DETERMINANTS OF IMPORT DEMAND FUNCTIONS OF PAKISTAN: AN ARDL BOUND TESTING APPROACH

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ABSTRACT

This study attempts to examine the factors that determine the import demand function of Pakistan using time series data of 1973-2013. Autoregressive Distributed Lag bounds testing approach cointegration is used to determine long run while ECM in ARDL framework to determine short run adjustments. The results showed substantial proof of the existence of a cointegration association at various degrees among variables included in the models.

Keywords: Cointegration, Import, Export, Pakistan.

JEL Classification: C50, F10.

1. INTRODUCTION

Pakistan is a developing small open economy, with a persistent trade deficit[1]. Imports in its initial periods are comprised of capital goods and raw material required for generation of income and employment. The liberalization of domestic economy results into increase imports of consumer goods, which aggravated its term of trade condition. The total imports of Pakistan are now comprised of broad commodity groups like Capital goods, Raw materials and Consumer goods. Trade liberalization under IMF structural adjustment program results in a sharp increase in the trade deficit. Further liberalization after joining WTO in 2005 results in sharp increasing import growth rate, however exports depict persistent sluggish growth. The domestic currency of Pakistan depicts continuous depreciation, which further aggravated balance of trade due to the less price elastic nature of both exports and imports. This paper aims to determine the impact of final consumption expenditure, investment expenditure, government consumption expenditure, exports, foreign direct investment, exchange rate on the aggregate imports of Pakistan.

Empirical analysis of import demand determinants has been done severally during the past quarter decade. The aggregate import demand function has received attention in recent years. Various models with different specifications are used to investigate the impact of various macroeconomic variables on demand of exports and imports in different countries. Goldstein and Khan (1985) explained the reason of popularity of demand of import as well as supply of export models. According to them the availability of relevant data, amendable theoretical foundations with a wide range of policy implications are reasons of popularity of trade models. The estimate price

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[1] Statistical Year Book 2010 printed by State Bank of Pakistan. The history of Pakistan witnessed persistent trade deficit since its inception. In its whole history there are only three years during which our trade balance is favorable.

and income elasticity's explain many factual and policy phenomena like impact of income growth, trade liberalization and other variables change in foreign trade. Many studies such as Tang (2002;2004) and Moazzami and Wong (1988) examined impacts of currency depreciation on import demand and export supply. Various scholars in Pakistan investigated the aggregate import demand function with different model specified; Baluch and Bukhari (2012) investigated imports' elasticity regarding income and relative prices. Rashid and Razzaq (2010) used the foreign exchange in reserve in import demand function in addition of income and relative prices. Sarmad and Mahmood (1987) estimated disaggregated import demand function of various commodities.

The models behind the majority of the estimated function of import demand is derived from conventional theory of price, according to which real impetus is inverse functional relative price levels. The non-price variables result in shifting of import demand, such as income level and other macroeconomic variables. The appropriate econometric methodology and variables for model estimation and position of the demand curve of import has been a topic of great debate among researchers. Many in use to signify real domestic income as germane variable, nevertheless many research articles used alternate variables (Sarmad and Mahmood, 1987). Giovannetti (1989) considered export; final spending like consumption and investment, as each of these components has different impacts on imports. GDP minus exports have been used by Senhadji (1998) instead of GDP alone, whereas Xu (2002) considered national cash flow as most appropriate variable.

In this study, we attempt to determine the impacts of various macroeconomics variables on aggregate import. The endeavor of this work is to observe changes in the relative effect of macroeconomic variables on import for policy purpose. ARDL Bounds estimation technique is used to examine the relative long as well as the short run impact of various macroeconomic variables, including Final Consumption Expenditure (FCE), Investment Expenditure (IE), Government Consumption Expenditure (GCE), Exports (EX), Foreign Direct Investment (FDI), Exchange Rate (EXR) in the estimation model proposed by Fukumoto (2012) in his estimation of aggregated import function.

The study is synchronized in the following pattern.

Segment 1: Introduction, Segment 2: Review of Literature, Segment 3: Model Specification, Estimation Technique and Data Sources, Segment 4: Estimation and Empirical Results and Segment 5: Conclusion and Policy Implication.

2. REVIEW OF LITERATURE

This section will provide import demand functions determined globally and locally

2.1. Global Studies

Clarida (1991) developed a structural econometric equation using rational expectations of the permanent income model. He used quarterly data of 1967 quarter 1 to 1990 quarter 2 for estimation of import demand for nonperishable trade goods, by employing Engle and Granger Causality estimation technique. The result shows that all variables are co-integrated with each other with highly significant level with expected signs.

Reinhart (1995) investigates separate regression equation for demand of import as well as export for twelve developing nations from the African region. He employed Engle and Granger Causality test on time series data span from 1970 to 1992. The outcomes establish that elasticity of income as well as price is significant with expected signs for the entire twelve nations.

Carporale and Chui (1999) explored elasticity income as well as the price of the trade using the model of cointegration for twenty one countries for the period of 1960-1992. ARDL and DOLS estimation techniques

employed conforms existence of co- integration. The result shows that fast growing economies have lower income elasticity's for imports with higher income elasticity's of exports.

Rijal *et al.* (2000) estimated aggregate function of import demand in Nepal, employing Johansen–Juselius multivariate cointegration estimation approach on time series data of1968-1997. They aim to determine sensitiveness of aggregate demand of import to prices of import, domestic price as well as real GDP. The estimation results show that the aggregate import demand of Nepal is inflexible concerning own as well as cross price in both short and long run.

Santos-Paulino (2002) analyzed the effect of the tariffs and non-tariff trade barrier reduction on imports of twenty two chosen developing nations. Dynamic Panel Data estimation technique on annual data from 1976 to 1998 is employed to determine the impact of macroeconomic variables on import growth. Empirical results found a significant positive relationship of domestic incomes, price level, and elimination of trade policy distortion with import growth, whereas import duties have significant negative impact.

Tang (2003) analyzes the cointegration association of aggregate import demand function of China using cointegration technique for the span from 1970 to 1999. This work attempts to check the effect of relative price as well as domestic activities like GDP, Export, final expenditure components, and national cash flow of function of import demand. Empiric outcomes support cointegration association between domestic activities' measures on import demand of china. In general, relative prices as well as domestic activity are inflexible in the long-term.

Tsionas and Christopoulos (2004) investigated, he behavior of import demand in five major industrial countries like USA, UK, Italy, France and Netherlands, using Annual time series data of 1960-1999. Estimation techniques like Maximum Likelihood Co-integration and Dynamic OLS estimation technique is employed to estimate long run import demand while short run import demand dynamics is observed using impulse response function based on VAR analysis. The empirical results of this study depict significant impact of relative price and income while the impulse response function showed the significant short run effect of temporary shock.

Kalyoncu (2006) examine the aggregate function of import demand for Turkey employing monthly data about 1994-2003. Johansen cointegration and ECM is employed to determine long-term and short-term relationship among real imports, the relative price of imports and real GDP. Econometric results conforms sensitivity of imports to change in relative import price. Price elasticity is found to be greater than the income elasticity of import demand.

Fukumoto (2012) estimates long as well as short run elasticity's of disaggregated import demand of China with relative imports' prices and germane variables. ARDL cointegration approach employing Bound test is employed to examine the existence of cointegration using annual time series data of 1988-2005. Results show cointegration between capital goods' import and both aggregate investment as well as GDP. Intermediate goods' import is determined to have a long term association with export whereas consumption goods' imports have a long term association with disposable income as well as GDP.

2.2. Local Studies

Sarmad and Mahmood (1987) examined demand elasticity of relative prices and those of activity variable, for selected imports at different level of aggregation. Cross-sectional data of 1969-1970 and 1983-84 analyzed using the OLS estimation technique. The result of this study shows that relative price elasticity's adjusted for tariffs are smaller and different from those estimated for developing countries where as elasticity's with respect to an activity variable are high which reflect the outward orientation of the economy.

Rehman (2007) estimated the aggregate function of import demand for Pakistan using annual data of 1975-2005. Johensen and Juselius Cointegration and ECM are employed to determine Cointegration and the short run

relationship between Import, Real Income, Domestic Price, and import price respectively. The outcomes of the study support the Cointegration association except Income. Whereas in the ECM, all variables there is no statistically significant impact of all variables in import demand.

Rashid and Razzaq (2010) tested model for aggregate imports of Pakistan using Johenson, cointegration, ARDL and DOLS estimation techniques. They attempted to determine cointegration of Real imports with Domestic consumption expenditure, Relative Prices and Foreign exchange reserve using annual time series data of 1975-2008. The empirical result of ARDL bound testing approach and Johensen's technique demonstrates substantial proof of the existence of the cointegration association among chosen variables.

Kakar *et al.* (2010) estimates ECM and cointegration association among trade balance, income, money supply and real exchange rate within Pakistan. ARDL Bound Testing approach, impulse response function and variance decomposition are employed on time series data from 1970 to 2005, to look into the existence of an association among variables. The result of bounds test confirms existence of the stable, cointegration association. The exchange rate depreciation showed positive long as well as the short run association

Fida *et al.* (2011) tries to re-calculate traditional Aggregate function of import demand of Pakistan using ARDL bound testing technique for time series data of 1972-2011. Their aim is to determine the cointegration association between import demand, real income and relative prices. The empiric outcomes validate the existence of long term association among the chosen variables.

Baluch and Bukhari (2012) investigate the imports' elasticity regarding income as well as price of Pakistan for the period of 1971-2009. Autoregressive Distribute lag cointegration technique is employed. Results found existence of the cointegration association of income and price on the demand of imported.

The above reviews of literature help us in determining the variables, model specification, and estimation technique. After reviewing the literature related to Pakistan we can say that there is a research gap that is filled by this study.

3. MODEL SPECIFICATION, ESTIMATION TECHNIQUE AND DATA SOURCES

This paper employs ARDL bounds estimation technique formulated by Pesaran *et al.* (2001) employing time series data for the period of 1991-2008. This estimation technique examines level relationship among variables, under Conditional modeling technique modeling technique on the basis of VAR (n). Proper Transformation of VAR (n) models yield Conditional error correction model (ECM), which is also obtained from ARDL bounds testing of regressors with different lag length[2]. The ECM uses to decide the existence of stable relationship among variables through the computation of the significance of Lagged variable using F-Statistics.

We employ ARDL bounds testing procedure of co-integration for determination of Import demand function due to following two advantages over traditional co-integration models like Johansen Juselius and Eangle & Granger. 1-Bounds test does not require I(1) order integration of all underlying variables[3], which reduce pretest uncertainty problems for determination of order of integration. 2- This technique can be employed to even a small number of observations, whereas conventional methods suffer from small sample bias[4].

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[2] ARDL model can estimate co-integration among all variables irrespective to their order of integration, where as traditional co-integration models requires all variable to be co-integrated with I (1).

[3] For estimation of co-integration using traditional models one has to estimate order of integration using various unit root tests and for determination of level one has to find same level of integration.

[4] For small number of observations, the bounds testtecnique is more suitable than theJohnansen test as well as Engle and Granger since it not put short-run dynamics to residual term Pattichis (1999).

The estimation of Bounds testing is done in two levels. 1- Investigation of existence of cointegration among all variables. 2- Estimation of Long as well as Short term estimated coefficients, employing Autoregressive Distributed Lag model.

3.1. Variables

The variables that are used in this study is Final Consumption Expenditure (FCE), Investment Expenditure (IE), Government Consumption Expenditure (GCE), Exports (EX), Foreign Direct Investment (FDI), Exchange Rate (EXR) and Imports (IM).

$$\Delta \ln IM_t = \delta_{\circ 1} + \sum_{i=1}^{l} \delta_1 \Delta \ln IM_{t-i} + \sum_{j=0}^{m} \delta_2 \Delta \ln FCE_{t-j} + \sum_{k=0}^{n} \delta_3 \Delta \ln IE_{t-k} + \sum_{l=0}^{o} \delta_4 \Delta \ln GCE_{t-l}$$

$$+ \sum_{m=0}^{p} \delta_5 \Delta \ln EX_{t-m} + \sum_{n=o}^{q} \vartheta_6 \Delta \ln FDI_{t-n} + \sum_{o=0}^{r} \vartheta_7 \Delta \ln EXR_{t-o} + \vartheta ETC_{t-1} + \varepsilon_i ..(4)$$

Where Δ is difference operators, the equation (4) includes unrestricted intercepts which are independent of intercept requirements. The maximum lag length of each variable is taken on the ground of Schwarz Bayesian Criterion. The null hypothesis of no cointegration is

$Ho : \vartheta \ IM \ _1 = \vartheta \ FCE \ = \vartheta \ IE \ = \vartheta \ GCE \ = \vartheta \ EX \ = \vartheta \ FDI = \vartheta \ EXR = 0$

is examined versus the alternate hypothesis of cointegration

$H_1 : \vartheta \ IM \ _1 \neq \vartheta \ FCE \ \neq \vartheta \ IE \ \neq \vartheta \ GCE \ \neq \vartheta \ EX \ \neq \vartheta \ FDI \neq \vartheta \ EXR \neq 0$

and resultant F-Statistic under the null hypothesis is estimated. Asymptotic critical bounds provided by Pesaran *et al.* (2001) comprise of two critical values: upper bound, assuming the explanatory variables I (1) and lower bound to assume I(0). If calculated values of the F-Statistic falls outsides of these two critical bounds values, then clear conclusion is derived regarding existence and no existence of cointegration[5]. If the estimated F-Statistic value lies within two critical bounds, then conclusion regarding the existence of cointegration is made on the basis of order of cointegration determined by unit root tests.

4. ESTIMATION AND EMPIRICAL RESULTS

The empirical estimations are as follows:

Table-1. Augmented Dickey Fuller Test for Unit Root

Variables	LEVEL		1ST DIFFERNCE	
	T-Statistics	Prob- values	T -Statistics	Prob- values
IM	-3.38474	0.0738	-6.545732	0.0001
TI	-4.492504	0.0068	-5.841805	0.0004
FCE	-3.890144	0.0280	-4.389409	0.0093
GCE	-3.248545	0.0958	-3.701881	0.0396
EX	-2.115267	0.5155	-5.984726	0.0002
FDI	-1.447457	0.8235	-4.024613	0.0206
EXRT	-2.045644	0.5521	-5.81918	0.0003

Source: Estimated by the Authors.

The Augmented Dickey Fuller test or in short ADF test is employed to assure stationarity of the time series data. Table No. 1 describes the ADF test results of the entire variables at level as well as the first difference having intercepts and trend term.

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[5] If the calculated F-Statistic values lies above upper bounds value we reject null hypothesis of no co-integration where as if the values lies below the lower bounds value we cannot reject null hypothesis.

Table-2. ARDL Estimates, ARDL(1,2,2,1,1,2,2) selected based on SBC

Regressor	Coefficient	Standard Error	T-Ratio[Prob]
IM(-1)	.27529	.092233	2.9848[.007]
TI	1.4008	.17522	7.9944[.000]
TI(-1)	-2.1125	.37940	-5.5680[.000]
TI(-2)	1.8569	.30788	6.0310[.000]
FCE	-.071572	.012866	-5.5626[.000]
FCE(-1)	.097663	.021884	4.4627[.000]
FCE(-2)	-.13166	.018834	-6.9905[.000]
GCE	.18113	.17687	1.0240[.318]
GCE(-1)	-.98070	.20698	-4.7382[.000]
EX	.33549	.18479	1.8155[.084]
EX(-1)	.37538	.18933	1.9827[.061]
FDI	57.8247	15.9312	3.6297[.002]
FDI(-1)	78.5572	27.8566	2.8201[.011]
FDI(-2)	-81.6628	26.2765	-3.1078[.006]
EXRT	-5641.2	2620.5	-2.1527[.044]
EXRT(-1)	-3227.1	4195.4	-.76920[.451]
EXRT(-2)	-9113.6	3088.1	-2.9512[.008]
CONS	40128.2	13127.6	3.0568[.006]
TREND	4639.0	1978.7	2.3445[.029]
R²	.99987	R²-Bar	.99976

Regression S.E.   18421.7   F-Statistics. F(18,20)   8850.5[.000]

Dependent Variable Mean   846201.9   Dependent Variable S.D.   1192849

RSS   6.80E+09   Equation Log-likelihood   -425.3460

AIC   -444.3460   SBC   -460.1499

DW-statistic   2.2605   Durbin's h-statistic   -.99490[.320]

                Diagnostic Tests

* Test Statistics * LM Version * F Version *

* A:Serial Correlation*CHSQ(1) = 1.0859[.297]*F(1,19) = .54417[.470]*

* B:Functional Form *CHSQ(1) = 9.0407[.003]*F(1,19) = 5.7336[.027]*

* C:Normality *CHSQ(2) = 5.2265[.073]* Not applicable *

* D:Heteroscedasticity*CHSQ(1) = 2.0096[.156]*F(1,37) = 2.0101[.165]*

A:Lagrange multiplier test of residual serial correlation, B:Ramsey's RESET test using the square of the fitted values, C:Based on a test of skewness and kurtosis of residuals,D: Based on the regression of squared residuals on squared fitted values.

Source: Estimated by the Authors.

Table-3. Estimated Cointegrated Coefficients employing the ARDL Approach

Regressor	Coefficient	Standard Error	T-Ratio[Prob]
TI	1.5801	.35537	4.4464[.000]
FCE	-.14567	.032351	-4.5028[.000]
GCE	-1.1033	.36697	-3.0065[.007]
EX	0.98090	.23179	4.2319[.000]
FDI	75.5051	57.7696	1.3070[.206]
EXRT	-9244.4	1802.3	-5.1293[.000]
CONS	55371.6	18690.1	2.9626[.008]
TREND	6401.2	2367.4	2.7039[.014]

F-statistic 95% Lower Bound 95% Upper Bound 90% Lower Bound 90% Upper Bound

62.4369   3.3468   4.7110   2.8162   4.0458

W-statistic 95% Lower Bound 95% Upper Bound 90% Lower Bound 90% Upper Bound

.7128E-3   23.4274   32.9767   19.7134   28.3206

Source: Estimated by the Authors.

Table-4. ECM for the Chosen ARDL Model

Regressor	Coefficient	Standard Error	T-Ratio[Prob]
dTI	1.4008	.17522	7.9944[.000]
dTI1	-1.8569	.30788	-6.0310[.000]
dFCE	-.071572	.012866	-5.5626[.000]
dFCE1	0.13166	.018834	6.9905[.000]
dGCE	0.18113	.17687	1.0240[.315]
dEX	0.33549	.18479	1.8155[.081]
dFDI	57.8247	15.9312	3.6297[.001]
dFDI1	81.6628	26.2765	3.1078[.005]
dEXRT	5641.2	2620.5	2.1527[.041]
dEXRT1	9113.6	3088.1	2.9512[.007]
dTREND	4639.0	1978.7	2.3445[.027]
ecm(-1)	-0.72471	.092233	-7.8574[.000]
dIM = IM-IM(-1), dTI = TI-TI(-1), dTI1 = TI(-1)-TI(-2), dFCE = FCE-FCE(-1)			
dFCE1 = FCE(-1)-FCE(-2), dGCE = GCE-GCE(-1), dEX = EX-EX(-1), dFDI = FDI-FDI(-1)			
dFDI1 = FDI(-1)-FDI(-2), dEXRT = EXRT-EXRT(-1), dEXRT1 = EXRT(-1)-EXRT(-2)			
dTREND = TREND-TREND(-1)			
ecm=IM-1.5801*TI +.14567*FCE +1.1033*GCE-.98090*EX-75.5051*FDI+9244.4*EXRT -55371.6*CONS-6401.2*TREND			
R²= 0.995,R²-Bar= 0.99, Regression S.E.=18421.7, F-StatsF(12,26)= 358.7[0.00]			
Dep Var Mean=110279.1, Dep Var S.D.=196518.3, RSS6.80E+09,			
EquLog-likelihood=-425.3460,AIC=-444.3460,SBC=-460.1499,DW-stas 2.2605			
F-statstic 95% Lower Bound 95% Upper Bound 90% Lower Bound 90% Upper Bound			
62.4369 3.3468 4.7110 2.8162 4.0458			
W-statistic 95% Lower Bound 95% Upper Bound 90% Lower Bound 90% Upper Bound			
.7128E-3 23.4274 32.9767 19.7134 28.3206			

Source: Estimated by the Authors.

4.1. Empiric Outcomes and Entailments

After the ARDL bounds analysis demonstrates the existence of the cointegration association between imports and the supposed independent variables, it's time to move on to the next step of the ARDL bounds analysis, which is to calculate equation employing ARDL specification to obtain the long as well as short run estimated coefficients. Lag selection is based on Schwarz Bayesian Criterion where n, p, r represents the lag order selection of imports and supposed independent variables correspondingly. The long-run coefficients through ARDL bounds testing approach is derived first and then estimates the restricted Error Correction Model from employing an ARDL bounds testing approach. In accordance with the review of past literature, it is supposed long as well as short run expected coefficients of independent variables are significant.

The above estimated model clears the entire analytical tests, for instance serial correlation, functional form, normality and homoskedasticity. In Table 2, the term ECM(-1) symbolizes Error Correction Term and signify the short-run correction processes for the long-term stability path. If it lies in between 0 and -1, it signifies that the adjustment of imports in the present period t is equal to a portion of the earlier period's error. A bigger ECM(-1) intends a faster adjustment speed toward stability path. For table no. 3, 72.47 percent of disequilibrium in the present time will be corrected in the next time period.

The estimated coefficients of exogenous variables show the estimated signs and are statistically significant. The relevant exogenous variables have substantial outcomes in both the long as well as short term.

5. CONCLUSION AND POLICY IMPLICATIONS

This study estimates the long and short run coefficients of Pakistan's import demand regarding the imports and relevant macroeconomic variables employing data span from 1973-2013. Employing data provided by the State

Bank of Pakistan and Pakistan Bureau of Statistics. Different exogenous variables, specifically, final consumption expenditure, investment expenditure, government consumption expenditure, exports, foreign direct investment and exchange rate were taken. The existence of cointegration between imports and domestic exogenous variables through ARDL bounds testing approach is examined.

The bounds testing approach demonstrates that there is a long run relationship between the import and final consumption expenditure, investment expenditure, government consumption expenditure, exports, foreign direct investment, exchange rate. We obtain coefficients which are according to the review of literature. The long-run coefficients relating to the entire domestic exogenous variables propose economic development and growth will impact trade balance of Pakistan inversely if the economic development and growth is not compelled through exports earning. In specific, additionally reliance on investment to encourage economic development and growth may bring about subsequent worsening on balance of trade. Nevertheless, in the short term, growth comes from export earnings will help the balance of trade of Pakistan.

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