthesis are p-values.

* Shows significant at 1% level

Table 2: Johansen Co-integration Tests

<table>
<thead>
<tr>
<th>Null Hypothesis</th>
<th>Alternative Hypothesis</th>
<th>Trace Statistics</th>
<th>5% Critical Value</th>
<th>Max-Eigen Value</th>
<th>5% Critical Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>r=0</td>
<td>r=1</td>
<td>51.5046 (0.0004)*</td>
<td>35.19275</td>
<td>26.92781 (0.0105)**</td>
<td>22.25962</td>
</tr>
<tr>
<td>r=1</td>
<td>r=2</td>
<td>24.57623 (0.0119)**</td>
<td>20.62184</td>
<td>13.9735 (0.0876)</td>
<td>15.89210</td>
</tr>
<tr>
<td>r=2</td>
<td>r=3</td>
<td>10.59888 (0.0266)**</td>
<td>9.164546</td>
<td>10.59888 (0.0266)**</td>
<td>9.164546</td>
</tr>
</tbody>
</table>

Note: * and ** indicate significance at 1% and 5% level respectively. Figures in parentheses are p-values.

Table 3: Results of Granger Causality Test based on VECM

<table>
<thead>
<tr>
<th>Dependent variables</th>
<th>ΔLGDP</th>
<th>ΔLEXP</th>
<th>ΔLIMP</th>
<th>Lagged ECT</th>
</tr>
</thead>
<tbody>
<tr>
<td>LGDP</td>
<td>2.104113 (0.3492)</td>
<td>0.231059 (0.8909)</td>
<td>-0.02262 (-0.49816)</td>
<td></td>
</tr>
<tr>
<td>ΔLEXP</td>
<td>3.325730 (0.1886)</td>
<td>3.325730 (0.1886)</td>
<td>-0.07026 (-2.38215)</td>
<td></td>
</tr>
<tr>
<td>ΔLIMP</td>
<td>0.053672 (0.9735)</td>
<td>0.053672 (0.9735)</td>
<td>-0.671101 (-2.67475)</td>
<td></td>
</tr>
</tbody>
</table>

Note: Figures in parentheses are t-statistics and all other estimated values are Granger χ² statistics. *Values in the parentheses are p-values.

Table 4: Diagnostic Test Results

<table>
<thead>
<tr>
<th>Model</th>
<th>LM test</th>
<th>ARCH test</th>
<th>Ramsey RESET test</th>
<th>JB Normality test</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>1.993730 (0.360033)</td>
<td>0.002780 (0.957050)</td>
<td>0.455168 (0.499750)</td>
<td>0.981001 (0.612320)</td>
</tr>
<tr>
<td>6</td>
<td>1.816911 (0.403146)</td>
<td>1.399459 (0.238016)</td>
<td>0.270750 (0.602829)</td>
<td>0.096197 (0.955040)</td>
</tr>
<tr>
<td>7</td>
<td>2.788940 (0.247964)</td>
<td>0.03458 (0.851681)</td>
<td>0.063133 (0.955361)</td>
<td>0.755861 (0.685964)</td>
</tr>
</tbody>
</table>

Note: Figures in the parentheses are p-values.

**Diagnostic Tests:** The diagnostic tests were conducted for the problems of the model specification, the serial correlation problem and the normality in the residuals. The diagnostic test statistics are given in Table 4.

All the diagnostic test statistics confirmed that the models are free from the serial correlation. The functional form of the models is correct and the residual terms are normally distributed.

**CONCLUSION AND RECOMMENDATIONS:**

This study uses the Granger causality and the co-integration tests to examine the long-run relation as well as to check the specific direction of the causality among economic growth, exports and imports of Pakistan. The econometric results based on the Error-Correction Models confirm the existence of long-run relation among exports, imports and economic growth. Both exports and imports are essential for economic growth of Pakistan. The study further reveals that economic growth has an important impact on exports and imports of the country. A sustained economic growth needs growth in both exports and imports. In fact the process of economic growth and trade based on exports and imports have an essential position. Exports enhance the economic growth through access to the world market and to the large scale
economies. Exports provide foreign exchange earning as well as give support to the rapid employment process in the economy.

The policy implications based on research findings are as under:

- The government should adopt such policies that support investment environment, to accelerate sound economic growth.
- Exports provide foreign exchange earning and also create employment opportunities. So the government should pay considerable attention to exports.
- Pakistan should embark on comprehensive trade liberalization policies.
- Pakistan should encourage the imports of essential raw materials for value addition which will expand the productive capacity and accelerate economic growth.

REFERENCES


