CAUSALITY BETWEEN EXPORTS AND IMPORTS OF AGRICULTURAL SECTOR IN THE CASE OF PAKISTAN.

Qazi Muhammad Adnan Hye¹, Ahmed Raza-ul-Mustafa² and Khalid Mahmood³

Applied Economics Research Centre, University of Karachi, Karachi, Pakistan.

ABSTRACT

This article examines the link between agricultural raw material exports and agricultural raw material imports in the developing economy like Pakistan. Using the annual data from 1971-2007, this study finds that agricultural raw material exports and agricultural raw material imports are cointegrated. There is unidirectional causality from agricultural raw material imports to agricultural raw material exports in the long run and no causality in either direction in the short run.

Key words: Agricultural raw material, Exports, Agricultural raw material, Imports, ARDL.

INTRODUCTION

Pakistan’s agriculture sector significantly contributes in the volume of total trade. Total exports is US $ 19.08 billions and total imports is US $ 34.33 billions in 2007, in which the agricultural raw material exports is US $ 261.88 millions & raw material imports is US $1297.44 millions and agricultural trade deficit in term of raw material exports and imports is equal to US $ 1035.59 millions¹. The agricultural growth in Pakistan is dependent on imported machinery, fertilizer and pesticides because the local production cannot meet the demand. Since agriculture is an important sector in the Pakistan economy, which provides employing 44 percent of the labor force, more than two third’s population live in rural areas and their living revolve around agricultural connected activities, contributing 21 percent to GDP and play important role in export earnings (GOP 2008).

The aim of this research is to investigate the relationship between the agricultural exports and imports. The number of empirical studies analysis the exports and imports cointegration on aggregate level. Husted (1992) stated that long run relationship exist between exports and imports in the USA. Bahmani-osoqoee and Rhee (1997) found cointegration relationship between exports and imports in Korea. Fountas and Wu (1999) conclude no cointegration relationship between exports and imports in the USA. Arize (2002) found that in the 50 OCED countries in which 35 countries was shown cointegration relationship. Narayan (2005) investigation exports and imports casual relationship in the 22 LDCs and concludes only in the 6 counties long run causal relationship exist. Bineau (2007) finds long run relationship between exports and imports and intertemporal budget constraint was not violated even though the financial crisis 1996/8 in Bulgaria.

But this empirical work is different from the previous empirical studies because this work tests the exports and imports cointegration hypothesis in the sectoral level i.e agricultural sector [cointegration between the agricultural raw material exports and agricultural raw material imports] of Pakistan by using the bound testing approach to cointegration.
and augmented granger causality test. The remaining part of the paper is organized as follows. Section- B represents trends of agricultural trade in Pakistan. Section- C discusses methodological framework. Section-D elucidates empirical results and final section (Section-E) conclusion.

**Trends of agricultural Trade in Pakistan**

Pakistan’s agricultural trade pattern is illustrated with the help of fig-1. The graphical representation of agricultural raw material exports and agricultural raw material imports shows that agricultural raw material exports and agricultural raw material imports moving closely from 1971-1997. The difference widen from 1997.

**Methodological Framework**

Husted (1992) examines a simple model to determine long run equilibrium relationship between total imports and total exports. This study is used Husted final transform model to test the long run relationship between the agricultural exports and agricultural imports. The model is as follows 2;

\[
AX_t = c + \varphi AM_t + \psi_t - - - - - (1)
\]

This model is rewrite as written by Arize (2002).

Where, \( AX_t \) and \( AM_t \) are the agricultural raw material exports and agricultural raw material imports respectively. The \( \psi \) represents the error terms, constant and slope coefficient of respective variables.

This study employs the Augmented Dickey Fuller Unit Root Test. ADF test is derived from the following regression equation: 3

\[
\Delta(Ln(AX)) = c + \pi Ln(AM) + \mu + \sum_{i=1}^{Q} \psi_i \Delta Ln((AM)) + \epsilon
\]

Where \( n \) is the number of lags of the dependent variable. The hypothesis \( H_0: \varphi = 0 \) is used to test that the series stationary or non-stationary. If the t-statistic associated with the estimated coefficient is greater than the critical values the null hypothesis is rejected. Large negative values in absolute terms indicate a rejection of \( H_0: \varphi = 0 \).

To empirically analyze the long run robust relationships among the variables of agricultural exports \( Ln(AX) \) & imports \( Ln(AM) \) by using the bounds testing approach [autoregressive distributed lag (ARDL), developed Pesaran et.al 2001] 3. The first step in the ARDL bounds testing approach is to estimate regression of ordinary least squares (OLS) in order to test for the existence of a long run relationship among the variables by conducting an F-test for the joint significance of the coefficients of the lagged levels of the variables, i.e. The ARDL models is formulated as follow:

\[
\begin{align*}
AX_t + \Delta Ln(AX) = & c + \pi Ln(AM) + \mu + \sum_{i=1}^{Q} \psi_i \Delta Ln((AM)) + \epsilon \\
& + \sum_{i=1}^{Q} \psi_i \Delta Ln((AM)) + \epsilon
\end{align*}
\]

In this case \( Q \) stands for the lag length for UECM. While \( \Delta Ln(AX) \) and \( \Delta Ln(AM) \) are the first differences of the logarithms of agricultural exports (AX) and agricultural imports (AM). The F-tests are used to test the existence of long run relationships. The Pesaran et al (2001) approach computes two sets of critical values for the sample sizes of ‘500’ and ‘1000’ observations. Narayan (2004) argues that the Pesaran et.al computed critical values cannot used for small sample size.

2 Husted makes several assumptions, when derives this transform equation from the intertemporal budget constraint that includes imports and exports are assumed to follow a random walk with drifts and that the world interest rate is stationary with mean \( r \).

3 The main advantage of the ARDL model: is that it can be applied irrespective of the order of integration while other cointegration techniques require all variables be of equal degree of integration.
Augmented Dickey Fuller Unit Root

<table>
<thead>
<tr>
<th>Variable</th>
<th>Level</th>
<th>1st Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ln(AX)</td>
<td>-2.13</td>
<td>-6.09*</td>
</tr>
<tr>
<td>Ln(AM)</td>
<td>-1.1</td>
<td>-4.71*</td>
</tr>
</tbody>
</table>

* 1% Level of significance

because it is based on the large sample size. But this study derives the critical values from the Turner (2006) response function according to the sample size.

Augmented Granger Causality Test

An augmented form of Granger causality test involving the error-correction term is formulated in a univariate pth order vector error-correction model (VECM), as follows:

$$
\begin{bmatrix}
\Delta Ln(AX) \\
\Delta Ln(AM)
\end{bmatrix}_t = \begin{bmatrix}
\Gamma_1 \\
\Gamma_2
\end{bmatrix} + \sum_{i=1}^{p} \begin{bmatrix}
n_{11i} & n_{12i} \\
n_{21i} & n_{22i}
\end{bmatrix} \begin{bmatrix}
\Delta Ln(AX)_{t-i} \\
\Delta Ln(AM)_{t-i}
\end{bmatrix}_i + \begin{bmatrix}
\Omega_1 \\
\Omega_2
\end{bmatrix} [EC_{t-1}] + \begin{bmatrix}
\psi_1 \\
\psi_2
\end{bmatrix}
$$

ECt-1 is the error correction term, which is derived from the long-run relationship. The Granger causality test may be applied to equation (6) as follows: i) by checking statistical significance of the lagged differences of the variables for each vector; this is a measure of short-run causality; and ii) by examining statistical significance of the error-correction term for the vector that there exists a long run relationship.

Empirical Result

This study employs annual time series data from 1971-2007. The data of both agricultural raw material exports and agricultural raw material imports has taken from the world development indicators. Both series transform in natural logarithms form for econometric estimation. In order to determine the integration level the ADF unit root test employ. The results are reported in table-1. ADF Results show that both variables are non-stationary at their level form but stationary at their first difference. Thus Ln (AX) & Ln (AM) integrated order one.

Table-2 represents the results of bounds testing approach to cointegration, the important step

---

4 One set assumes that all variables are I(0) and the other set assumes they are all I(1). If the computed F-statistic exceeds the upper critical bounds value, then the $H = 0$ (null hypothesis) is rejected. If the F-statistic falls within the bounds set, then the test becomes inconclusive. If the F-statistic falls below the lower critical bound value, it implies no cointegration. When a long run relationship exists, the F-test indicates variable should be normalized.

5 SBC best in the small sample data (See Pesaran et al. 2001)
in this test is to the selection of optimal lag length. So, the lag length is selected in this by using the Schwarz Bayesian Criterion (SBC). The results of F-test indicate that there is evidence of a long-run relationship between the variables at 5% significance level when Ln(AX) is dependent variable.

Thus on the basis of above long run robust bound tests result, we conclude that there is unidirectional causality from agricultural raw material imports to agricultural raw material exports. The long run 'cointegrated equation' indicates that agricultural raw material imports significantly determine agricultural raw material exports at one year lag and long run elasticity of agricultural raw material exports with respect to the agricultural raw material imports is 0.85.

Table 3 demonstrates the outcome of Argument Granger Causality test. The result states no short run causality in the either direction. But when agricultural export is dependent variable, the Ecm terms is negative and statistically significant which confirms the long run causal relationship from agricultural raw material imports to agricultural raw material exports. The coefficient of error correction term indicates the speed of adjustment from short run discrepancy to the long run equilibrium. Where the coefficient of error correction is -0.36 in the agricultural raw material imports and agricultural raw material exports move towards equilibrium in the long run at the pace of 36% every year.

**CONCLUSION**

This endeavor is different from the pervious studies on the exports and imports cointegration hypothesis because present study tests this hypothesis on the sectoral level [i.e agriculture raw material exports and raw material imports]. Empirical, investigation is important because Pakistan has been spending millions of rupees on the imports of agriculture raw material to fulfill the gap between the agricultural inputs demand and supply.

This empirical study investigates cointegration between agricultural raw material exports and agricultural raw material imports in Pakistan by using the bound test approach to...
cointegration and augmented Granger causality test. The results of bound testing confirm long run relationship when the agricultural raw material exports dependent variable. Which indicate agricultural raw material imports cause the agricultural raw material exports in the long run. The results of augmented Granger causality test support the bounds testing approach to cointegration. The long run elasticity of agricultural raw material exports with respect to the agricultural raw material imports is 0.85. In the short run no causality in either direction.

On the basis of above empirical findings the following policy implication derives: First, Pakistan can import agricultural inputs to meet the existing demand of agriculture raw material in order to maintain the momentum of agricultural growth and exports earnings from agriculture sector. Second, Pakistan will have to concentrate more on installation of plants that have value added in the agricultural product and produce agricultural raw material locally in order to reduce the agricultural deficit that show increasing trend from last several years.

REFERENCES