



Pakistan's Export Demand Income and Price Elasticity Estimates: Reconsidering the Evidence

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Abstract

In this article, basic export demand determinants are reconsidered for Pakistan. There are empirical studies on Pakistan's export demand, however, ignore to calculate for export weighted foreign income and relative export prices taking a large number of trading partners, which is important due to high involvement of the country with utmost trading partners for accurate elasticity estimate. To communicate the issue, we in this paper estimated the export model with two regressors, real effective exchange rate and real foreign income. The empirical finding depicts that there is co-integration among the variables but the export model is functionally weak having two conventional determinants for the year of 1981 to 2010. Instead, the analysis indicates an important role for the average foreign income and insignificant for real exchange rate.

Keywords: Export demand, time series, co-integration, real effective exchange rate, Pakistan, JEL Classification: C22, F12, F14, F31

Introduction

Research studies are numerous that have been designed to measure the relationship between changes in real export, real foreign income and changes in relative export prices. For instance, if we step back and look at the referred studies and so many others, all have investigated for the price and income elasticity in export demand function besides the import demand¹⁻³. However, the knowledge of price and traded quantity relationship desired for many reasons, particularly a nation often seeks to influence the trade flows for trade balance. In regards of export price elasticity, there reports that higher export price elasticity represents the competitive market for export of the country, and the situation would lead to a successful devaluation and thus greater export revenues⁴.

As for as Pakistan's export demand is concerned, based on previous literature many research studies have employed different measure of relative export prices. To quote few examples, literatures often use the ratio of domestic export prices to world export prices as the relative export price term⁵⁻⁷. Someone utilize the relative price data of exports defined as the ratio of domestic export prices to the trade weighted price of exports of trading partners⁸, while other employed the trade weighted real effective exchange rate (REER) to measure for price elasticity in export demand^{9,10}. Furthermore, unlike aggregate analysis, many other use real exchange rate as a measure of relative price in bilateral analysis^{11,12}.

As for as the measure of relative export prices data and this paper is concerned, we entertain the long run relationship

between export demand and real effective exchange rate of Pakistan. Previously has shown that Pakistan's export demand and real effective exchange rate are co-integrated¹⁰. However, we considered this objective by replacing our measure of relative prices, the REER, with the export weighted measure. Utilize the data on export share of the twenty trading partners that share more than 2/3 in Pakistan's total export. Furthermore, alike REER, the export weighted real income of the trading partners is calculated to measure for income elasticity in export demand. Using a modified relative price term, this research study presents new evidence on stated issue. For details discussion the subsequent section are as following. Section II presents the model of export demand, and Section III data and methodology of the study. Section IV gives results and Section V concludes the study.

Export Model for Estimation

The model of study is rooted in previous studies of export demand function^{6,9,10}. More explicitly, for estimation the model of export demand is of the following form:

$$\ln RX_t = \alpha_0 + \phi \ln REER_{X,t} + \gamma \ln FRGDP_{X,t} + \mu_t \quad (1)$$

Where RX = real export, $REER$ = real effective exchange rate, $FRGDP$ = weighted real gross domestic product or income level of trading partners i.e. 20 in our case, the subscript X represents the export weight and t the time, and \ln = natural logarithm. Note that the real effective exchange rate is used to measure for price elasticity in export demand and is assumed to obtain a negative coefficient while $FRGDP$ is used to measure for income elasticity in export demand and is assumed to get a

positive coefficient, whereas, in equation (1) ϕ and γ represents the price and income elasticity, respectively.

Data Sources and Variable Description

The included variables in export demand of equation (1) are annual, the time period is from 1981 to 2010, and the data are collected from different database as given below: i. Pakistan Economic Survey (various issues)¹³, ii. A Handbook of Statistics, October 2010, State Bank of Pakistan¹⁴, iii. The World Bank, World Development Indicators and Global Development Finance¹⁵.

All variables are in constant 2000=100 prices. Real export is equivalent to the nominal export from source first divided by export unit value from source second. As for relative export prices, the variable real effective exchange rate were used. Our study first calculate for export weighted nominal effective exchange rate (NEER) and foreign price index, then construct for real effective exchange rate (REER). The real foreign income is taken as the average weighted gross domestic product of trading partners, and have taken foreign income from world development indicators (for more on formulations of nominal and real effective exchange rate, foreign prices and income level see in appendix).

The Empirical Findings

Unit Root: Before findings the long run relationship and error correction representation, our study tested each individual series, real export, real effective exchange rate and foreign income level for unit roots using the Augmented Dickey Fuller (ADF) test and Phillips-Perron (PP) test^{16,17}. Both, the test results are portrayed in table 1 for every variable in level and at first difference.

In all, results depicts that variables are non stationary at level excepting real effective exchange rate, if we include for intercept only. This REER is too integrated first order, if we

consider for trend in estimating equation. After taking the first difference, all I (1) variables becomes I (0) irrespective of the tests and estimating equation. In conclusion, all variables become stationary when we take the difference.

Long Run Analysis

Various econometric techniques help us to find out for long run relationship among the variables in export model. However, our study test for co-integration among the variables by using autoregressive distributed lag (ARDL) method. This method has been rigorously discussed by Pesaran et al. and is preferred over the other co-integration approaches for several reasons¹⁸. The most relevant to our study are, the use of ARDL is more appropriate in small sample case and applicable even if some explanatory variables are integrated zero order. Moreover, ARDL mature in different steps where F-test calculation is foremost for decision of co-integration in specified model. Following Pesaran et al.¹⁸, the Wald test restrictions were imposed on the following model:

$$\Delta \ln RX_t = \alpha_0 + \sum_{i=1}^m \alpha_{1,i} \Delta \ln RX_{t-i} + \sum_{i=0}^n \alpha_{2,i} \Delta \ln REER_{x,t-i} + \sum_{i=0}^o \alpha_{3,i} \Delta \ln FRGDP_{t-i} + \alpha_4 \ln RX_{t-1} + \alpha_5 \ln REER_{x,t-1} + \alpha_6 \ln FRGDP_{t-1} + \varepsilon_t \tag{2}$$

Where, Δ represent the difference for all variables, i the number of lags and t-1 the level lag of variable. Under the Wald test, takes the null and alternative hypothesis as given:

- Null Hypothesis: $a_4 = a_5 = a_6 = 0$ (No Co-integration)
- Alternative Hypothesis: $a_4 \neq a_5 \neq a_6 \neq 0$ (Co-integration)

Thus, based on Schwarz Criteria estimated equation (2). After selected model F-statistics is calculated and are compared with the critical bound values that are extracted from Pesaran et al.¹⁸. Only real export is taken as dependent variable and then results for F-statistic is tabulated in table 2.

Table-1
ADF and PP tests for Order of Integration

Test for I (0)			Test for I (1)			
Variables in log	RX	REER _x	FRGDP	Δ RX	Δ REER _x	Δ FRGDP
<i>ADF Test Results</i>						
With constant	-0.848	-3.55**	-0.91	-5.71*	-4.13*	-4.90*
With trend	-2.28	-1.08	-1.23	-5.76*	-5.41*	-5.27*
<i>PP Test Results</i>						
With constant	-0.84	-4.20*	-0.95	-5.58*	-4.11*	-4.94*
With trend	-2.24	-0.70	-1.61	-5.89*	-5.54*	-6.45*

Note: The null hypothesis in both cases is that the variable has a unit root. The superscript * and ** represent one per cent and five per cent level of significant, respectively. For ADF and PP tests, the critical values are -3.65 (with constant) and -4.31 (with trend) at 1 per cent, while -2.96 (with constant) and -3.57 (with trend) at 5 per cent level of significance. The critical values based on Mackinnon (1996) one-sided p-values.

Table-2
F-statistic Results for Co-integration

Estimated F-statistics: 7.130	
Critical values at 5 %:	
Lower Bound = 4.94,	Upper Bound = 5.73
Two explanatory variables and intercept with no trend in the model	
Critical values are from Pesaran et al. (2001), p. 300, Case III, Table CI. Iii,	

The value of F-statistic is 7.13 when real export is taken as dependent variable, which exceeds than upper critical value of at the 5 % level. Therefore, accept alternative hypothesis and indicates that export demand and its two explanatory variables are co-integrated.

Having found that export demand and its two explanatory variables are co-integrated, we now use the general long run ARDL (see in equation 3) to estimate for long run elasticity estimates. The general form of long run ARDL is given as:

$$\ln RX_t = c + \sum_{i=1}^m \beta_{1i} \ln RX_{t-i} + \sum_{i=0}^n \beta_{2i} \ln REER_{x,t-i} + \sum_{i=0}^o \beta_{3i} \ln FRGDP_{t-i} + \mu_t \quad (3)$$

From equation (3), it is obvious that proper lag selection is opening task and should be mentioned that Pesaran et al. suggests two maximum lag lengths for annual observation. Therefore, estimated the model presented above based on different lag selection criteria's such as Akaike, Schwarz and Hannan-Quin. Using alternative criteria, in our case the results are consistent and specify the maximum one lag. After all, the results for long run export demand elasticity estimates are reported in table 3. From adjusted R-square of 0.97 the regression model is fit well and passes the diagnostic test of no auto correlation and no heteroscedasticity. However, functionally specify the specification error as the p-value for functional form diagnostic test lies within the range of below 10 per cent. The problem can be avoided, as we exclude the constant from regression but it vary in large the resultant coefficient. In conclusion, the functional form is weak for export demand in case of two conventional determinants. Its reason may be that the study takes the time period from 1981 and ignore for the trade liberalization effects in the regression, where trade liberalization is part of the trade policy regimes in Pakistan since the mid of eighties.

Table-3
Estimated Long Run Standard Export Demand Elasticity Estimates, ARDL (1, 0, 0)

Variable (parameter)	Coefficient (s.e)	T-statistics [Prob.]
Constant (c)	-5.438 (8.43)	-0.645 [0.525]
$\ln REER_x (\beta_2)$	-0.858 (0.52)	-1.624 [0.117]
$\ln FRGDP (\beta_3)$	1.281 (0.43)	2.961 [0.007]
<i>Diagnostic Tests</i>		
Test Statistic		LM Version
A: Serial Correlation		0.222 [0.637]
B: Functional Form		3.822 [0.051]
C: Heteroscedasticity		2.357 [0.125]

Note: s.e. stant for standerd error, the bracket value as given against t-ratio and diagnostic tests are p-values or probability.

Table 3 also presents the long run export price and income elasticity estimates. As real effective exchange rate were used to measure for price elasticity in export demand, which appears to influence negatively export demand but not significantly, indicates that in long run real exchange rate variation remain ineffective to change export growth. However, the foreign income coefficient appears to dominate the demand for Pakistan's export. The results reveal that the foreign income elasticity estimate is positive in regression and statistically significant. The income coefficient indicates that in long run one percent increase in average foreign income increases Pakistan's export demand by more than one percent, it means that exports are income elastic.

Error Correction Representation

After long run analysis, it is imperative to test for the short run adjustment of export demand to its long run equilibrium. The presence of co-integration provides support for estimation of short run dynamics. Therefore, now estimate the error correction model (ECM) that represents the short run elasticities and information about the long run speed of adjustment. In current case, the analysis based on the following ECM specification:

$$\Delta \ln RX_t = c + \sum_{i=1}^m \theta_i \Delta \ln RX_{t-i} + \sum_{i=0}^n \pi_i \Delta \ln REER_{x,t-i} + \sum_{i=0}^o \rho_i \Delta \ln FRGDP_{t-i} + \delta ECT_{t-1} + \mu_t \quad (4)$$

Where, all variables were as previously explained. However, at this time the lagged residual of estimated long run equation is added to infer about speed of adjustment.

Again based on selection criterion, a parsimonious model is derived and final results of the selected ECM are reported in table 4. Both the short run elasticity has their expected sign and is hardly significant at 10 per cent. In short run not only the effect of relative price but the impact of income is too inelastic. Further, literature favors the negative significant error correction coefficient. Thus, the ECT coefficient is negative and significant at 5 per cent that further confirm the long run relationship in the regression. The coefficient of ECT suggests that the convergence to long run equilibrium after short run deviation is equal to 0.415 that is moderate.

Table-4
Error Correction Representation of Selected ARDL

Variable (parameter)	Estimate (s.e)	T-statistic [Prob.]
Constant (c)	-2.256 (3.88)	-0.580 [0.567]
$\Delta \ln REER_x$	-0.356 (0.21)	-1.699 [0.102]
$\Delta \ln FRGDP$	0.532 (0.31)	1.719 [0.098]
ECT_{t-1}	-0.415 (0.15)	-2.773 [0.010]

Conclusion

In this paper, the standard export demand function for Pakistan is reexamined. To provide new estimate for long run relative price and income elasticity, the econometric approach of ARDL is employed using annual data for the year of 1981 to 2010. We find evidence of long run relationship in the regression equation when regressed real export of the country on real effective exchange rate and real average foreign income. Foreign income was found major determinant of aggregate export demand and real exchange rate have no important effect on export demand in the long run. In short run the effects of variables are faithfully weak than long run effects. The significant negative sign of error correction term support the long run equilibrium and a fair adjustment process. The coefficient of ECT is -0.415 that suggest 41 percent adjustment in a year.

Appendix: The export weighted nominal effective exchange rate, average foreign income and foreign prices have been constructed geometrically by formula as given in equation (5), (6) and (7), consecutively:

$$NEER_t = \prod_{i=1}^N (ERI_{i,t})^{x,i} \quad (5)$$

$$FGDP_t = \prod_{i=1}^N (GDP_{i,t})^{x,i} \quad (6)$$

$$P_{f,t} = \prod_{i=1}^N (CPI_{i,t})^{x,i} \quad (7)$$

Where, i implies trading partner (i....., N), t = time, x = export weight, NEER = nominal effective exchange rate, ERI = exchange rate index, FGDP = export weighted foreign average income, GDP = gross domestic product, P_f = export weighted foreign average price level, and CPI = consumer price index.

Note that after data in hand the study has measured the real effective exchange rate (REER) as given:

$$REER_t = \frac{P_{d,t}}{P_{f,t} NEER_{x,t}} \quad (5)$$

Where, P_d is domestic price level and is home country consumer price index.

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