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Exchange Rate Volatility and Bilateral Cotton Exports from Pakistan: An Empirical Analysis

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ABSTRACT

This study used the generalized gravity model to examine the impact of exchange rate volatility and exchange rate regime on Pakistani cotton exports. Pakistan's bilateral data set with major cotton trading partners, such as the United States of America, the United Kingdom, Hong Kong, China and the United Arab Emirates, was used in the panel framework from 1982 to 2017. Volatility in the exchange rate is measured by moving average standard deviation. The results confirm that exchange-rate volatility does not affect Pakistan's cotton exports, while the exchange-rate regime has a significant negative impact on cotton exports. Other variables such as economic size have a significant positive effect, distance has a significant negative effect and the relative price has a significant negative effect on Pakistan's cotton exports. The government should take steps to make the export of cotton competitive.

Keywords: Cotton exports, Gravity model, Exchange rate regime, Exchange rate volatility, Bilateral exports.

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1. INTRODUCTION

Cotton is an important cash crop for Pakistan which is known as 'white gold'. Pakistan is the fourth largest cotton producer in the world and some 1.5 million small farmers rely on it for their livelihoods. Pakistan is the third-largest exporter of raw cotton. Cotton is mostly grown in the plains of Punjab and Sind. It contributes 8.2 per cent to agricultural income, 3.2 per cent to national income and 45 percent to Pakistan's total exports. It also employed more than 45 percent of Pakistan's total workforce.

Global competition exists in the cotton export market, and exchange rate volatility can also have an impact on cotton exports (Kadir *et al*., 2011). Pakistan's cotton producers are very concerned about exchange-rate volatility, as 45 percent of cotton is exported, and exchange-rate volatility can create uncertainty in profits.

The exchange rate is an important economic policy tool that can influence the production and exchange of tradable goods, in particular cotton. It can influence tradable inputs and outputs, such as fertilizers and raw cotton. In 1952, the Government of Pakistan imposed restrictions on imports of cotton and jute, and in 1956, the Pakistani rupee was devalued in order to promote exports, but exports decreased due to unfair incentives (Block, 1991).

Exchange rate is the exchange power of a country, but many studies have found either a positive (Asseery and Peel, 1991 and IMF, 1984) or a negative (Arize, 1998; Chowdhury, 1993) relationship between exchange rate volatility and international trade.

Following the fall of the Breton Wood system in 1973, a floating exchange-rate system was introduced that initiated a debate on the impact of exchange rate (ER) volatility on global trade. Hooper and Kohlhagen (1978), Either (1973) and several other researchers conducted theoretical analyzes of the affiliation between ER volatility and global trade. The interesting thing found in theoretical literature is that there is no consensus among researchers on the impact of exchange rate (ER) volatility on international trade. Either (1973), Clark (1973), Baron (1976), Cushman (1986) and Peree and Steiner (1989) have confirmed, with the help of traditional trade theories, that increasing ER volatility has had adverse effects on the volume of international trade. In other words, ER uncertainty is a kind of threat or fear of loss; it creates uncertainty for traders; if the trader or exporter is at risk, it tends to reduce exports (Coes, 1988). In this context, literature related to Pakistan is mostly found at aggregate level with time series analysis by Mustafa *et al*. (2004) Aqeel *et al*. (2006). This study will fill the gap between the commodity wise and the cotton commodity selected because it is Pakistan's second major export commodity.

The objective of the study is to investigate the effect of the bilateral exchange rate volatility and free-floating exchange rate regime on Pakistani cotton exports (disaggregate exports) in the 1982 to 2017 panel data framework.

2. LITERATURE REVIEW

There is a vast literature on exchange rate volatility and its impact on international trade. Many empiric studies have been found in Economics literature with different objectives, different data sets and different or mixed results on the impact of exchange rate volatility on exports. Exchange rate volatility has been widely discussed in both theoretical and empirical literature since 1973. Hooper and Kohlahagen (1978) and Either (1973) conducted theoretical analyzes of the affiliation between exchange rate volatility and global trade. The key aspect identified in theoretical literature is that there is no consent among researchers to the effect of the Exchange Rate uncertainty on exports. (Either, 1973; Cushman, 1986; and Peree *et al*., 1989), with the help of traditional trade theories, confirmed that the increase in exchange rate volatility had adverse effects on the volume of international trade. On the other hand, Franke (1991) using data from developed countries has shown that an increase in exchange rate volatility could have a positive effect on international trade.

Mustafa and Nishat (2004) investigated the impact of exchange-rate volatility on Pakistan's export growth with major trading partners. Their findings support the negative and significant relationship between exchange rate volatility and export growth in the long term as well as in the short term with trading partners such as the United Kingdom and the United States. Similarly, Saad *et al*. (2019) analyzed the behavior of Pakistani cotton producers under exchange rate volatility and concluded that Pakistani cotton producers are risk-averse. Paul *et al*. (2018) analyzed the effect of nominal exchange rate, inflation rate, capital stock and foreign direct investment on economic growth in Kuwait using time series data from 1975 to 2015. The results confirm that, as nominal exchange rate increases, this result in a significant positive effect on economic growth. Similarly, Mustafa and Rashid (2018) found that exchange-rate volatility had a negative effect on different macroeconomic variables in Pakistan. Abbas, *et al*. (2019) analyzed the impact of the revaluation of fixed assets on the future performance of firms in Pakistan. The cement sector in Pakistan was analyzed. Results have shown that the revaluation of fixed assets has a negative impact on future firm performance in cement companies. Khan, *et al*. (2019) studied the relationship between export demand and exchange-rate volatility in Pakistan. They used a self-regressive, distributed lag model (Bound test). The result confirms that the actual effective exchange rate has an insignificant negative effect on Pakistan's aggregate export demand.

Cho *et al*. (2002) examines the effect of Exchange Rate Volatility on the global trade in wheat and finds mixed results. Molina *et al*. (2013) examined the effect of Exchange Rate Volatility on Thailand's rice exports to major trading partners for the period 2001 to 2012. The results confirm the significant negative effect of the exchange rate volatility on the volume of rice exports. Samuel *et al*. (2014) analyzed the impact of Exchange Rate Volatility on French Kenyan beans exports to major trading partners. Results have shown that the unit

increase in exchange rate volatility leads to a more than proportionate decrease in French beans exports to major trading partners.

In contrast to the above studies, Franke (1991) demonstrated that increased ER volatility could have a positive effect on international trade volumes through the use of different data sets of developed countries. Herwart (2003) suggested that "there could be a condition in which the uncertainty of exchange rates could have either positive or negative effects on the quantity of trade". The conclusion drawn from the theoretical literature review is that there is no consensus among researchers on the impact of exchange rate volatility.

3. METHODOLOGY

This study focuses on bilateral cotton data using a generalized gravity model with a panel estimation technique. Jan Tinbergen (1962) was the first to use the Newton Gravitational Model to estimate bilateral trade between two countries. Anderson (1979) later formulated the theoretical background to the Gravity Trade Model. The basic model of trade between two countries is as follows

$$F_{ij} = G\frac{{M_i}^{\beta_1}{M_j}^{\beta_2}}{{Dis_{ij}}^{\beta_3}} . \epsilon \qquad \ldots\ldots. (1)$$

F_{ij} is the bilateral trade flow between i^{th} and j^{th} countries. G is constant, M_iM_j is the product of the economic size [1](M_i and M_j). M_i is the economic size of i^{th} country M_j is the economic size of j^{th} country or Pakistan. Dis_{ij} is the distance between the capital of country i^{th} and Islamabad, the Capital of Pakistan. ϵ is the residual term. This study uses generalize gravity model similar to Bergstrand (1985) for explaining the export performance of Pakistan with bilateral exchange rate volatility measure and exchange rate regimes in panel frame work.

The Estimation model is

$X^i_{pak,j,t,} = f(GDP_{pak,t}, GDP_{j,t}, RP^i_{pak,j,t}, Dis_{pak,j}, V_{pak,j,t}, D_{reg})$ …….(1.a)

$X^i_{pak,j,t}$ = Value of bilateral cotton export to the j^{th} country from Pakistan at 't' time

$GDP_{pak,t}$ = Real Gross Domestic product of Pakistan at t time

$GDP_{j,t}$ = Real Gross domestic product of j^{th}country at t time

$RP^i_{pak,j,t}$ = Relative price of cotton exports of Pakitan to the j^{th} country at t time

$Dis_{pak,j}$ = Distance between Pakistan capital Islamabad to the j^{th} country capital city in KM

$V_{pak,j,t}$ = volatility measure of bilateral exchange rate Pakistan Rupee to j^{th} country currency

D_{reg} = dummy for free-floating exchange rate regime

The model estimation is done in log-linear form. Thus, the coefficients represent the elasticity of each dependent variable.

$$\ln(X^i_{pak,j,t}) = \delta_0 + \delta_1 \ln(GDP_{pak,t}) + \delta_2 \ln(GDP_{j,t}) + \delta_3 \ln(RP^i_{pak,j,t}) + \delta_4 \ln(Dis_{pak,j}) + \delta_5 \ln(V_{pak,j,t}) + \delta_6 D_{reg} + \xi_t \quad \ldots\ldots\ldots\ldots\ldots\ldots.(2.b)$$

Here δ_0, δ_1, δ_2, δ_3, δ_4, $\delta_5$andδ_6 are parameter and ξ_t represent error term. Expected sign of $\delta_3$and $\delta_4<0$, i.e. negative and $\delta_1, \delta_2 > 0$, i.e. positive. The sign of δ_5 and δ_6 are ambiguous.

[1] Market size of exporter and importer (i.e. Masses of the economies) could represent by alternative variables, like Gross Domestic Product (GDP), Per capita GDP. This study uses Real Gross Domestic Product (RGDP).

For one way cross fixed effect cannot be possible because of cross invariant variable $GDP_{PAK,t-1}$ Cross invariant effect of $GDP_{PAK,t}$ can be controlled by the Krugman and Maurice (2005) by employing the ratio form of economics sizes i.e. $GDP_{j,t}$ / $GDP_{pak,t.}$ the model would have become:

$$\ln (X^{i}_{pak,j,t}) = \lambda_0 + \lambda_1 \ln (GDP_{j,t} / GDP_{pak,t}) + \lambda_2 \ln (RP^{i}_{pak,j,t}) + \lambda_3 \ln (Dis_{pak,j}) + \lambda_4 \ln (V_{pak,j,t}) + \lambda_5 D_{reg} + \omega_t \quad \text{.....(2.c)}$$

Here λ_0, λ_1, λ_2, λ_3, λ_4 and λ_5 are parameter and ω_t represent error term. Expected sign of λ_2 and $\lambda_3<0$, i.e. negative and $\lambda_1> 0$, i.e., positive. The sign of λ_4 and λ_5 is ambiguous.

Aristotelous (2001) used the exchange rate regime with exchange rate volatility as a determinant of bilateral exports. If only the exchange rate volatility is included in the model, the regime may also have an impact on bilateral exports. It is therefore important to add the dummy to a free-floating exchange-rate system as a determinant of bilateral exports with exchange-rate fluctuations in order to measure the effect separately.

Transportation costs are generally used as a proxy for the distance variable. Vido and Prentice (2001) summarized the problem of distance-related time-invariants and encouraged the application of freight rates as a perfect measure of transport costs between trading partners. However, distance in kilometer (km) is used in this study.

Different measurements of volatility can report different results on trade, as McKenzie (1999) verified different methods could produce different results. In this study, the Moving Average Standard Deviation method is used as a measure of exchange rate volatility.

This study used bilateral annual data for the period 1982 to 2017 to estimate Pakistan's cotton export performance with five major cotton exporting partners[2]. This period is taken because Pakistan is modifying the Peg exchange rate regime to manage the floating regime, followed by a free floating regime. The data chosen from different sources, the definition and the sources of each variable are described in the appendix.

Xipak, j, t bilateral exports of cotton from Pakistan to the country of 't' time. The date of bilateral exports of cotton between Pakistan and major cotton exporting partners (countries) is set at USD$ and extracted from the UN comrade. UVIipak, t Unit Value Index of Pakistani cotton exports is extracted from the State Bank of Pakistan Real Gross Domestic Product (GDPPak, t) of Pakistan, calculated by the Nominal Gross Domestic Product in US$ divided by the gross domestic deflator.

$$GDP_{pak,t} = \frac{Nominal\ GDP_{pak,t}}{GDPdeflator_{pak,t}}$$

Data from Nominal Gross Domestic Product of Pakistan (NGDPpak, t) and GDP deflatorpak, t extracted from IFS.

Real Gross Domestic Product (GDPj, t) of the selected export partners is calculated by the nominal gross domestic product of the country in USD $ divided by the gross domestic deflator of the country.

$$GDP_{j,t} = \frac{Nominal\ GDP_{j,t}}{GDPdeflator_{j,t}}$$

The GDP data of the jth country and the GDP deflator of the jth country at the time are extracted from the IFS. CPIj, t Consumer price index defined as the weighted average price of a consumer goods and services basket over a t-term period. The Consumer Price Index data for selected countries is extracted from the IFS. RPipak, j, t The relative price index of Pakistan's cotton exports is the ratio of the unit value index of Pakistan's cotton exports (UVIiPak, t) to the consumer price index of the country (CPIj, t).

[2] United States of America, United Kingdom, Hong Kong, China, and the United Arab Emirates.

$$RP^{i}_{pak,j,t} = \frac{UVI^{i}_{pak,t}}{CPI_{j,t}}$$

Dispak, j Distance data is time-invariant taken in Km, defined as the distance between the capital city of Pakistan (Islamabad) and the chosen capital city of Pakistan. A number of studies have also used the freight rate as a proxy to nullify the time-invariant problem. The distance data shall be taken from CEPII.

NEPAK, j, t is a bilateral nominal exchange rate; it is defined as the value of Pakistani rupees per unit currency of the country at t. The bilateral nominal exchange rate is extracted from the different issues of the Pakistan Economics survey.

Dreg is the dummy variable of the free-floating exchange rate regime. As the study covers Pakistan from 1982 to 2017, it contains only two types of exchange rate regime, i.e. managed floating and free floating. For the period 1982-2000 the floating exchange rate regime employed and after 2000 the free-floating exchange rate regime 2017 managed.

D_{reg} = 0 for managed floating exchange rate regime and

D_{reg} = 1 for free-floating exchange rate regime.

4. EMPIRICAL RESULT

The results of the least square, fixed and random effects pooled are shown in Table **1**. Hausman chi-square statistics indicate that the ECM (random effect) model is not appropriate. F-test confirms that the restricted model is better than the unrestricted model, i.e. the least square pool. The f-test[3] between the pool of least square and two-way (cross and time) fixed effect models concludes the rejection of the null hypothesis.

Table 1. Estimation of Cotton Exports of Pakistan.

Variables	Pool Least Square	Fixed Effect Model	Random Effect Model
		Time and Cross	Time and Cross
Constant	6.80* (8.21)	6.41* (3.056)	-0.677* (9.14)
Log(GDPJ/GDPPAK)	0.867* (12.61)	0.477 (0.720)	0.884* (12.31)
Log(DIS)	-0.55* (-6.00)	----	-----
Log(RP)	-0.211 (-1.09)	1.93** (1.57)	-0.302** (-1.52)
Log(V)	0.018 (0.343)	0.0045 (0.093)	0.0471 (0.989)
DREG	-0.647* (-2.22)	----	----
Adj R^2	0.62	0.73	0.62
N	160	160	160
F- statistics	53.80	12.82	67.75
Hausman test Chi sq statistics			13.29
Df			3

The figures in parentheses are t-statistics; White cross-section standard error and covariance (d.f. corrected)

*Show significance at 5% level, **show significance at 10% level

[3] F-calculated value is 22.07> f-critical value at 5% 3.07; it concludes that it is better to use Pool least square i.e. unrestricted model.

The empirical analysis in Table **2** shows the estimated result of Pakistan's cotton exports in four different ways. The model in column (a) is estimated in its original form. In column (b), the model is estimated after the elimination of the free-floating exchange rate regime (DREG) dummy. In column (c) the estimation model after the elimination of the exchange rate variation volatility. In column (d) of the estimation model, both the exchange rate volatility and the free-floating exchange rate regime dummy are eliminated.

Table 2. Cotton Export of Pakistan.

Variables	Column (a)	Column (b)	Column (c)	Column (d)
Constant	6.80* (8.21)	6.558* (4.594)	6.661* (5.157)	6.225* (4.765)
Log(GDPJ / GDPPAK)	0.867* (12.61)	0.934* (14.312)	0.859* (13.797)	0.918* (15.465)
Log(DIS)	-0.55* (-6.00)	-0.6179* (-3.753)	-0.564* (-3.553)	-0.640* (-4.018)
Log(RP)	-0.211 (-1.09)	-0.593* (-3.04)	-0.198 (-0.880)	-0.557* (-3.018)
Log(V)	0.018 (0.343)	0.04 (0.585)	-----	-----
DREG	-0.647* (-2.22)	-----	-0.6554* (-2.688)	-----
Adj R^2	0.62	0.60	0.62	0.61
F- statistics	53.80	63.14	67.63	84.43
No. of observation	165	165	165	165

The figures in parentheses are t-statistics; White cross-section standard error and covariance (d.f. corrected)
*Show significance at 5% level, **show significance at 10% level

The F-test[4] between models presented in Table **2** concludes that it is better to use a restricted model, i.e. a model without exchange rate volatility. In other words, exchange rate regimes influence Pakistan's cotton exports.

The GDPJ / GDPPAK coefficient is positive and means a 1% increase in GDPJ / GDPPAK decreases Pakistan's cotton exports by 0.85 percent. Coefficient of distance is negative and significant means of unit increase in distance decreases Pakistan's cotton exports.

Coefficients of exchange rate volatility are positive and insignificant with and without a dummy for the exchange rate regime as shown in Table **2** (columns (a) and (b)). This means that the uncertainty of the exchange rate has no bearing on Pakistan's cotton exports.

The dummy coefficient for the exchange rate regime is negative and significant at a 5% significance level as shown in columns (a) and (b) of Table **2**. This means that the free-floating exchange rate (when DREG = 1) causes Pakistan's cotton exports to decline.

[4] F-test between models presented in Table 2. F-calculated value between column (a) and (c) is 0.41< f-critical value at 5% 3.92; it concluded that it is appropriate to use restricted model present in column (c).

5. CONCLUSION

The study used the Generalized Gravity Model to assess the impact of exchange rate volatility and exchange rate regime on Pakistani cotton exports to major trading partners such as the United States of America, the United Kingdom, Hong Kong, China, and the United Arab Emirates, using data from 1982 to 2017 in the panel framework. Empirical estimates confirm that exchange-rate volatility has an insignificant effect on cotton exports, which is contrary to Haseeb *et al*. (2014). The free-floating exchange rate regime has a significant negative impact on the export of cotton to Pakistan. This result is contrary to Aristotle (2001). While other determinants such as the export market size ratio of the exporting partner to the exporter (i.e. GDPJ / GDPPAK) are positive, they show that Pakistan's cotton exports are highly related to the partner income. Geographical distance (DIS) has a negative impact, the relative price (RP) has a negative but insignificant impact on Pakistan's cotton exports. The results of other determinants are in line with Aristotle (2001).

6. POLICY IMPLICATIONS

Steps should be taken by the government to make the export of cotton competitive, although the relative price is insignificant. The Government must provide a storage facility for cotton producers to maintain the cotton reserve and export it at a time when prices are relatively high on the international market.

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APPENDIX

Variables for Disaggregate Exports

Symbol	Defining	Data Source
$X_{i,j,t,pak}$	Value of cotton export of Pakistan to j^{th} country	UN-Com trade
$GDP_{t,pak}$	GDP of Pakistan (exporting country)	IFS
$GDP_{t,j}$	GDP of importing j^{th} country	IFS
UVXi,t	Unit Value Cotton of Export Pakistan	Hand book Statistics Chapter 8 (8.5)
CPIi,j,t	Consumer Price Index of cotton in j^{th} country	
$RP_{i,t,pak}$	Relative Price index of i^{th} sector of i.e. Pakistan cotton exports $= \frac{UVX_{i,pak,t}}{CPI_{i,j,t}} \times 100$	Computed
$Dis_{pak,j}$	Distance between Pakistan capital to j^{th} country capital	CEPII
$NEER_{pak,j,t}$	Nominal exchange rate Pakistan currency to j^{th} country	Pakistan Economic survey
V_t	Exchange rate volatility	Computed through moving average method
D_{reg}	Dummy for free floating exchange rate regime in Pakistan	D=0 for managed floating D=1 for flexible floating