Modeling and Forecasting Import Demand for Pakistan: An Empirical Investigation

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Abstract

The study investigates import demand for Pakistan considering four different models for the period 1978 to 2016. The study estimates standard model, revised traditional, dynamic structural and dynamic financial import demand models. Although import demand is found to be cointegrated with relative prices of imports and real activity variables in all four models yet, activity variable plays an important role in classifying imports as necessity or luxury goods. Moreover, the results show that estimated short-run elasticities are smaller than long-run elasticities. It reveals the ineffectiveness of exchange rate policy in influencing import demand in the short-run but not in the long-run. Besides, the study finds that the estimates of import demand elasticities and the slope of demand curve are subject to the choice of the model. Therefore, the study conducts within sample as well as out of sample forecasting analysis of the estimated models to evaluate forecasting performance. The study finds that the standard import demand model performs the best for Pakistan. The study concludes that gains from trade can be maximized when a suitable model is focused for the formulation of trade policy.

Keywords: import demand, economic growth, cointegration, forecasting.

JEL Classification: F14, F17, C22.

Introduction

The empirical investigation of import demand models is still one of the most addressed topics in international economics. Besides, it is widely believed that global financial crisis of 2008-09 has been caused by the global imbalances and one of such imbalances is increase in import demand (Obstfeld & Rogoff, 2009). While the empirical literature on the modeling of import demand is substantial and alternative models have been tested for Pakistan. However, little attention has been paid to the evaluation and forecasting performance of import demand models whereas, a good forecasting performance serves as a 'seal of approval' to the empirical model (Clements & Hendry, 2005). Hence, there is an urgent need to evaluate import demand models based on their forecasting performance as the formulation of an effective trade policy depends upon appropriate models.

Pakistan has been experiencing consistent trade deficit since 1970's as imports has exceeded exports in almost every year. Likewise, Pakistan has been witnessing persistent deterioration in terms of trade for almost last two decades as unit value index (UVI) of imports has been rising at a faster pace than the unit value index of exports. The graphs given below illustrate balance of trade (BOT) and terms of trade (TOT) for Pakistan over the period 1970-2016.

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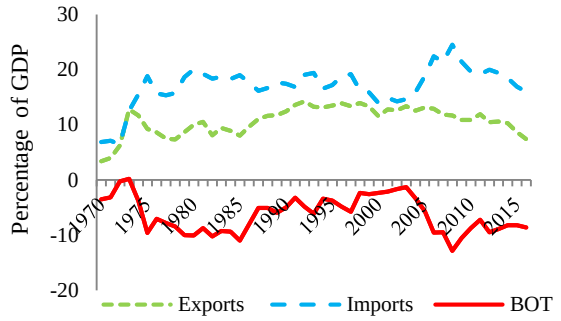
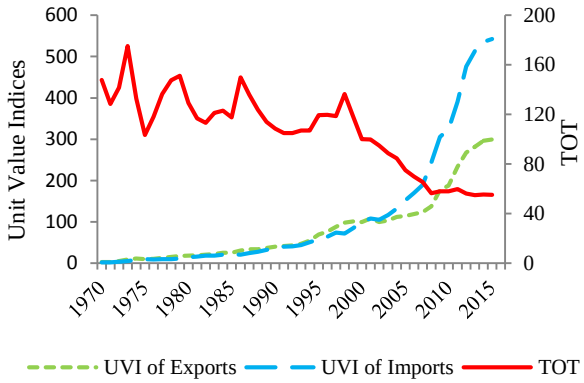
Figure 1: Balance of Trade



Source: Economic Survey of Pakistan

Figure 2: Terms of Trade



Source: Economic Survey of Pakistan

The figure 1 shows negative balance of trade while the figure 2 shows deterioration of terms of trade for the country. While foreign trade is regarded as the engine of economic growth yet, Pakistan has been unable to maximize the benefits of global trade. The downward sloping parts of the curves in the figures depict the severity of the situation and demand an in-depth analysis of the situation for the improvement of balance of trade.

It is usually argued that imports respond more quickly to trade policies and therefore, imports should be focused for the improvement of balance of trade (Rehman, 2007). Indeed, the higher trade openness has led to more import sensitive economies and besides the obvious role of import demand as an important input in the macroeconomic models, the coefficients of import demand functions have become fundamental from the perspective of trade policy in general and exchange rate policy in particular (Oktay & Gozgor, 2013). Hence, the modeling of import demand has strategic significance in present globalizing world.

A large number of studies have modeled import demand, which can be broadly divided into two groups. The first group includes standard import demand models which are partial and static in nature and suggest conventional determinants of import demand (real income and relative price of imports). However, the second group includes dynamic import demand models which employ dynamic optimization framework with rational expectations. Three important models referred as revised traditional model, dynamic structural model and dynamic financial import demand model are included in this group.

All these three models are based on dynamic-optimizing approach and suggest some unconventional determinants of import demand. For instance, the revised traditional model introduced by Senhadji (1998) suggests that real GDP net of exports instead of GDP should be considered for the modeling of import demand as it is the correct activity variable. Conversely, dynamic structural model derived by Xu (2002) recommends the use of 'national cash flow' variable for the modeling of import demand while the 'national cash flow' excludes government expenditure and investment along with exports from GDP. Whereas, dynamic financial import demand model proposed by Tang (2004) considers the inclusion of financial variables along with the national cash flow variable in the modeling of import demand.

These models have been tested for different countries and alternative models may provide inconsistent evidence about import demand elasticities of the same country. Tang (2008) reveals that existing studies provide controversial evidence about the import demand functions for Japan. Similarly, Zhou and Dube (2011) explain that import demand studies usually adopt a subset of these models and present mixed evidence about the import elasticity estimates. However, these estimates are crucial for the formulation of trade policy.

Therefore, the concern is to establish the validity of these models and it may be done through forecasting analysis. As yet, a good predictive ability of a model is viewed as the acid test for the model. Moreover, a good out of sample forecasting performance is usually considered as the 'gold standard' of evaluation for the model (Clements & Hendry, 2005). However, the existing literature does not focus on the forecasting of import demand (Narayan, 2008).

This study has major contributions in import demand literature as it investigates all four models for Pakistan covering the period from 1978 to 2016. Besides, the study is an attempt to establish the validity of these import demand models on the basis of their forecasting output. The study estimates the parameters of standard import demand model, revised traditional, dynamic structural and dynamic financial import demand models to know about the range of available estimates of elasticities. Moreover, the study makes a comparison among these estimated import demand models on the basis of their forecasting performance to determine best import demand model for Pakistan. Therefore, in this sense this study provides a comprehensive analysis of import demand for Pakistan.

The study is organized as follows. Section 2 reviews import literature for Pakistan while Section 3 presents the four import demand models to be investigated. Section 4 describes the data and Section 5 includes the discussion of results. Finally, Section 6 concludes the study.

Review of Literature

The modeling of import demand has received a great deal of attention from the researchers and it has been investigated by adopting a variety of models.[1] Reinhart (1995) estimates standard import demand model for Pakistan over the time period 1970-1992 and finds that income elasticity is greater than one while price elasticity is less than one for the country. The study also explains that conventional specification of import demand performs well for a developing country because it models both income and relative prices to explain the behavior of import demand. Similarly, Baluch and Bukhari (2012) estimate standard import demand model for Pakistan and report similar results.

An important feature which can be inferred from these studies is that import demand can be modeled by only two variables which are real income and relative prices of import. Tang (2008) more precisely, explains that the effect of a given change in taste, trade barriers and exchange rate eventually comes through changes in relative prices of imports. Therefore, import demand is completely modeled by real income and relative prices of imports when adopting standard import demand model.

[1] An earlier comprehensive review of literature on import demand is available in Goldstein and Khan (1985).

However, Senhadji (1998) considers the standard import demand model as the static model. The study criticizes the standard model on the ground that it has not been derived from the utility maximization approach and therefore, it is not grounded in micro foundations of the standard model. The study employs dynamic optimization framework and estimates import demand model for a sample of 77 countries including Pakistan covering the period from 1963 to 1993. Senhadji (1998) reports that both income and price elasticities are less than one for Pakistan.

Arize et al. (2004) estimate import demand for Pakistan and mention that standard specification of import demand function may provide implausible estimates of import demand elasticities in LDCs. Similarly, Rashid and Razzaq (2010) employ a two good version of rational expectation permanent income model and derive a structural econometric equation for the estimation of parameters of import demand model for Pakistan. The study emphasizes that the correct activity variable is GDP net of exports rather than GDP. The study estimates import demand model over the period 1975-2008 and finds almost unitary elastic demand curves.

Alam (2012), however, explains that standard import demand model has a micro foundation, as it has been built on the consumer demand theory, which states that the main objective of a rational consumer is utility maximization. In a recent study, Tirmazee and Naveed (2014) also estimate standard import demand model for Pakistan and find significant elasticities with correct signs. Besides, the study mentions that most of the existing import demand models are adopted according to the 'best-fit' criteria. Therefore, these studies provide inconclusive evidence about the parameters of import demand functions for Pakistan.

As discussed, standard as well as dynamic import demand models have been estimated for Pakistan. These studies provide estimates of relative price elasticity that range from -0.12 to -5.26 while the estimates of income elasticity range from 0.18 to 3.19 (Afzal, 2004; Alam, 2012; Chani & Chaudhary, 2012). Unfortunately, on the basis of these estimates, neither it can be concluded that imports are luxury or necessity goods nor it can be decided that import demand is elastic or inelastic. Because of this confusion in import demand literature some evaluation of these models is essential to assess the suitability of these estimates.

All this makes necessary to investigate import demand in details considering all four models along with their forecasting analysis to choose the best import demand model for Pakistan as it has not been done yet for Pakistan. Therefore, the study tests the following hypothesis.

Ho: Import demand elasticities are not sensitive to the choice of import demand models.

H1: Import demand elasticities are sensitive to the choice of import demand models.

Methodology

The study follows imperfect substitute model of import demand which assumes that imported and domestically produced goods are imperfect substitutes (Gozgor, 2014).[2] This study further assumes that Pakistan has perfectly elastic supply of imports because it is generally assumed that

[2] The perfect substitute model assumes that imported and domestically produced goods are perfect substitute to each other and a country can be either exporter or importer of a good but not both. As it is quite difficult to confirm the existence of an economy which is displaying the characteristics of a perfect substitute model, consequently, little attention has been given to this model.

world supply to a single economy is perfectly elastic (Glover & King, 2011). In this study, we adopt standard model, revised traditional model, dynamic structural model and dynamic financial import demand model to investigate the long-run and short-run behavior of import demand for Pakistan.

The standard formulation of import demand model suggests that demand for imports is fully explained by the real income and the relative price of imports. Thus, following Gozgor (2014) import demand function has been specified as follows:

$$lnIM_t = \beta_0 + \beta_1 lnRP_t + \beta_2 lnGDP_t + \varepsilon_t \quad (1)$$

here *IM, RP and GDP* denote real aggregate imports, relative import price (import price index divided by domestic price index) and real GDP; ε is the random error term; *t* refers to time period and $\beta_1$and β_2 are the relative price and income elasticities of import demand, respectively. It is generally, assumed that an increase in the competitiveness variable, relative price (RP), lowers the demand for imports and, therefore, yields negative import price elasticity. Hence, the parameter β_1 is expected to be negative. Whereas, it is believed that a given increase in real income stimulates imports, and therefore, it produces positive income elasticity of imports. Hence, the parameter β_2 is expected to be positive.

Senhadji (1998) revised traditional import model by employing the dynamic optimization framework. Following Senhadji (1998) and Giansoldati and Gregori (2017), the next import model is given as follows.

$$lnIM_t = \beta_0 + \beta_1 lnRP_t + \beta_2 lnGDX_t + \varepsilon_t \quad (2)$$

here GDX represents GDP minus exports.

Although different models have been estimated for Pakistan however, dynamic structural and dynamic financial import demand models are yet to be investigated. Therefore, the third model adopted in this study is dynamic structural import demand model, derived by Xu (2002). Following Zhou and Dube (2011) the model has been specified as follows:

$$lnIM_t = \beta_0 + \beta_1 lnRP_t + \beta_2 lnNCF_t + \beta_3 T + \varepsilon_t \quad (3)$$

where *NCF* is the national cash flow variable, which is calculated as ($GDP - I - G - X$), where *I, G,* and *X* represent investment, government expenditure and exports, respectively. While the term *T* shows time trend.

The last model examined by the study is dynamic financial import demand model introduced by Tang (2004). The model includes financial variables to explain import demand.

$$lnIM_t = \beta_0 + \beta_1 lnRP_t + \beta_2 lnNCF_t + \beta_3 lnRER_t + \beta_4 T + \varepsilon_t \quad (4)$$

where RER represents financial variables (rate of interest) while all other notations are as defined above. The study has employed log-log modeling by taking natural logarithm form of all selected variables. The advantage of log-log model is that parameter estimates are easy to interpret. In this way, the estimation of import demand model will yield elasticities of outcome variable (import demand) with respect to input variables.

The study employs the Johansen cointegration technique for the estimation of these models (Johansen, 1988; Johansen & Juselius, 1990). It is usually considered the most accurate method to apply for the integrated of order one variables. Ho (2004) estimating import demand model for Japan, mentions the popularity of this approach in applied time series econometrics. Similarly, Chen (2008) estimating import demand for Taiwan, finds that the estimated results with Johansen and Juselius (1990) technique and autoregressive distributed lag method (ARDL) are quite alike. Moreover, the study verifies the robustness of the ARDL technique as compared to the Johansen and Juselius (1990) method. Thus, following these studies, we employ Johansen's cointegration procedure for the estimation of import demand models.[3]

DATA

The study is based on annual data covering the period from 1978 to 2016. The data has been taken from Economic Survey of Pakistan and World Development Indicators (WDI). The real quantity of imported goods and services represents the nominal quantity of imports deflated by unit price index of imports (UVM), whereas, the relative import price variable is the ratio of unit price index of imports to domestic price index proxied by consumer price index (CPI). All the indices and real variables are based on 2005 prices. The summary statistics of all the variables included in import demand models is given in Table A1 in the appendix.

Results and Discussion

The study applies Augmented Dickey Fuller (ADF) as well as Phillip-Perron (PP) unit root tests to verify the stationarity of the variables included in import demand models (Dickey & Fuller, 1979; Phillips & Perron, 1988). The results of the unit root tests given in Table 1 show that all variables are intergrated of order one. Moreover, these results provide rationale for the application of Johansen's cointegration analysis.

Table 1: Results of unit root tests

Variable	ADF test statistic		PP test statistic		I(d)
	Level	Ist. Diff.	Level	Ist. *Diff*.	
IM	-1.23	-4.75	-1.25	-4.59	I(1)
RP	-1.15	-5.37	-1.15	-5.33	I(1)
GDP	-0.88	-5.61	-0.88	-5.61	I(1)
GDX	-1.51	-4.90	-.1.51	-4.94	I(1)
NCF	-0.96	-9.68	-1.14	-10.28	I(1)
RER	-0.77	-3.26	-0.49	-3.25	I(1)

Note: The critical values for ADF test (with a constant) are -3.61, -2.94 and -2.61 while those for PP test are -3.62 -2.94 and -2.61 which are significant at 1%, 5%, and 10% level of significance, respectively.

The study proceeds to test for the possibility of cointegrating relationships among the variables in alternative import demand models. Therefore, the study applies Johansen (1988) and Johansen & Juselius (1990) techniques to estimate the test statistics for the maximal eigenvalue test as well as for the trace test. The cointegration results are given in Table 2.

[3] Masih and Masih (2000) discuss the advantages of Johansen and Juselius (1990) approach in details.

Table 2: Cointegration results: Pakistan's import demand models

Import demand model	Null Hypotheses	Maximal Eigenvalue test		Trace test	
		Max-Eigen statistic	critical value	Trace statistic	critical value
Standard model	H_0 : r = o	33.541*	22.300	49.914*	35.193
	H_0 : r ≤ 1	13.050	15.892	16.374	20.262
	H_0 : r ≤ 2	3.323	9.165	3.323	9.165
Revised traditional model	H_0 : r = o	27.605*	22.300	42.908*	35.193
	H_0 : r ≤ 1	11.605	15.892	15.303	20.262
	H_0 : r ≤ 2	3.698	9.165	3.698	9.165
Dynamic structural model	H_0 : r = o	48.533*	22.300	61.908*	35.193
	H_0 : r ≤ 1	8.944	15.892	13.375	20.262
	H_0 : r ≤ 2	4.431	9.165	4.431	9.165
Dynamic financial model	H_0 : r = o	52.699*	28.588	79.982*	54.079
	H_0 : r ≤ 1	12.449	22.300	27.283	35.193
	H_0 : r ≤ 2	8.910	15.892	14.833	20.262
	H_0 : r ≤ 3	5.922	9.165	5.922	9.165

The * denotes rejection of the null hypothesis at a 5 % significance level.

Table 2 shows that the null hypothesis of no cointegration for maximal eigenvalue and trace tests is decisively rejected for all models. It implies that there is at least one cointegrating vector in our import demand models.

Long-run analysis of import demand

The estimates of long-run income and relative price elasticities for all four models are reported in Table 3. It is evident from the table that the estimates of elasticities appear with expected signs in all models. Moreover, the real activity variable is found to be elastic and statistically significant in all models while relative price variable is significant only in the first two models. It suggests that real activity variable is relatively more important in explaining import demand for Pakistan.

The first model estimated by the study is standard import demand model. Table 3 shows that the estimated relative price elasticity is -1.568 for this model. It means that a 1% increase in relative price variable is likely to induce a -1.568 % decrease in import demand in the long-run. It may be because of the presence of relatively cheaper substitutes that import demand falls when there is an increase in its relative price. This result is consistent with Afzal (2004).

Table 3: Long-run import demand elasticities for Pakistan

Import demand model	Variables	Estimated coefficients	t-statistics
Standard import demand model	*RP*	-1.568***	-3.10
$lnIM_t = \beta_0 + \beta_1 lnRP_t + \beta_2 lnGDP_t + \varepsilon_t$	*GDP*	2.156***	6.23
Revised traditional import demand model	*RP*	-0.866**	-2.11
$lnIM_t = \beta_0 + \beta_1 lnRP_t + \beta_2 lnGDX_t + \varepsilon_{tt}$	*GDX*	1.391***	5.12
Dynamic structural import demand model	*RP*	-0.057	-1.08
$lnIM_t = \beta_0 + \beta_1 lnRP_t + \beta_2 lnNCF_t + \beta_4 T + \varepsilon_t$	*NCF*	0.864***	2.63
Dynamic financial import demand model	*RP*	-0.678	-1.34
$lnIM_t = \beta_0 + \beta_1 lnRP_t + \beta_2 lnNCF_t + \beta_3 RER_t + \beta_4 T + \varepsilon_t$	*NCF*	0.871**	2.53
	RER	0.240	1.64

The ***, ** and * show the statistics significance at 1%, 5% and 10% of level of significance, respectively.

As far as the income elasticity is concerned, it appears with expected positive sign and it is statistically significant as well. It indicates that when an economy experiences a rise in income, people demand more imports in the long-run. It follows from the discussion that imports are not only normal goods but also luxury goods as income elasticity is greater than unity. This finding of higher income elasticity is consistent with Reinhart (1995) and Tirmazee and Naveed (2014).

The second model estimated by the study is revised traditional model. The estimate of price elasticity is -0.866 and it indicates that imports are relatively less elastic towards changes in relative price variable. Although, the estimate of price elasticity is below unity for this model, however, the estimate of income variables is well above one. It means more growth causes higher imports demand even in this model. Senhadji (1998) also reports similar results for the price elasticity.

The next two models estimated by the study are dynamic structural and dynamic financial import demand models. Both models contain national cash flow variable as the main activity variable and show similar results. The table reports that the estimates of price elasticity although appear with the correct signs however, price coefficients are insignificant in both models. It implies that no important role is played by the prices in these models. Furthermore, the estimates of income elasticity are less than unity for both models indicating that the imports are less elastic with respect to income. It implies that imports may be regarded as necessity goods in accordance with these models (Rehman, 2007). Similarly, Alam (2012) also reports estimates of income elasticity in the range of 0.17 to 0.23.

Table 3 clearly shows that real activity variable is an important variable in explaining demand for imports in Pakistan. However, interestingly the estimates of elasticity with respect to real activity variable range from 0.86 to 2.16. This finding suggests that a 1% increase in the activity variable is likely to induce a 0.86% to 2.16% increase in import demand in the long-run. Also notice that

income elasticity is greater than unity in the first two models suggesting that imports are luxury goods however, income elasticity is less than unity for the next two models suggesting that imports are necessity good. Similarly, the estimates of relative price elasticity range from 0.06 to 1.56, again providing inconclusive evidence about the slope of demand curve. Moreover, these results provide contradictory evidence about the role played by the relative prices as it plays significant role in the first two models but insignificant role in the next two models.

These results offer two important implications. Firstly, the real activity variable is found to be elastic in the standard model and revised traditional model but it appears with low estimate in dynamic import demand models, where investment, government expenditure and export component is removed from the GDP. It suggests that results are overestimated by the first two models due to the GDP measure. This phenomenon reveals that investment and government expenditure, which are excluded from GDP, are important variables in explaining demand for imports in Pakistan. Secondly, it can also be concluded that these results provide inconclusive evidence about the parameters of import demand functions for Pakistan and as a matter of fact, these estimates of elasticies are subject to the choice of the model.

Short-run analysis of import demand

When a cointegrating relationship has been established among the variables of interest, then error-correction model is estimated to investigate the dynamic behavior of demand for the imported goods.[4] The coefficients of error correction term (ECT) represent the speed of adjustment of imports quantity back to its long-run value following a shock.

Table 4 shows that error correcting process generally, appears to work for our import demand models. The results show that relative prices are adjusting in the right direction in the short-run and playing significant role in all models. Moreover, the significant error correction term also supports the presence of a stable long-run relationship.

The short-run elasticities are also reported in Table 4. Though estimated elasticities have the correct sign but they are small and statistically insignificant. Moreover, the Table 4 also reveals that short-run elasticities are generally smaller than their long-run counterpart. It implies that over time demand for imports becomes more responsive to changes in relative prices of imports and real income. The study estimates four different import demand models and finds that the estimates of elasticies are subject to the choice of the model. For example, whether imports are considered luxury goods or necessity goods depends on the choice of model. Similarly, the slope of demand curve is also sensitive to the adoption of the model. Now two important questions in the context of import demand are whether imports should be considered luxury or necessity goods and whether import demand should be taken as elastic or inelastic while designing policies for imports. Because of this inconclusive evidence which has been provided by these models, it is important to conduct forecasting analysis to evaluate these models on the basis of their forecasting performance

[4] For a good discussion of error correction dynamics, see also Khan and Ahmad (2009).

Table 4: Estimates of error correction model and short-run elasticities

Import demand models	Error correction term	Short-run Elasticities		
		Relative price	Real activity variable	Rate of interest
Standard import demand model	-0.11*	-0.11	1.63	
	(-1.91)	(-0.46)	(1.63)	
Revised traditional import demand model	-0.22*	-0.21	0.57	
	(-1.78)	(-0.99)	(0.85)	
Dynamic structural import demand model	-0.18*	-0.16	0.22	
	(-1.81)	(-0.75)	(0.64)	
Dynamic financial import demand model	-0.17*	-0.12	0.25	0.01
	(-1.69)	(-0.55)	(0.66)	(0.62)

The number in parentheses are t-statistics while***, ** and * show the statistics significance at 1%, 5% and 10% of level of significance, respectively.

Forecasting analysis

Now the final step of the analysis is to conduct forecasting analysis for these estimated models. For this purpose, the study has evaluated within sample as well as out of sample forecasting output of all these models.

The study computes different forecast errors such as mean percentage error (MPE), Root Mean Squared Error (RMSE), Mean Absolute Error (MAE) and Mean Absolute Percentage Error (MAPE) (Kargbo, 2007). Likewise, the study has computed Theil inequality coefficient (TIC) for the evaluation of estimated models. Narayan (2008) suggests that the predictive ability of a model is assumed to be perfect if the value of MAPE is less than 10 percent, and it is assumed good if it is in the range of 10 to 20 percent, while if MAPE is above 50 percent then the forecasting performance of the model is regarded as inaccurate or weak. However, it is generally assumed that if the values of these statistics are close to zero, the forecasting performance of the model would be superior.

The within sample forecast errors for all four import demand models have been reported in Table 5. It is evident from the table that minimum MPE is meant for the standard import demand model and maximum is reported for the dynamic structural import demand model. Interestingly, almost the same information is given by the other forecast errors.

Table 5: Forecast evaluation measures for the within sample forecasts

Import demand models	MPE	RMSE	MAE	MAPE	TIC
Standard import demand model	0.014	0.047	0.037	0.365	0.0023
Revised traditional model	0.018	0.048	0.037	0.368	0.0024
Dynamic structural import demand model	0.021	0.056	0.043	0.426	0.0028
Dynamic financial import demand model	0.020	0.053	0.041	0.409	0.0027

The forecasting performance statistics indicate that although all the models have been estimated fairly well. However, the forecasting statistics for standard model can best track the actual values. It suggests that the standard model has relatively superior predictability and high tracking ability as compared to the other three models.

The forecasting performance of a model may also be presented in the form of graphical forecast. The following figures display graphs for the import demand models that are estimated by the study. The graphs show the actual values as well as fitted values from within sample forecast output.

Actual and forecasted series of import demand

(Within sample forecasts)

Figure 3: Standard model

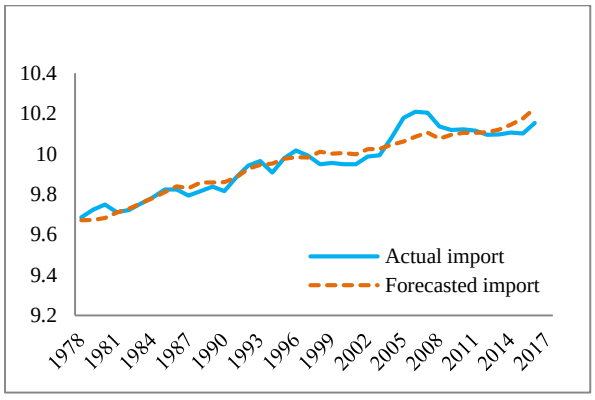


Figure 4: Revised traditional model

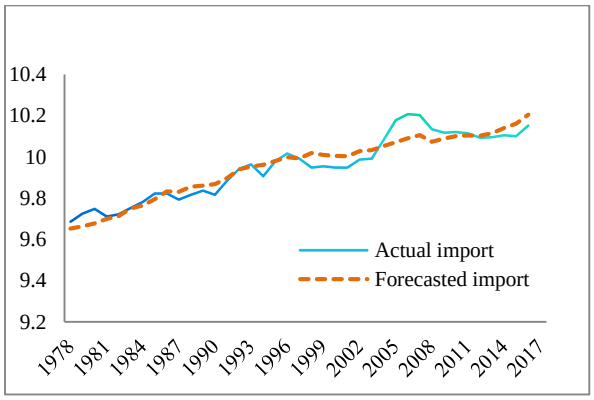


Figure 5: Dynamic structural model

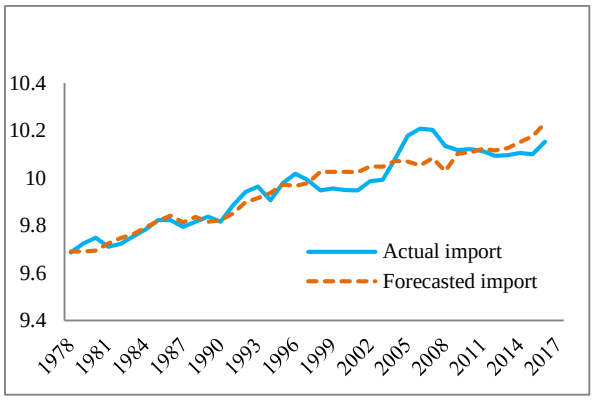
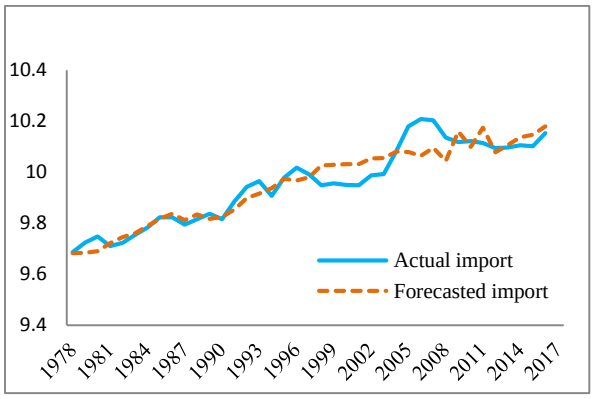


Figure 6: Dynamic financial model



In case of standard import demand model, the forecasted series of the dependent variable almost rightly reproduce the long-run trend of the actual series. It implies that the tracking ability of this model is quite satisfactory and the forecasted series track their historical values almost perfectly.

Table 6 shows out of sample forecast errors for our import demand models. Although, the study has estimated models for the period 1978 to 2016, however, the study has conducted out of sample forecasting analysis for the period 2014-16. The Table shows that the out of sample forecast errors for our estimated models are consistent with the within sample forecast errors. The output for out of sample forecasts also confirm that standard import demand model has higher predictability as it has small mean prediction errors as compared to other three import demand models. It also suggests that the solution of this model tracks the actual time path of the focused variable quiet closely.

Table 6: Forecast evaluation measures for the out of sample forecasts

Import demand models	MPE	RMSE	MAE	MAPE	TIC
Standard import demand model	0.171	0.051	0.049	0.490	0.025
Revised traditional model	0.212	0.064	0.062	0.615	0.031
Dynamic structural import demand model	0.603	0.069	0.066	0.661	0.033
Dynamic financial import demand model	0.384	0.066	0.065	0.645	0.027

On the basis of the within sample as well as out of sample forecasting output it can be concluded that the standard import demand model has better forecasters of the (historical) movement as compared to other import demand models. Moreover, the forecasting performance of revised traditional model is also quite close to it. However, dynamic structure and financial models do not perform well for Pakistan on the basis of their forecasting performance.

Conclusion

The study estimates four different import demand models for Pakistan covering the period from 1978 to 2016. The study estimates standard import demand model, revised traditional model introduced by Senhadji (1998), dynamic structural model derived by Xu (2002) and dynamic financial model proposed by Tang (2004).

Although import demand is found to be cointegrated with relative import price and real activity variables in all four models yet, activity variable plays an important role in classifying imports as necessity or luxury goods. This phenomenon reveals that real activity variable is a key variable in defining the demand for imports in Pakistan. The results also show that continued economic growth and hence, import growth in Pakistan is likely to have negative impacts on balance of trade in the long-run as import demand is positivity related with real income. It implies that there is a long-run trade-off between economic growth and balance of payments for Pakistan.

Moreover, the error correcting process seems to work for Pakistan. The results show that the estimated short-run relative price and income elasticities are smaller than their long-run counterpart and are also small in absolute term. It reveals the effectiveness of exchange rate policy in influencing import demand in long-run but not in short-run. However, it implies that over time import demand in Pakistan becomes progressively more responsive to changes in income and relative prices.

The study has conducted forecasting analysis to evaluate import models on the basis of their forecasting performance Although, the standard import demand model is considered static however, on the basis of within sample as well as out of sample forecasting output it can be concluded that the standard import demand model performs the best for Pakistan as it has better forecasts of the (historical) movement in import demand than the other three dynamic import demand models. The study concludes that gains from trade can be maximized only when a suitable model is focused for the formulation of trade policy. So this study concludes imports as luxury and therefore certain imports restrictions are recommended.

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Appendix

Table A1: Summary statistics of the variables

Variable	Observation	Maximum	Minimum	Mean	Std. Dev.
IM	39	10.208	9.686	9.954	0.155
UVM	39	2.566	0.826	1.696	0.531
CPI	39	2.442	1.133	1.781	0.395
GDP	39	13.438	11.246	12.370	0.672
GDX	39	10.955	10.184	10.591	0.222
NCF	39	10.801	10.025	10.424	0.230
RER	39	1.069	0.213	0.811	0.181