Are Imports and Exports Cointegrated in Pakistan?
A Rolling Window Bound Testing Approach

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Abstract: This study investigates the correlation between exports and imports in the case of Pakistan by using the variance decomposing analysis and rolling window bound testing approach to determine the stability of cointegration over the sample. The results from variance decomposition indicate that imports cannot cause the exports but in contrast the exports effectively cause imports. Cointegration stability test confirms that imports cause the exports from the period of 2003 to over the sample size and exports cause the imports from 1994 to 2004.

JEL Codes: F00 · C4
Key terms: Imports · Exports · Rolling Window Bound Test

INTRODUCTION

Pakistan is a developing country and like other developing countries its economy depends on the exports earnings because exports earnings generate employment opportunities and more importantly it is helpful to maintain the trade balance. But on the other hand imports have a source of those goods that cannot produce locally like technology, raw material of industrial and agricultural sectors and consumer goods. See Fig. 1 imports expenditures almost greater than exports earnings over the period 1985-2008.

The objective of this study is to explore the link between the exports earnings and imports expenditure in the case of Pakistan economy by using the quarterly data from 1985 to 2008. For econometrics estimation this empirical work employs the Variance Decomposition method and rolling window bound testing estimation to check the stability of causal relationship over the sample. Remaining paper is organized as follows; section-B describes theoretical background and review of literature. Section-C discusses empirical results and explanation and final section represents (section-D) conclusion.

![Graph of Ln(Exports) and Ln(Imports)]

Fig. 1: Ln (Exports) and Ln (Imports)

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Theoretical Background and Review of Literature:
Husted [1] has provided simple theoretical model of imports and exports association. He has started with the current budget constraint.

\[ C_i = Y_i + B_i - I_i (1 + r)B_i \]  

(1)

Where: \( C_i, Y_i, B_i, I_i \) and \( r \) respectively confer current consumption, output, investment and current interest rate in the international market. Husted has imposed several assumptions on eq-1 in order to derive an empirically testable model, which is as follows:

\[ X_i = \alpha_0 + \beta M_i + \epsilon_i \]  

(2)

Arize [11] tested the eq-2 alternatively by as

\[ M_i = \alpha_1 + \beta X_i + \epsilon_i \]  

(3)

In eq-2 & eq-3 the \( X_i \) and \( M_i \) are represented exports and imports respectively. The *intertemporal budget constraint is stable* when cointegration relationship exists between the exports and imports\(^1\). On the other hand if exports and imports show no-cointegration it means that *intertemporal budget constraint is unstable* and economy cannot fulfill its foreign debt liabilities.

Review of Literature: Husted [1] has begun the debate of imports and exports cointegration. He has suggested long run relationship between exports and imports by using the data of USA. Bahmani-Oskooee, [2] empirically examined the link between exports and imports in the case of Australia. He found cointegration among the both variables and also suggested macroeconomic policies have efficient in the sample period because the cointegrating coefficient value is near to one. Fountas and Wu [3] reinvestigated the Husted [1] hypothesis and rejected the earlier Husted findings in the case of USA. Narayan and Narayan [4] concluded that exports and imports were co-integrated.

Erbaykal et al. [5] empirically examine the relationship between exports and imports in the case of Turkey. They found cointegration between the exports and imports. Konya et al. [6] investigated the cointegration between imports and exports in the case of India by using the data from 1949 to 2005. They concluded no-cointegration among exports and imports, so Indian macroeconomic policies have ineffective and international budget constraint could not sustainable. Hye et al. [7] examined the association between the exports, imports and exchange rate in the case of Pakistan by using the monthly time series data from 1995-2006. They found cointegration and bidirectional causality between exports and imports.

Uddin [8] found bidirectional causality between exports and imports in the long run and unidirectional causality from imports to exports by using the data of Bangladesh economy. Emmy et al. [9] concluded exports and imports were cointegrated and bidirectional causality found in the long run and unidirectional in the short run from imports to exports in the forestry sector of Malaysia. Hye et al. [10] empirically examine the association between the agricultural raw material exports and agricultural raw material imports in the case of Pakistan by using the data from 1971-2007. They found unidirectional causality from imports to exports and no causality in the short run. On the basis of these results, they suggested “Pakistan will have to concentrate more on installation of plants that have value added in the agricultural products and produce agricultural raw material locally in order to reduce the agricultural deficit that show increasing trend from last several years”.

Estimation Methodology and Empirical Results:
To determine the order of integration this study employs the augmented dickey fuller (ADF) unit root test. Unit root is tested by estimating the following regression model.

\[ \Delta Y_i = \delta_0 + \delta_1 Y_{i-1} + \sum_{j=1}^{p} \delta_j \Delta Y_{i-j} + \mu_i \]  

(4)

Where: \( Z_i \) is represented a time series variable data, \( \Delta \) is the first difference operator, \( \delta_0 \) and \( \rho \) are represented respectively constant term and optimum lags of the dependent variable. The non-stationarity hypothesis \( H_0: \delta_0 = 0 \) is tested against the hypothesis of stationary \( H_1: \delta_0 \neq 0 \). Decision could be taken in the following way. If the \( t \)-Statistic of estimated coefficient \( \delta_0 \) is greater than the critical value the hypothesis of stationary could be accepted. Next we apply the variance decomposition method (VDC) for causal inference. The VDC approach serves as tool for evaluating the dynamic interaction and strength of causal relationship among variables in the system. The VDC indicates the percentage change of the variable forecast error variance attribute to its own innovation and innovation in other variable.

We also apply the rolling window bounding testing method in order to investigate the stability of causal relationship over the sample. In contrast the other causal

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\(^1\)This means that there is a cointegration relationship between two variables, that is to say they act together in the long period.
method assumes that causal relationship remains constant in the sample size, although economic situation cannot stable and thus the economic variables are changed over the time. With the help of rolling window bound testing approach we can estimate the causal relationship of each observation and if the economic variables are changed overtime so this techniques capture this instability.

**Empirical Results:** This study uses quarterly data from 1985 to 2008; data has been taken from international financial statistics (IFS). Exports and imports are measured in millions of rupees on the current prices. To determine the order of integration this study employs the augmented dickey fuller (ADF) unit root test. The important unit root results are reported in Table 1

Results show that both variables are integrated order one or I (1). After determining the level of integration in next step this study employs the variance decomposition method.

The variance decomposition approach has provided guidance about a shock to any variable, such as a shock to exports, will directly impact on exports and the impact of this shock also pass on the other variables in the model. In Table 2 the first part demonstrates the variance decomposition of imports. In the round first, the entire change in imports has showed by a shock to the imports innovation. In round third, exports variable accounts for 3.74% of the change in imports and remaining is showed by the own imports innovations. When the entire 9-quarter has taken into account, the effect of imports on exports has not significantly transmitted because in the 9th round the major portion has explained the imports innovation on its own shock.

Second portion of the Table 2, which is shows the variance decomposition of exports. A shock to export innovations has an immediate effect on current imports. In round one, a shock to the export innovation accounts for 57.25% of the variation of own shock and remaining accounts the imports i.e. 42.74%. In round third, imports accounts for 49.99% of the variation in exports and exports itself account for 50.01% of its own variation. The causation of exports to imports increase at the end of 9 quarter, exports accounts for 36.43% of its own variation and remaining 63.56% explains by imports.
Table 3: Descriptive analysis of normalized F-statistics for rolling approach to ARDL cointegration tests

<table>
<thead>
<tr>
<th>Number of</th>
<th>Number of</th>
</tr>
</thead>
<tbody>
<tr>
<td>Values</td>
<td>Percentage</td>
</tr>
<tr>
<td>More than 1</td>
<td>49</td>
</tr>
<tr>
<td>Less than 1</td>
<td>19</td>
</tr>
<tr>
<td>Total</td>
<td>68</td>
</tr>
</tbody>
</table>

Note: Rolling Window Size is equal to 28 observations.

Rolling Window Bound Testing analysis: This study also uses rolling window bound testing approach to cointegration in order to investigate the stability of long run relationship or long run causality over the sample size. Fig. 1 represents the graph of F-statistics when the dependent variable is exports. This fig-1 shows that from 2003 the imports cause the exports in the case of Pakistan.

Fig. 2 shows the graph of F-statistics when the dependent variable is imports. Graph demonstrates that from 1994 to 2004 the exports earning causes the expenditure of imports in the case of Pakistan.

Table 3 show the descriptive of the normalize F-statistic. When LM is dependent variable ‘49’ observations are above ‘1’ which confirms long run robustness. Although the remaining, 19 observations are less than one that indicates no cointegration. On the other hand, when LX is dependent variable only ‘23’ F-statistic value above than one (confirms cointegration) and ‘45’ F-statistic values are below than one (show no cointegration).

CONCLUSION

The study is tested the Husted [1] and Arize [11] hypothesis in the case of Pakistan by using the quarterly data from 1985-2008. This study employs the newly develops rolling window bound testing approach to cointegration and variance decomposition method in order to provide the empirical evidence. The variance decomposition results are suggested that ‘imports cannot cause the exports’ but on the other hand ‘exports effectively cause imports’. Rolling window bound testing approach suggests imports leads exports from 2003 to the remaining sample and exports earning leads expenditure on imports from 1994 to 2004. This study suggests on the basis of empirical results the international budget constraint of Pakistan unsustainable.

REFERENCES