EFFECT OF AGRICULTURAL AND FINANCIAL SECTOR REFORMS ON EXPORT OF COTTON LINT FROM PAKISTAN: AN ERROR CORRECTION MECHANISM*

Fauzia Shaukat**, Sofia Anwar*** and Zakir Hussain****

ABSTRACT

A study was conducted in the Department of Economics, University of Sargodha, Sargodha, Pakistan during the year 2009. In this study effect of liberalization policies adopted by the country on export of cotton lint was analysed for the period from 1971 to 2008. The effect of agricultural reforms was analyzed in terms of export competitiveness and openness of agricultural trade and concentration index. The financial sector reforms were examined under the changes in real effective exchange rate of the country. The quantitative analysis of the study emphasized the importance of trade policies both domestic and global in increasing the export of cotton lint from Pakistan. World demand for the cotton export positively affected the export of cotton. Export competitiveness and increase in trade openness led to higher export of cotton. Currency depreciation had the positive impact on export of cotton lint but this affect was not significant due to high input prices.

KEYWORDS: Cotton lint; trade; exports; concentration index; Pakistan.

INTRODUCTION

Agriculture sector provides the opportunities to millions of rural people to strive against poverty and hunger. This sector alone cannot achieve the desired level of economic development but its role in the process of economic development is very unique. It can work with other sectors to achieve the faster rate of economic growth and development. Therefore, agricultural terms of trade linking with output, investment, productivity and growth in agriculture affect rural economy and improvement in agricultural terms of trade would lead to gain welfare of farmers (19).

In the last few decades developing countries widely adopted trade liberalization policies to achieve economic growth (11). Before the 1980s,

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agricultural sector was highly protected and various policies of support price and subsidizing programs were working in both developed and less developed countries. Many less developed countries (LDCs) adopted the trade liberalization and market deregulation policies to reduce the Government intervention in agricultural input and output markets and to enhance the role of free market mechanism. Many countries liberalized their agricultural sector under the frame work of structural adjustment policy (SAP) with conditional ties as imposed by World Bank and IMF (27).

Following the international scenario Pakistan also liberalized its trade and investment regime alongwith the stabilization measures, in late 1980s. The tight monetary and fiscal policies were adopted as short run stabilization measures alongwith wage and employment restraints and exchange rate policies. The long term measures included tariff rate reduction, removal of non-tariff barriers, price controls and shifting from fixed exchange rate to a policy of flexible exchange rate, privatization policy, removal of subsidies alongwith depreciation of currency (8, 22) and the de-linking of rupee from US dollar, price deregulation of a large number of products, import liberalization, export extension schemes and liberalization of trade and foreign exchange (2).

In order to promote the trade liberalization, Pakistan adopted structural reforms in 1988 and reduced the tariff rate from 225 percent in 1986-87 to 65 percent in 1995-96. To handle the problem of inflation and to promote the export growth and export competitiveness, the exchange rate devaluation policy was adopted. The adjustment in real effective exchange rate (REER) index was failed to compensate exporters for the loss of competitiveness due to declining factor productivity and high energy cost (20).

Exchange rate is very important macro economic policy that has greater influence on cotton sector. It had the impact on relative domestic prices of tradable inputs and outputs such as fertilizer and raw cotton (12). Real exchange rate defined both in external and internal terms, is consistent with purchasing power parity (PPP) theory. The internal exchange rate is the ratio of domestic price of tradable to non-tradable goods within a country and concerned sector with domestic resource allocation. In external terms, real exchange rate is defined as the nominal exchange rate adjusted for price level differences between home country and foreign country. In internal terms, real exchange rate is defined as real effective exchange rate (REER) which is the product of nominal effective exchange rate (NEER) and the effective relative price indices (1). (REER is a relative term that plays an
important role in the allocation of resources in production. REER influences the performance of export sector. The departure of actual REER from its equilibrium REER rate is called as exchange rate misalignment. In case of misalignment, its role in allocation of resources and export performance becomes less effective.

During 1952, Government of Pakistan imposed the import restriction in the form of import licenses along with export duties on cotton and jute to encourage the exports. In 1956, there was devaluation of rupee but due to poor price incentives, exports were declined. After the year 1960, Pakistan adopted the export promotion policy. From 1978-1982, government appreciated its currency with constant nominal exchange data to control inflation. After 1982, there was managed floating exchange rate (12). Since 1999, Pakistan adopted an export led growth strategy through successive trade regimes (22).

Many studies have been conducted to estimate the effect of trade liberalization. In the decade of 1990s a detailed study was conducted by CGPRT Centre to estimate the effects of trade liberalization in Asian countries (4, 10, 13). Understanding the need of hour, adoption of structural adjustment policies was recommended for all relevant countries. The importance of achieving efficiency in production, market diversification and competitiveness was also emphasized. In addition to these some researchers (5, 17, 23, 26, 28, 29) further analyzed the relationship among trade liberalization, trade openness and economic growth of the country. The countries embracing the new liberalized policies in trade moved forward towards increased economic growth. A positive relationship among the trade liberalization, trade openness and economic growth prevailed at the general national economy level. Mwaba (25) concluded that increased adoption of trade liberalization policies would lead to export promotion of the African countries. According to Kherallah et al. (21) the removal of price controls, changes in foreign exchange markets and deregulation in agriculture marketing were the core components of agriculture reforms adopted by Sub-Saharan African countries in last two decades. Liberalized policies resulted in mix results but increased competition, reduced marketing margins and gave boost to exports and export crop productions. Export diversification and improved quality strategy for products were the key factors to achieve the continual increase in exports in Algeria, Tunisia and Morocco (24). Ganuza et al. (15) concluded that with fixed foreign savings, tariffs reduction led to real devaluation and export led growth in 16 Latin American countries. Bashir (11) advocated that the export performance of agriculture sector of Pakistan was
extremely responsive to domestic economic policies and reforms. The export diversification and openness showed positive impact on export performance. Pakistan is likely to maintain its competitiveness in the free trade scenario but trade liberalization policies demanded improvement in quality, efficient marketing mechanism and reduction in cost of production (19). Development in agricultural terms of trade or higher technology investment are not sole responsible for faster growth in agricultural output but a joint effort of favourable price incentive and investment in technology work in parallel in agriculture sector of Pakistan.(18). Cotton export of Pakistan can be improved through adoption of favorable domestic policies affecting supply side and Pakistan can achieve a profound rise in its exports through adopting trade liberalization policies (9).

The present study was undertaken to analyse the effect of liberalization policies adopted in Pakistan on cotton lint export from the year 1971 to 2008.

**METHODOLOGY**

This study was conducted in the Department of Economics, University of Sargodha, Sargodha, Pakistan during the year 2009. The time series data on all variables were taken for the period 1971-2008. The main sources of data were Economic Surveys of Pakistan (various issues), State Bank of Pakistan, Food and Agricultural Organization (FAO), All Pakistan Textile Mills Association (APTMA), International Cotton Advisory Committee (ICAC). All the variables in the analysis were used in log form and data on exports were expressed in value form and expressed in national currency.

An appropriate model was needed to estimate the impact of exchange rate on exports of cotton lint from Pakistan. The co-integration technique of vector error correction model (VECM) was selected to examine the long-run and short run dynamics between the variables of model. The concept of co-integration in economic literature was introduced by Granger (1981) and Engle Granger (1987). Provided the variables are co-integrated, there existed a long run or equilibrium relationship among the variables.

The certain indicators were taken to represent both supply and demand side. Therefore, the impact of exchange rate variation on account of currency devaluation was studied in terms of competitiveness, world market potential and openness and export concentration as explanatory variables in the model.

*J. Agric. Res., 2011, 49(4)*
Demand side

**World Demand of cotton lint:** World demand or export market potential for cotton (DQ\textsubscript{CX}) was measured in terms of weighted-average index of world export price for cotton lint

\[ WD\ c\ x = \alpha P\ c\ x \quad .... (1) \]

Where,
- \( \alpha \) = Share of cotton in country’s total agricultural exports
- \( P_{cx} \) = Constant price index of world exports for cotton.

Supply side

**Competitiveness:** Competitiveness was measured through the ratio of country’s export of cotton lint in its relevant sector at national level and then at world level.

\[
CM_{cx} = \frac{\sum_{i} \frac{V_{ij}}{V_{ij}}}{\sum_{j} \sum_{i} \frac{V_{ij}}{V_{ij}}} \quad .... (2)
\]

- \( V \) = Export value of cotton lint
- \( i \) = Commodity class (Cotton Sector or Agriculture Sector)
- \( j \) = Country (Pakistan)

**Concentration Index:** This variable was constructed to depict the extent of expansion in marketing of cotton in total exports of the country. Following formula was utilized to estimate the

\[
CI = \sqrt{\sum \left( \frac{V_{ij}}{V_{tx}} \right)^2} \quad (3)
\]

- \( V_{ij} \) = Country j’s exports of product i (at three digit) i.e. cotton lint export for Pakistan
- \( V_{tx} \) = Country j’s total exports i.e. Pakistan’s total exports
Trade Openness: Openness of agricultural trade was measured by the ratio of agricultural exports to agricultural sector GDP. It represented the average share of agricultural exports to the agricultural sector GDP.

$$\text{TOP} = \frac{\text{Value of total agricultural exports}}{\text{agriculture sector GDP}}$$

Model structure

The impact of indicators of liberalization on export of cotton lint (CX) was estimated by following equation:

$$LCX = \beta_0 + \beta_1 LWD + \beta_2 LCM + \beta_3 LCI + \beta_4 LTOP + \beta_5 LER + \epsilon_t$$

LCX = Export of cotton lint  
LWD = World demand for cotton lint  
LCM = Competitiveness of cotton lint in international market  
LCI = Concentration of export  
LTOP = Openness of agricultural sector  
LER = Real effective exchange rate

The modeling strategy involved three steps, i.e. determines the order of integration of the variables (i) find the number of co integrated vectors for variables integrated of the same order, and (ii) the error correction mechanism application (iii).

Stationarity check

The empirical estimation through ordinary least square (OLS) based on time series data involved the implicit assumption that time series was stationary. Non-stationary of data leads to some serious problems in estimation like autocorrelation, unreliable and misleading results i.e. spurious regression (16).

To know whether the time series data on export of cotton(LCX), log of world demand for cotton(LDX), log of competitiveness(LCM), log of openness(LOP), log of concentration index(LCI) and log of real effective real effective exchange rate(LER) were stationary or non-stationary, two methods were applied i.e. graphical analysis and unit root test.
A time series $S_t$ was declared as stationary depending upon the existence of invariable mean and variance over time. Further the covariance between two time series depended upon the time difference between two values only and not upon the actual time of covariance assessment. The times series $S_t$ was stationary if, for all the values, it was true that

$$\begin{align*}
(St) = \mu & \quad \text{(Constant mean)} \\
va (St) = \sigma^2 & \quad \text{(Constant variance)} \\
\text{cov} (St, St+s) = \text{cov} (St, St-s) = \gamma_s & \quad \text{(Covariance depends on s, not t)}
\end{align*}$$

The distinction of stationary time series from non-stationary time series was very significant as significant relationship may exist among the variables with unrelated data on analysis with time series data lacking properties of stationary time series (17).

**Graphical analysis:** The graphical analysis of the time series was performed to examine the behavior of data over time. The non-stationary time series called random walk, were those moving gradually upward or downward with unstable mean and variance and showing no real pattern. The plot for such time series showed a fluctuating movement without any specific trend. While the non-stationary time series called the random walk with a drift, were those moving arbitrarily with changing mean and variance but showing a definite trend over the time. The graphical presentation of such time series showed a distinct upward or downward trend.

**Unit root test:** To further check the stationarity of the data, Augmented Dickey-Fuller (ADF) unit root test was applied. ADF test was preferred over the DF test, because it considers the problem of correlation between the error terms and includes the lagged value of dependent variable in the regression.

**Co-integration**

Co-integration analyzed the relationship between integrated series and explored a linear combination of integrated time series that was itself stationary. The Johansen (1991, 1995) maximum likelihood procedure was applied to estimate the co-integration. Johansen maximum likelihood approach for co-integration utilizes the following two test statistics for deciding the number of co-integrating vectors;
(i) Trace test ($\hat{\lambda}_{trace}$)

Null hypothesis ($H_0$): the number of co-integrating vectors is less than or equal to $r$
Alternate hypothesis ($H_1$): the number of co-integrating vectors is more than $r$.

(ii) Maximum Eigen value ($\hat{\lambda}_{max}$) test.

Null hypothesis ($H_0$): the number of co-integrating vectors is $r$
Alternate hypothesis ($H_1$): the number of co-integrating vectors is $r+1$.

**Error correction model**

The short dynamics involved in the model was determined by the ECM. The ECM equation of the model was

$$DLCX_t = \beta_0 + \beta_1 DLCX_{t-1} + \beta_2 DLWD + \beta_3 DLCM + \beta_4 DLCI + \beta_5 DLTOP_t + \beta_6 DLER + t e (\cdot 1) + t \xi \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldOTS AND DISCUSSION

The graphical analysis was carried out to test the behavior of relevant time series data (Fig. 1 - Fig. 6). It showed a fluctuating trend over the time period. It implied that mean of these time series were changing with the time period. These series were declared as non-stationary on the existence of unit root. Further, first differenced time series were generated for all the variables and then plotted. The graphs of all differenced series (Fig. 7 – Fig. 12) showed that the mean and variance of these s time series were constant over the time and series were stationary with order of integration [1 (1)]

Further, the unit root test was performed on the level values of all time series to know whether the time series data were stationary or non-stationary. The results of ADF test on level values (Table 1) showed that all time series were non-stationary. The first difference of these variables was taken in order to make them stationary. ADF was applied at the difference values to ascertain the order of integration.
Effect of agricultural and financial sector reforms on export of cotton

Fig. 1 Graph of log of cotton export in value terms (LCX).

Fig. 2 Graph of log of world demand for cotton (LDX).

Fig. 3 Graph of log of competitiveness (LCM).

_J. Agric. Res., 2011, 49(4)_: 579
Fig. 4 Graph of log of concentration index (LCI).

Fig. 5 Graph of log of trade openness (LTOP).

Fig. 6 Graph of log of exchange rate (LER).
Fig. 7 Graph of cotton export with first difference (DLCX).

Fig. 8 Graph of world demand for cotton export with first difference (DLDX).

Fig. 9 Graph of competitiveness for cotton export with first difference (DLCM).
Fig. 10  Graph of log of concentration index with first difference

Fig. 11  Graph of log of openness with first difference (DLOP).

Fig. 12  Graph of log of real effective exchange with first Difference (DLER).
Table 1. Results of Dicky Fuller and Augmented Dickey Fuller unit root test (at level).

<table>
<thead>
<tr>
<th>Variables</th>
<th>Type of test</th>
<th>Without trend</th>
<th>With trend</th>
</tr>
</thead>
<tbody>
<tr>
<td>LCX</td>
<td>DF</td>
<td>-3.9961</td>
<td>-2.4056</td>
</tr>
<tr>
<td></td>
<td>ADF(1)</td>
<td>-2.3948</td>
<td>-2.4429</td>
</tr>
<tr>
<td>LWD</td>
<td>DF</td>
<td>-3.2977</td>
<td>-2.4136</td>
</tr>
<tr>
<td></td>
<td>ADF(1)</td>
<td>-1.7162</td>
<td>-2.4682</td>
</tr>
<tr>
<td>LCM</td>
<td>DF</td>
<td>-3.9677</td>
<td>-4.3668</td>
</tr>
<tr>
<td></td>
<td>ADF(1)</td>
<td>-2.1703</td>
<td>-2.509</td>
</tr>
<tr>
<td>LCI</td>
<td>DF</td>
<td>-3.7599</td>
<td>-3.6004</td>
</tr>
<tr>
<td></td>
<td>ADF(1)</td>
<td>-2.7118</td>
<td>-2.5791</td>
</tr>
<tr>
<td>LOP</td>
<td>DF</td>
<td>-2.3247</td>
<td>-5.1559</td>
</tr>
<tr>
<td></td>
<td>ADF(1)</td>
<td>-1.7436</td>
<td>-3.8625</td>
</tr>
<tr>
<td>LER</td>
<td>DF</td>
<td>-0.58358</td>
<td>-1.8388</td>
</tr>
<tr>
<td></td>
<td>ADF(1)</td>
<td>-0.81231</td>
<td>-2.4338</td>
</tr>
</tbody>
</table>

Critical value for ADF statistics without trend = -2.9472 (p=0.05)
Critical value for ADF statistics with trend = -3.5426 (p=0.05)

The results (Table 2) showed that after taking the first difference, all time series became stationary. All time series were integrated of order [I(1)].

Table 2. Results of Dicky Fuller and Augmented Dickey fuller unit root test (at first difference values).

<table>
<thead>
<tr>
<th>Variables</th>
<th>Type of test</th>
<th>Without trend</th>
<th>With trend</th>
<th>Order of integration</th>
</tr>
</thead>
<tbody>
<tr>
<td>DLCX</td>
<td>DF</td>
<td>-10.6787</td>
<td>-10.5320</td>
<td>I(1)</td>
</tr>
<tr>
<td></td>
<td>ADF(1)</td>
<td>-6.9296</td>
<td>-6.8599</td>
<td></td>
</tr>
<tr>
<td>DLWD</td>
<td>DF</td>
<td>-10.5295</td>
<td>-10.3920</td>
<td>I(1)</td>
</tr>
<tr>
<td></td>
<td>ADF(1)</td>
<td>-7.0422</td>
<td>-6.9862</td>
<td></td>
</tr>
<tr>
<td>DLCM</td>
<td>DF</td>
<td>-10.100</td>
<td>-10.5566</td>
<td>I(1)</td>
</tr>
<tr>
<td></td>
<td>ADF(1)</td>
<td>-6.7976</td>
<td>-6.7125</td>
<td></td>
</tr>
<tr>
<td>DLCI</td>
<td>DF</td>
<td>-8.1141</td>
<td>-8.0704</td>
<td>I(1)</td>
</tr>
<tr>
<td></td>
<td>ADF(1)</td>
<td>-5.6413</td>
<td>-5.7177</td>
<td></td>
</tr>
<tr>
<td>DLOP</td>
<td>DF</td>
<td>-9.1331</td>
<td>-9.0031</td>
<td>I(1)</td>
</tr>
<tr>
<td></td>
<td>ADF(1)</td>
<td>-6.5528</td>
<td>-6.4775</td>
<td></td>
</tr>
<tr>
<td>DLER</td>
<td>DF</td>
<td>-4.3586</td>
<td>-4.3060</td>
<td>I(1)</td>
</tr>
<tr>
<td></td>
<td>ADF(1)</td>
<td>-3.6016</td>
<td>-3.5594</td>
<td></td>
</tr>
</tbody>
</table>

Critical value of Augmented Dickey-Fuller statistics without Trend (p=0.05) = -2.9472
Critical value of Augmented Dickey-Fuller statistics with Trend (p=0.05) = -3.5426

Co-integration analysis

Since the variables were non-stationary and integrated of order 1, Johansen co-integration test was applied to check whether the variables were co-integrated or not, suggesting the long run relationship among the variables.
The co-integration leads to error correction model and the lagged error correction term integrated short run dynamics into long-run function (3). The co-integration equation was

$$Y_t = \alpha + \beta X_t + \mu_t$$  (6)

$\alpha =$ Constant
$\beta =$ long run relationship between the variables
$\mu_t =$ Deviation from long-run equilibrium path

If $Y_t$ and $X_2$ were $I(1)$ and $U_t$ was $I(0)$ then $Y_t$ and $X_t$ were co-integrated of order $I(1,0)$. Johansen-Juselius approach (1990) was used for testing co-integration. For this, the optimal lag length or the order of VAR was determined through the AIC (Akaike information criterion), and SBC (Schwarz Bayesian criterion) criteria. Test statistics of AIC and ABC are shown in Table 3.

### Table 3. Test statistics and selection criteria for selecting the order of VAR.

<table>
<thead>
<tr>
<th>Order</th>
<th>Lag length (LL)</th>
<th>AIC</th>
<th>SBC</th>
<th>Adjusted LR test</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>181.5404</td>
<td>31.5404</td>
<td>-82.9367</td>
<td>-----------------</td>
</tr>
<tr>
<td>3</td>
<td>83.1288</td>
<td>-30.8712</td>
<td>-117.8738</td>
<td>52.1003[.040]</td>
</tr>
<tr>
<td>2</td>
<td>37.9231</td>
<td>-40.0769</td>
<td>-99.6049</td>
<td>76.0327[.350]</td>
</tr>
<tr>
<td>1</td>
<td>8.9090</td>
<td>-33.0910</td>
<td>-65.1446</td>
<td>91.3931[.874]</td>
</tr>
<tr>
<td>0</td>
<td>-87.8616</td>
<td>-93.8616</td>
<td>-98.4407</td>
<td>142.6246[.517]</td>
</tr>
</tbody>
</table>

According to SBC criterion, the lag $(p)$ of VAR model was 1 and according to AIC criterion (largest value criteria) the lag $(p)$ of VAR was 4. Due to difference in both results, the lag $(p)$ of 2 was used in the model as the order of VAR. The Johansen (1990) test of co-integration was applied and results are shown in the Table 4.

### Table 4. Johansen co-integration test for determining the long run relationship between cotton lint export and liberalization indicators.

<table>
<thead>
<tr>
<th>Trace test</th>
<th>Maximum Eigen value test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test statistics</td>
<td>95 % critical value</td>
</tr>
<tr>
<td>H0</td>
<td>H1</td>
</tr>
<tr>
<td>r ≤ 1</td>
<td>r = 2</td>
</tr>
<tr>
<td>r ≤ 2</td>
<td>r = 3</td>
</tr>
<tr>
<td>r ≤ 3</td>
<td>r = 4</td>
</tr>
<tr>
<td>r ≤ 4</td>
<td>r = 5</td>
</tr>
<tr>
<td>r ≤ 5</td>
<td>r = 6</td>
</tr>
</tbody>
</table>
The test statistics (maximum value) was greater than critical value at one co-integrating vector \( (r =1) \) for both trace test and maximum-Eigen value test. This indicated the existence of one co-integrating association among all the variables, showing the long run relationship.

**Long run relationship**

The variables in model were co-integrated, thus there existed a long run relationship between the dependent and explanatory variables. The coefficients of long run relationship between the variables estimated through ordinary least square (OLS) method are shown in Table 5.

**Table 5. Regression analysis to estimate the impact of indicators of liberalization on cotton lint export (LCX) from Pakistan.**

<table>
<thead>
<tr>
<th>Variables</th>
<th>Coefficient</th>
<th>Std.Error</th>
<th>t-statistics</th>
<th>Prob</th>
</tr>
</thead>
<tbody>
<tr>
<td>LCX</td>
<td>9.345***</td>
<td>2.44</td>
<td>3.829</td>
<td>0.00</td>
</tr>
<tr>
<td>LWD</td>
<td>0.234**</td>
<td>0.1234</td>
<td>1.900</td>
<td>0.06</td>
</tr>
<tr>
<td>LCM</td>
<td>0.817***</td>
<td>0.134</td>
<td>6.077</td>
<td>0.00</td>
</tr>
<tr>
<td>LCI</td>
<td>0.394***</td>
<td>0.145</td>
<td>2.704</td>
<td>0.01</td>
</tr>
<tr>
<td>LTOP</td>
<td>0.133***</td>
<td>0.057</td>
<td>2.312</td>
<td>0.02</td>
</tr>
<tr>
<td>LER</td>
<td>-0.105</td>
<td>0.512</td>
<td>-0.206</td>
<td>0.83</td>
</tr>
</tbody>
</table>

\( R^2 \) = 0.97 \quad \text{Adjusted } R^2 = 0.97

**S.E of regression** = 0.18 \quad \text{Durbin-Watson} = 1.88

**The coefficient was significantly different from zero at 5 percent probability level.**

**The coefficient was significantly different from zero at 1 percent probability level.**

\( LCX = \beta_0 + 0.234LWD + 0.817LCM + 0.394LCI + 0.133LTOP - 0.105LER + \varepsilon \quad (7) \)

The high value of adjusted \( R^2 \) and Durbin-Watson showed the goodness of fit of the model. About 97 percent variation in the dependent variable was explained through the specified model. Since all the variables were expressed in log form, the estimated coefficients of all explanatory variables can be explained as elasticities. The estimated model is given in equation – 7. The coefficient value for world demand (LWD) was significant at 0.05 percent probability level. It showed that 10 percent increase in world demand lead to 2.3 percent increase in cotton export. The competitiveness showed the highest contribution. For a 10 percent increase in competitiveness, cotton export increased by 8.1 percent. The concentration index caused a 3.9 percent increase in the cotton export for a 10 percent rise in concentration. Surprisingly the openness of trade did not show a greater contribution in enhancing the cotton trade as compared to other variables. For a 10 percent increase in openness, cotton export increased only by 1.3 percent. The coefficient value of variable real exchange rate (LER) was 0.10 which was
not significant. Its negative sign showed that 10 percent increase in real exchange led to decrease in export by the same magnitude. It further implied that there existed a positive relationship between currency depreciation and cotton export. The corresponding change in cotton export due to change in currency depreciation was of the same magnitude and in same direction. These results are in consistent to the findings of Edwards and Alves (14) where export performance of South Africa was studied. Exchange rate depreciation positively affected export performance by raising the profitability of export supply. Exporters were responsive to domestic policies and environment.

Error correction mechanism

The short dynamics involved in the model was determined by the ECM. The ECM equation of the estimated model was

\[
DLCX_t = \beta_0 + 0.308DLWD_t + 0.744DLCM_t + 0.33DLCO_t + 0.202DLTOP_t - 0.19DLER_t + e(-1) + \varepsilon_t \quad (8)
\]

Table 6. Results of error correction mechanism to estimate the short run dynamics between indicators of liberalization on cotton lint export (CX) from Pakistan (1971-2008)

<table>
<thead>
<tr>
<th>Variables</th>
<th>Coefficient</th>
<th>Std. error</th>
<th>t-statistics</th>
<th>Prob</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>0.066***</td>
<td>0.0157</td>
<td>4.35</td>
<td>0.00</td>
</tr>
<tr>
<td>DLWD</td>
<td>0.308***</td>
<td>0.101</td>
<td>3.02</td>
<td>0.00</td>
</tr>
<tr>
<td>DLCM</td>
<td>0.744***</td>
<td>0.108</td>
<td>6.87</td>
<td>0.00</td>
</tr>
<tr>
<td>DLCI</td>
<td>0.330***</td>
<td>0.115</td>
<td>2.85</td>
<td>0.00</td>
</tr>
<tr>
<td>DLOP</td>
<td>0.202***</td>
<td>0.050</td>
<td>4.02</td>
<td>0.00</td>
</tr>
<tr>
<td>DLER</td>
<td>-0.190***</td>
<td>0.314</td>
<td>-2.05</td>
<td>0.05</td>
</tr>
<tr>
<td>E(-1)</td>
<td>-0.210**</td>
<td>0.109</td>
<td>-2.05</td>
<td>0.05</td>
</tr>
</tbody>
</table>

R² 0.98
Adjusted R² 0.98
S.E of regression 0.15
Durbin-Watson 1.88

**The coefficient was significantly different from zero at 5 percent probability level.
***The coefficient was significantly different from zero at 1 percent probability level.

The coefficient value of variable world demand (LWD) was 0.30 which was significant at 0.01 percent probability level. It showed that 10 percent increase in world demand (LWD) led to 3.0 percent increase in cotton export. The competitiveness showed positive relationship and 10 percent increase in competitiveness caused a 7.4 percent increase in cotton export. The magnitude of concentration (LCI) was 0.33 that was significant at 0.01 percent probability level. It showed that 10 percent increase in LCI caused 3.3 percent increase in cotton export. The openness (LOP) was 0.20 which was significant at 0.01 percent probability level showing 2.0 percent increase.
in cotton export due to 10 percent increase in LOP. The coefficient value of real exchange rate (LER) was -0.19 which was not-significant. It showed for 10 percent increase in real exchange rate (LER) implying the currency depreciation leads to decrease in export by 1.9 percent. The coefficient of error correction term was significant and had the correct sign which showed the convergence of system towards the equilibrium. The value of error correction term was 0.21 which showed that economy corrects its disequilibrium if it grows at 21 percent a year. In other words a period of 5 years is required to bring the economy at equilibrium.

**Long run and short run elasticities**

The long run and short run elasticities of cotton lint (LCX) with the variables were positive except exchange rate. The elasticities for world demand for cotton were 0.234 and 0.308 for long and short period, respectively. The change in export of cotton lint due to 1 percent change in world’s demand for cotton was less than proportionate.

**Table 7. Long run and short run elasticities of cotton lint export with the indicators of liberalization.**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Long run elastic ties</th>
<th>Short run elastic ties</th>
</tr>
</thead>
<tbody>
<tr>
<td>LWD</td>
<td>0.234**</td>
<td>0.308***</td>
</tr>
<tr>
<td>LCM</td>
<td>0.817***</td>
<td>0.744***</td>
</tr>
<tr>
<td>LCI</td>
<td>0.394***</td>
<td>0.330***</td>
</tr>
<tr>
<td>LOP</td>
<td>0.133***</td>
<td>0.202***</td>
</tr>
<tr>
<td>LER</td>
<td>-0.105</td>
<td>-0.190</td>
</tr>
</tbody>
</table>

**The coefficient was significantly different from zero at 5 percent probability level.**

**The coefficient was significantly different from zero at 1 percent probability level.**

The estimated elasticities of cotton lint (LCX) with competitiveness were 0.817 and 0.744 for long run and short run, respectively which indicated that the change in cotton export (LCX) due to competitiveness (CM) was less than one. The export of cotton lint (LCX) had the positive elasticities with openness (LOP) and concentration of export (LCI). The values of long run and short run elasticities of cotton export with openness and concentration index were less than proportionate change in LCX. The LCX had the negative elasticity with exchange rate (LER) which showed the positive relationship between currency depreciation and cotton export.

**CONCLUSION AND POLICY IMPLICATIONS**

The impact of domestic and international policies on export of cotton lint was studied for the year 1971 to 2008 in terms of world demand for cotton,
competitiveness (CM), export concentration, openness and effective exchange rate. World demand for cotton lint showed the impact of international policies on export of cotton lint while all other variables showed the impact of domestic policies on cotton lint export.

The co-integration existed among the dependent and explanatory variables. The results showed the existence of positive relationship between export of cotton lint and world’s demand for cotton. One percent increase in world’s demand for cotton caused 0.23 percent increase in export of cotton lint in Pakistan. Export of cotton lint in Pakistan had the positive relationship with competitiveness and openness. The results showed that 10 percent increase each in export competitiveness and openness caused 8.2 and 1.4 per cent increase in cotton’s export of Pakistan, respectively.

The results on short relationship among the world demand for cotton lint, competitiveness, export concentration and openness showed that domestic policies having positive impact on supply side performance, also led to better export performance. Agricultural export was responsive to domestic and international policies. The competitiveness in cotton export contributed maximum in increasing the cotton lint export from Pakistan alongwith agricultural export openness. This country will benefit from trade liberalizations in the real terms only if WTO agreements are fully implemented with fair dealings between all developing and developed countries. Based on the findings of study following policy implications and recommendations are made:

1. Development of new technologies with high productive potentials and comparative advantage are required to maintain and further improve the competitiveness of Pakistan in cotton sector.

2. There is a need for investment in agricultural sector to achieve the increased productivity, efficiency and quality at all stages of this sector with reduction in cost of production, marketing and processing.

3. Cotton marketing mechanism requires improvement to become innovative and efficient. There is need for such policies measures and flexibility in this sector that can boost the change and adjustments process in response to international market demands due to liberalization.

4. An aggressive policy is required to discover the niche market for trade.
5. There is a need to negotiate on the trade discriminations in the international trade against less developed countries to improve the world demand.

REFERENCES