

Reviewing Pakistan’s Import Demand Function: A Time-Series Analysis, 1970–2010

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Abstract

This paper investigates the conventional import demand function for Pakistan using time-series data sourced from the World Development Indicators for the period 1970 to 2010. Using a vector error correction model and impulse response functions, we show that, for the given period, relative prices and income lose their significance as long-run determinants of import demand. This indicates the need for additional determinants. We compare the residuals of the conventional import demand function with those of a model that includes the terms of trade and foreign exchange availability (in addition to the conventional parameters) as determinants of import demand, and find that the latter largely resolves much of what is nondeterministic in the former model. The paper also explores the peculiar trend of a falling imports-to-GDP ratio (from the 1980s to the 2000s), which is unusual for a developing country. In a subsidiary regression analysis for this period, we argue that falling net capital inflows explain this persistent fall in the imports-to-GDP ratio. The recovery thereafter, when Pakistan started catching up with other developing economies, may have been responsible for the 2008 balance-of-payments crisis.

Keywords: Pakistan, import demand function estimation, capital inflows, balance of payments.

JEL classification: F140.

1. Introduction

Despite the rapid globalization of trade in recent decades, Pakistan has largely failed to maximize the benefits of this development and faces a consistent trade deficit. Figure 1 shows that the country’s imports have remained volatile over time while the trade deficit almost mirrors the volume of imports as a result of stagnant exports. Import surges, which have tended to occur during boom periods, are directly linked to the rising trade deficit. The main objective of this paper is to understand and explain the anomalies in Pakistan’s import behavior.

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Figure 1: Pakistan's imports and trade balance over the last 50 years

After independence in 1947, Pakistan followed an import substitution industrialization policy, which overvalued the exchange rate in order to boost the domestic economy. In 1980, the policy paradigm shifted toward rigorous trade liberalization and export promotion in order to integrate Pakistan's economy with the rest of the world. These policies did not much affect the economy till the 1990s; even then, international trade has had a limited impact on the health of the economy. It has not led to any significant diversification of exports or to economic growth. Exports have, in turn, failed to contribute significantly to output and growth (Afzal 2004; Afzal & Ali, 2008). In combination with the country's stagnant exports, imports have increased persistently over time, contributing to the rising trade deficit.

The current trade deficit is approximately PRs 218 billion—a record high and, therefore, one of the main macroeconomic problems facing the economy. One of the main reasons for this is Pakistan's heavy dependence on other countries for fuel and capital goods. As Table 1 shows, the share of fuel in imports has increased by 33 percent in the last decade, while that of machinery and transport has decreased by 14 percent. The share of food and metal has remained stable over time and that of agricultural raw materials has decreased by 21 percent. Fuel and capital goods still account for a significant portion of imports and their share has remained either stable or increased over time.

Table 1: Pakistan's major imports

Commodity	Percent share of total imports										
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Fuel	27.32	24.09	22.21	21.59	26.22	25.7	33.25	28.09	30.49	34.24	36.26
Machinery and transport	53.16	56.48	58.21	59.95	56.47	46.85	52.45	48.58	48.51	45.98	45.58
Agriculture	4.85	5.04	5.85	4.27	3.65	5.01	4.94	4.25	4.92	4.94	3.83
Food	11.95	11.52	10.54	10.59	10.42	8.88	11.85	11.37	13.08	11.99	11.11
Metal	2.54	2.70	2.85	3.38	3.11	3.73	3.08	3.69	2.95	2.78	2.63

Source: World Bank.

Our aim is to determine which factors cause import fluctuations by empirically estimating the import demand function. We then move one step further from the literature by investigating and trying to account for these surges. Intriguingly, we also find that imports as a percentage of GDP fall over the period 1980–2000. This is rare for a developing country and so our analysis is divided into two periods to determine the reason for this anomaly.

2. Empirical Estimates of the Import Demand Function

There are numerous empirical studies of Pakistan's import demand function, most of which estimate best-fit models using different econometric techniques and measures or different determinants of import demand. Explanatory variables such as relative prices and GDP appear to explain—fairly convincingly—most of the variations in import demand.

Sarmad and Mahmood (1985) estimate the income and price elasticity of imports for Pakistan at an aggregated and disaggregated level for the period 1969/70 to 1979/80. Their results show that **relative price and income** significantly explain most of the variations in imports at both levels. In their disaggregated analysis, most import commodities have a statistically significant sign and are in the right direction. The authors argue that relative prices, adjusted for customs duties and an income variable, are enough to explain a large portion of the variations in individual commodity imports as well as in aggregate imports. However, their estimation is not adjusted for stationarity and the results are as a result biased to some extent.

Rehman (2007) estimates an import demand function for Pakistan based on **import prices, domestic prices, and income** (using the Johansen-

Juselius cointegration technique) for the period 1975–2005. The results of the log-log model indicate that, in the long run, import prices and income are significant determinants of import demand. The coefficient of income elasticity is 1, implying that imports act as normal goods in the long run. A comparison of long-run and short-run elasticities shows that imports are less sensitive to changes in import prices and income in the short run than in the long run. The study's stability tests conclude that the results are reliable as the import demand function is stable over time.

Fida, Khan, and Sohail (2011) employ the bounds test or autoregressive distributed lag (ARDL) model to examine the long-run relationship between import demand and its determinants—real income and relative prices (the ratio of import prices to domestic prices)—for Pakistan. The short-run elasticities of price and income are estimated using an error correction model (ECM) and their signs are in line with economic theory: thus, imports are price-inelastic (with a negative sign associated with the law of demand) and the income elasticity is positive and less than 1 (imports act as normal goods but are less sensitive to changes in income). The short-run and long-run elasticities are different with imports being relatively more elastic in the long run than in the short run. The stability tests conducted indicate that the import demand function remains stable over time.

Foreign exchange reserves are also seen as an important determinant of imports because they directly determine the international liquidity available to a country for purchasing imports. A country with high foreign exchange reserves also has room to pursue less restrictive trade policies. Rashid and Razzaq (2010) model the import demand function for Pakistan and argue that there is a binding foreign exchange constraint on imports. Apart from relative prices and income, they add exchange rate reserves to their model to study the impact of **foreign exchange availability**. The results suggest that there is a long-run relationship between foreign exchange reserves and imports, implying the presence of a foreign exchange availability constraint on imports. The coefficients of price and income elasticity are higher than the previous estimates, indicating that, after accounting for the effect of the foreign exchange constraint, imports become more sensitive to changes in income and relative prices.

Arize and Malindretos (2012) carry out an empirical investigation of the short-run and long-run impact of domestic income, relative import prices, and foreign reserves on real imports for selected Asian economies. They employ a number of econometric methods—the Johansen and Harris-

Inder cointegration techniques, fully modified ordinary least squares (OLS), dynamic OLS, and the ARDL model—and find that foreign exchange reserves are an important determinant of imports. In line with theory, the effect of foreign exchange reserves is positive. Thus, policies aimed at increasing foreign exchange reserves will encourage imports. The estimates also show that real income is a significant variable in explaining the demand for imports and that income elasticity is highly elastic for India, the Republic of Korea, and Thailand, but inelastic for Japan and Singapore. A high degree of income elasticity implies that higher income growth will lead to a greater trade imbalance. Finally, the results indicate that rising relative prices significantly discourage imports.

Arize, Malindretos, and Grivoyannis (2004) test the relationship between imports and foreign exchange reserves for Pakistan. Their results indicate that, in addition to relative prices and real income, exchange reserves are an important determinant of imports: foreign exchange reserves have a positive and significant impact on imports in the long run. Foreign exchange reserves lose their impact in the short run, however, and have no significant effect on imports for Pakistan.

Sultan (2011) employs Johansen's cointegration method to estimate the aggregate import demand function for India. In his model, import demand is determined by relative prices, real imports, and foreign exchange reserves. He argues that foreign exchange reserves are the primary medium of exchange for every country in the foreign market and, therefore, can present a constraint to the ability to buy imports. The results indicate that an improvement in foreign exchange reserves increases import demand. Like Arize et al. (2004), the author finds that foreign exchange reserves have a long-run relationship with imports, i.e., they have a significant and positive impact on import demand for India.

Aziz and Horsewood (2008) follow a similar approach and include foreign exchange reserves as a major determinant of import demand for Bangladesh for the period 1980–2006. The other determinants of trade included in their model are relative prices, income, GDP components, and liberalization. Using error correction models and cointegration analysis, they find a one-cointegration relationship among the volume of imports, real GDP, relative import prices, and foreign exchange reserves. The results also indicate that real GDP as well as GDP components (final consumption expenditure, expenditure on investment goods, and export expenditure) are positively associated with aggregate import demand. Relative import prices are negatively and significantly associated with aggregate import

demand and are significant in the long and short run. Foreign exchange reserves are positively associated with import demand.

Bahmani-Oskooee (1998) identifies the foreign exchange rate as an important determinant of import demand for six developing countries (Pakistan, Greece, the Philippines, Singapore, the Republic of Korea, and South Africa). He employs the Marshall-Lerner condition, which implies that, for devaluation to have a positive effect on imports, the sum of the elasticities of the import and export demand functions should be greater than 1. Thus, there are two effects attached to devaluation: it will lead to a fall in imports and a rise in exports because exports are now relatively cheap. If the Marshall-Lerner condition is satisfied, then the positive export effect will be greater than the negative import effect. The author's analysis indicates that this condition is satisfied for almost all the countries in the sample, implying that devaluation has positive effects and is, arguably, a good instrument for improving the trade balance.

Afzal (2001) estimates import and export demand functions using a simultaneous equation system for both import demand and import supply. In addition to the traditional determinants of import demand (import prices and income), he includes a dummy variable for liberalization to measure its impact on imports for the period after 1990. Using OLS and two-stage least squares to determine the import function, he finds that income elasticity is positive, implying that imports are an increasing function. The negative sign of price elasticity indicates the same principle: an increase in the price of imports will cause a drop in demand for imports.

3. Methodology

The study's main objective being to critically analyze the determinants of import demand for Pakistan in a static as well as dynamic framework, we have used time-series data for 1980–2010 sourced from the World Development Indicators database. We test the determinants of import demand and empirically evaluate their significance by estimating two different equations: first, we estimate the conventional import demand function, to which we then add two new determinants. When the residuals are estimated for each of these equations, we find that they fall in magnitude when additional variables are introduced. The reduction in the size of the error terms shows that much of what stands to be unknown and nondeterministic in the basic import demand function is resolved in the new regression equation.

Our motivation for estimating the import demand function and the determinants of import demand lies in wanting to explain the peculiar trend of imports in Pakistan between the 1980s and 2000s. Imports as a percentage of GDP were fairly high in the early 1980s, after which they began to decline, then picking up once again after 2004 and returning to their earlier high level. As mentioned before, the import demand function is estimated for two subperiods (1980–2000 and afterward) to isolate the main factors behind this episode.

In the first step, we estimate the conventional import demand function:

$$M = f(RP, Y) \quad (1)$$

Imports (M) are a function of relative prices (RP) measured as the ratio of the import price index to the domestic price index; real income (Y) is measured by the real GDP. All the variables are expressed in natural logarithm form to make this a log linear model (usually the preferred choice of the functional form of the import demand function; see Doroodian, Koshal, & Al-Muhanna, 1994). Given these, we predict that

$$\partial Y > 0, \partial RP < 0$$

The negative coefficient of RP implies that imports fall as relative prices rise because consumers tend to substitute domestic products for imports when the prices of imports increase. The positive coefficient of Y implies that an increase in real income leads to an increase in real consumption; if the distribution of income remains unchanged, more foreign goods will be purchased. Additionally, if the increase in income also leads to an increase in real investment, then investment goods not domestically produced must be bought from abroad. However, the literature also suggests a potentially negative relationship between the two variables, given that, when real income grows, the country becomes more self-sufficient in terms of production and productive capacity, thereby needing to rely less on foreign goods and more on domestically produced goods.

Once the basic model has been estimated, we estimate the second model:

$$M = f(Y, RP, TOT, FXR/Y) \quad (2)$$

$$\text{Net Barter Terms of Trade} = \frac{\text{Unit Value Index of Exports}}{\text{Unit Value Index of Imports}} * 100$$

and FXR/Y represents foreign exchange reserves as a fraction of real GDP.

Here, the terms of trade must have a positive impact on import demand. If the prices of a country's exports rise relative to the prices of its imports, this signifies that its terms of trade have moved in a favorable direction, because it now receives more imports for each unit of goods exported. A depreciation of the exchange rate will lead to a fall in the prices of exports and a rise in the cost of imports. This will worsen the terms of trade and cause import demand (by domestic consumers) to slow down. However, the lower exchange rate will restore the country's competitiveness as the demand for exports grows.

Further, we expect that

$$\partial FXR/Y > 0$$

We associate the greater availability of foreign exchange with higher imports and vice versa. The availability of foreign exchange and its impact on import demand is linked to the import restrictions imposed by the government. Thus, for example, if foreign exchange reserves receipts fall, the balance of payments (BOP) will worsen, leading the government to tighten import controls, thereby reducing import flows. Therefore, the relationship between the volume of imports and foreign exchange availability is expected to be positive.

4. Data

The data for this study—import volumes, the price indices for imports and exports, real GDP, and foreign exchange reserves—were sourced from the World Development Indicators for 1980 to 2010. The summary statistics for these variables are given in Table 2 below.

Table 2: Summary statistics

Variable	1978–82	1983–87	1988–92	1993–97	1998–2002	2003–07	2008–11
<i>Imports (US\$ mn)</i>							
Average	4,454.040	5,597.460	7,458.040	10,523.660	10,185.500	21,506.160	37,393.800
SD	1,193.796	231.982	1,095.541	1,387.485	476.215	7,963.796	3,636.932
<i>Relative price ratio</i>							
Average	7.304	4.842	5.611	3.119	2.682	3.147	3.743
SD	1.464	0.149	0.304	1.234	0.259	0.215	0.050
<i>Real GDP (US\$ mn)</i>							
Average	67,850.300	65,175.150	61,005.850	46,453.580	37,221.200	35,894.370	30,094.780
SD	2,690.678	2,015.270	3,625.711	5,191.141	1,468.834	790.337	3,588.070
<i>Terms of trade</i>							
Average	105.744	92.706	87.262	97.200	103.796	72.390	56.185
SD	14.255	3.247	7.085	9.342	14.978	8.444	1.082
<i>Foreign exchange reserves (US\$ mn)</i>							
Average	1,451.800	1,971.800	1,431.000	2,288.800	4,539.000	13,809.000	14,169.500
SD	497.146	640.997	202.251	779.690	3,242.903	1,945.305	3,761.101

Source: Authors' calculations based on data from the World Development Indicators.

A brief review of the statistics shows that the five-year average for import volume and foreign exchange reserves has increased over the last 30 years, which is our main concern. Moreover, the relative prices ratio has fallen because of the very high domestic inflation rate over the last decade. The terms of trade have also fallen owing to the continuous devaluation of the domestic currency in recent years.

5. Empirical Estimation

Equations 1 and 2 cannot be estimated using simple OLS as we are dealing with time-series data, which suffers from nonstationarity and can, therefore, yield spurious relationships between the variables under consideration. Post-estimation tests reveal that there is a long-run cointegrating relationship between the variables and so we estimate the following vector autocorrection model (VECM):

$$\Delta Y_t = \beta_0 + \sum_{i=1}^k \beta_{1,i} \Delta X_{t-i} + \sum_{i=1}^k \beta_{2,i} \Delta Y_{t-i} + \sum_{i=1}^k \delta ECT_{t-i} + \varepsilon_t \quad (3)$$

where X is a vector of all the independent variables specified above, Y is import demand, ECT is the error correction term specific to a VECM, the β terms are the short-run elasticities of the independent variables, δ is the parameter of the ECT term and measures the error correction mechanism

that drives X_t and Y_t back to their long-run equilibrium relationship, and i is the number of lags to be included in the VECM specification.

In order to determine the causality among the test variables used in equation (3) in the VECM framework, we need to carry out certain pre-estimations, such as testing the stationarity of the variables and seeking the cointegration of the series. Without this, the conclusions drawn from the estimation will not be valid. First, we apply the augmented Dickey-Fuller test to carry out a unit root analysis of the stationarity of the variables. All the variables we are working with are integrated of order 1. The results of the test are given in Table 3 and assume nonstationarity (a unit root) under the null hypothesis.

Table 3: Augmented Dickey-Fuller test statistics

Variable †	Level t-stat.	First diff. test stat.*	Order of integration
LnM	-1.259	-3.794***	I(1)
LnY	0.076	-6.030***	I(1)
LnRP	-1.485	-5.691***	I(1)
LnToT	-2.184	-7.789***	I(1)
Ln(FXR/Y)	-1.392	-9.083***	I(1)

* If test statistic > critical value, we reject H_0 of nonstationarity.

† All the variables were taken in their natural log form and in first-differenced series.

Source: Authors' calculations.

Having determined that all the variables are integrated of order 1, the next step is to determine whether they are cointegrated. If the series is cointegrated, then the VECM will be the most suitable model for the variables under consideration. The Johansen and Juselius multivariate trace and maximal eigenvalue cointegration test is applied to the variables of equation (1) first and the results are presented in Table 4.

The trace values obtained are greater than the critical value for $r = 1$, implying that the null hypothesis of no cointegration is rejected for trace tests at a 5 percent level of significance. (The trace statistics test the null hypothesis that the number of cointegrating relations is r against k cointegrating relations, where k is the number of endogenous variables.) Our results clearly show that there is at least one cointegrating vector. Therefore, we conclude that, although the individual data series are nonstationary, their linear combination is stationary. We can now apply the ECM to estimate the short-run elasticities of import demand with respect to real GDP and relative prices.

Table 4: Cointegration test (Johansen-Juselius maximum likelihood method) for equations (1) and (2)

		$\ln M = \alpha_0 + \alpha_1 \ln RP_t + \alpha_2 \ln Y_t + \mu_t$		$\ln M = \theta_0 + \theta_1 \ln RP_t + \theta_2 \ln Y_t + \theta_3 \ln \left(\frac{FXR}{Y}\right)_t + \theta_4 \ln T_t + \varepsilon_t$	
Null hypothesis	Alternative hypothesis	Cointegration test stat.	5% critical value	Cointegration test stat.	5% critical value
$r = 0$	$r > 0$	35.29	29.68	82.45	68.52
$r \leq 1$	$r > 1$	11.25*	15.41	45.90*	47.21
$r \leq 2$	$r > 2$	0.47	15.41	26.18	29.68
$r \leq 3$	$r > 3$			12.08	15.41

Source: Authors' calculations.

Before estimating the VECM, we need to determine the optimal lag length that is to be included in the specification. The lag order selection criteria are applied as a VECM pre-estimation diagnostic test. The results are given in Table 5. We have used the Schwarz information criterion (SIC), Akaike information criterion (AIC), and Hannan-Quinn information criterion (HQIC) to select the optimal lag length.

Table 5: Lag order selection criteria

Lag	Equation (1)			Equation (2)		
	AIC	HQIC	AIC	HQIC	SBIC	SBIC
0	3.51	3.55	3.51	3.49	3.57	3.68
1	-3.31	-3.14	-3.31	-4.58	-3.59	-1.72
2	-3.45*	-3.14*	-3.45*	-4.59	-3.80	-2.51
3	-3.23	-2.79	-3.23	-4.74*	-4.15*	-3.44*
4	-3.33	-2.76	-3.33			

Source: Authors' calculations.

The results of the VECM analysis for equation (1) are presented in Table 6. The estimates for the short-run and long-run elasticities of import demand with respect to relative prices and real income are given separately in the table. As far as the short-run elasticities are concerned, the results suggest that both relative prices and real income are not only significant at the 5 and 10 percent levels, respectively, but also have the expected signs. Relative prices have a negative sign and a coefficient less than 1, which means that imports are demand-inelastic. A basic breakdown of commodities shows that Pakistan's imports are concentrated in a few

products such as machinery and fuel for which demand is very price-inelastic. Real GDP has a positive sign and an elasticity that is greater than 1, implying that imports are normal goods. This is in line with the literature: when an economy experiences a rise in income, people demand more imports.

Table 6: Estimates for VECM for equations (1) and (2)

Coefficients	Equation (1) †			Equation (2) ††	
	Elasticities			Elasticities	
	Short Run	Run	Long Run	Short Run	Long Run
$\Delta \ln M_{t-1}$	0.286	-	-	-0.124	-
	0.206	-	-	0.181	-
$\Delta \ln Y_t$	1.146**	-0.621***		0.498	2.400***
	0.669	0.193		0.544	0.813
$\Delta \ln RP_t$	-0.157**	-0.246		-0.055	-0.679**
	0.072	1.414		0.121	0.361
$\Delta \ln TOT_t$	-	-		0.630**	2.411**
				0.290	1.063
$\Delta \ln \left(\frac{FXR}{Y} \right)_t$	-	-		0.159**	1.186***
				0.070	0.319
Constant				0.060	-
				0.030	-
Error Correction Term	0.0384***	-		-0.1436***	
	0.017			0.0425	
R-squared	48.01			65.88	

† Equation (1) was estimated with two lags of the independent variables with one cointegrating rank.

†† Equation (2) was estimated with three lags of the independent variables with one cointegrating rank.

Source: Authors' calculations.

In the long run, however, these variables lose their explanatory power (here, for the period under consideration). Relative prices become insignificant in the long run whereas real GDP remains significant with the correct, expected sign. This makes it necessary to estimate another import demand function with additional determinants: TOT and foreign exchange availability. Before we do this, we need to make sure that the results of the first model are valid. Accordingly, we test for serial correlation in the error

terms using the Lagrange multiplier test, also testing for normally distributed error terms. The results in Table 6 suggest that there are no signs of autocorrelation and, therefore, the VECM results are valid.

The results of the second model suggest that, in the short run, relative prices and real GDP do not significantly affect import demand. Moreover, the terms of trade and foreign exchange availability have now become significant at a 5 percent significance level and have the correct signs. In the long run, however, all the variables become significant and have the correct signs. Foreign exchange availability is significant in explaining variations in imports in the long and short run. Its sign is positive, indicating that it is a major constraint in Pakistan's case and that an improvement in the availability of foreign exchange would enable the country to import more. Likewise, the terms of trade are significant both in the short and the long run and have the correct positive sign, suggesting that, as the terms of trade fall, so does import demand and vice versa, Falling terms of trade imply that imports are becoming relatively expensive.

This result has to be interpreted with caution: even if imports become relatively more expensive, this does not always imply a significant fall in import demand. A fall in import demand would depend on how elastic it is to a price change. In Pakistan's case, the nature of imports does not allow for a very flexible import demand. Incorporating the effect of the terms of trade and foreign exchange availability has improved our results for the long run, suggesting that, for the period under consideration, relative prices and real GDP alone are not enough to explain the variations in import demand. Moreover, the adjustment coefficient, which was positive in the previous model, has the correct sign and is greater in magnitude; this suggests that a 14.3 percent adjustment in the total import demand toward equilibrium occurs in each period for the sample used.

To test the validity of the estimated VECM, we test for autocorrelation in the residuals of the estimated model, the results of which are given in Table 7. They clearly show that we cannot reject the null hypothesis of no autocorrelation in the residuals. We run a second test to confirm the stability of the VECM estimates—the Jarque-Bera test, which tests for the normality of the error terms. The results show that we cannot reject the null hypothesis that the disturbances in the VECM are normally distributed.

Table 7: Results of VECM stability tests for Equations (1) and (2)

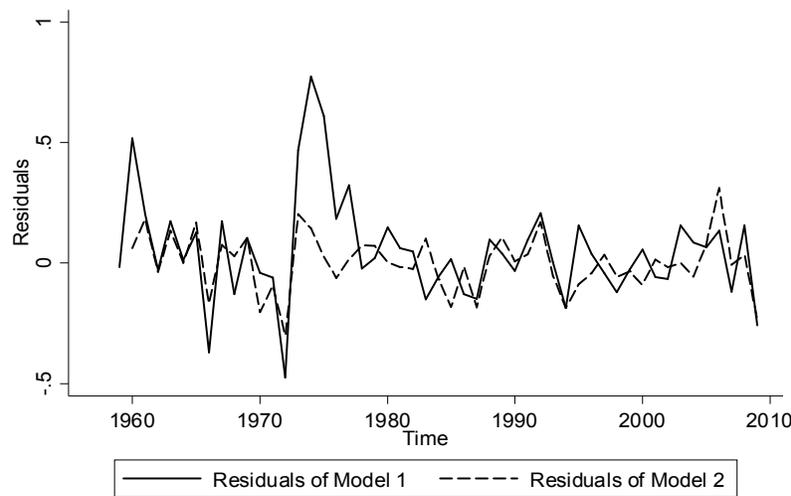
Tests for stability check	Model 1		Model 2	
	Chi ² value	P-value of chi ²	Chi ² value	P-value of chi ²
Lagrange multiplier test*	3.3925	0.94668	12.8565	0.97821
Jarque-Bera test†	0.6950	0.70649	0.3760	0.82864

* H0: no autocorrelation at lag order.

† H0: Error terms are normally distributed.

Source: Authors' calculations.

Having estimated the valid VECMs, we now analyze their residuals. If the residuals of the second model are smaller than those of the first and if the variations in the residuals of the second model are lower than those of the first, then we can safely say that the second model is superior. Figure 2 plots these residuals against time and shows that the residuals of the second model are much smaller than those of the first. Specifically, the period between 1990 and the mid-2000s is worth noting: this is the problematic period for our analysis since it is when imports surged.

Figure 2: Residuals of equations (1) and (2)

For the said period, the residuals of the second model are very small and show little variation. Table 8 gives the summary statistics for these residuals. The statistics show that the mean and standard deviation of the residuals of the second model are smaller than those of the first. The minimum and maximum of the residuals of the second model are also lower.

An examination of the residuals graph indicates four major peaks. The first peak occurs in the 1970s and has two possible explanations: the oil price hike and the separation of East Pakistan. To test for the second explanation, we introduce a dummy variable for 1970. Since it has no significant effect, we assume that the first explanation holds instead. Rising world oil prices led to an increase in the unexplained part of imports; including the terms of trade and foreign exchange reserves greatly reduces this variation in unexplained shocks. The intuition behind this is simple: both factors pick up the effect of market shocks more effectively and the residuals are reduced as a result of this.

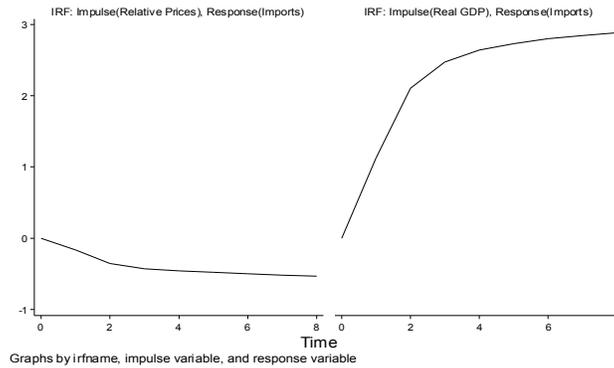
The second peak occurs in 1960 and is due mostly to the import substitution and restrictive policies in place at the time. Again, part of this effect is picked up by the terms of trade and foreign exchange reserves. Some fluctuations are observed after the 1990s, but the residuals are compressed only to some extent, mainly because other factors are responsible for causing these fluctuations in imports. For this reason, we carry out a detailed analysis of the post-1980s period in the next section and estimate another import demand function for the years after 1980.

Table 8: Summary statistics for residuals of equations (1) and (2)

Variable	Mean	SD	Minimum	Maximum	Mean \pm 3SD
Residuals of equation (1)	0.053357	0.217880	-0.5	0.773229	-0.653, 0.706
Residuals of equation (2)	-3.4E-10	0.119502	-0.3	0.312250	-0.358, 0.360

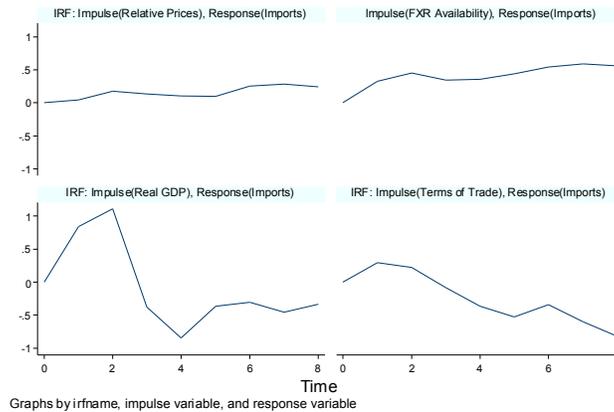
Source: Authors' calculations.

These stability tests help validate the VECM estimates for the included years, but they do not say much about the causal relationships between the variables beyond the period under study. In order to analyze the dynamic properties of the system, we estimate a set of impulse response functions (IRFs), which illustrate the impact of a one-standard-deviation shock to one of the endogenous variables (caused by an external shock) on the current and the future values of another endogenous variable in the system (see Figures 3 and 4).

Figure 3: IRFs for model (1)

Note: Left-hand-side: impulse (relative prices) response (imports); right-hand-side: impulse (real GDP) response (imports).

Figure 3 (for the conventional import demand function) shows that the impact of a one-standard-deviation shock to RP (impulse) on import demand (response) is an ever-decreasing fall in imports (due to the shock to relative prices) and an ever-increasing rise in imports (due to the shock to real GDP). This simply means that even a minor change in relative prices and income will bring about large changes in imports. However, for the second model (Figure 4) in which additional factors are controlled for, the IRFs for relative prices and real GDP begin to move toward their mean far more quickly, that is, within four years.

Figure 4: IRFs for model (2)

Note: Top left-hand-side: impulse (relative prices) response (imports); top right-hand-side: impulse (FXR availability) response (imports).
Bottom left-hand-side: impulse (real GDP) response (imports); bottom right-hand-side: impulse (terms of trade) response (imports).

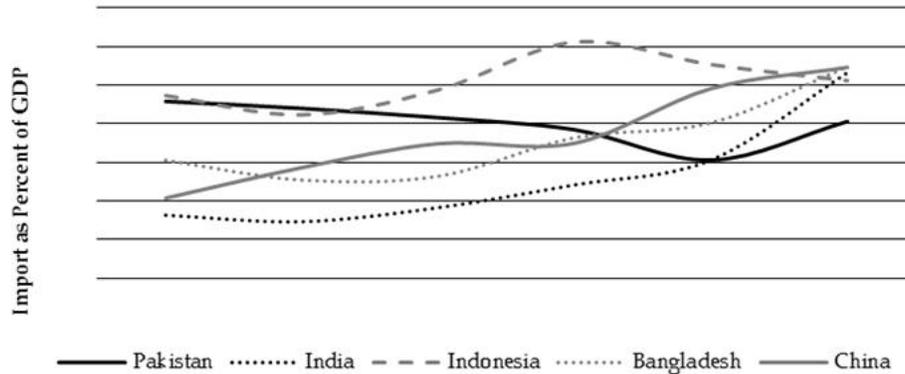
The IRFs for terms of trade and foreign exchange availability show that a one-standard-deviation shock to these variables leads to extreme variations in imports before the latter begins to revert to its mean. It is evident from the second panel that, after including the two new variables, the changes in imports induced by a change in any of the independent variables are very modest. This implies that, once the model has been specified more accurately, conventional estimates of import demand (relative prices and income) lose their significance in terms of causing fluctuations in imports.

6. Analyzing the 2008 BOP Crisis via the Import Demand Function

Looking at the residuals plotted in Figure 2 for the period 1980 to the mid-2000s, we can see that the residuals of both models almost overlap. The fourth peak occurs in 2008 and depicts the recent BOP crisis that Pakistan underwent. This shows that both models are unable to explain the variations in import demand that occurred during this time. What happened in this particular period that might be responsible for these variations?

A closer look at the imports-to-GDP ratio of Pakistan for 1980–2000 reveals that it fell consistently. Starting from a high of 22 percent, it fell to around 15 percent over 20 years, recovering sharply thereafter and maintaining its pre-1980s level. A falling imports-to-GDP ratio is a peculiar trend for a rapidly growing developing country. As GDP grows, imports (being normal goods with an elasticity greater than 1) tend to grow faster. Since everyone's incomes increase, the overall purchase of goods and services also increases. Part of this increased income is spent on imports as well. Thus, the higher the income, the more of it will be spent on imports.

However, this has not been true for Pakistan, at least not for the 20 years in question. As is evident in Figure 5, the imports-to-GDP ratio of other developing countries (China, India, Bangladesh, and Indonesia) increased while that of Pakistan moved in the opposite direction. Both our conventional and additional determinants fail to explain this occurrence, and so we need to look for other explanations.

Figure 5: Imports-to-GDP ratio for selected developing countries

One likely candidate is foreign resource inflows—imports are constrained by the availability of foreign exchange reserves. In the case of Pakistan, one could hypothesize that imports were constrained during these years due to insufficient foreign resource inflows. If we examine foreign resource inflows during the late 1980s and throughout the 1990s, we observe that the country struggled with a dire BOP situation simply because it was hard to obtain foreign capital owing to domestic political and economic instability. Toward the end of this period, Pakistan found itself isolated economically after it conducted nuclear tests in May 1998 and was subject to sanctions by the West. The situation worsened when General Pervez Musharraf came to power in 1999. At the start of the 2000s, remittances were the chief form of foreign resource inflows. Foreign borrowing seemed unlikely because Pakistan was already on the verge of defaulting on its external debt payments; instead, there was a net capital outflow as the country paid off its previous debts.

Foreign resource inflows picked up only post-2002 when Musharraf declared that Pakistan would support the US-led war effort in Afghanistan. The country's circumstances changed dramatically as the resource constraint began to ease: foreign aid and capital flows were resumed, external debts were rescheduled, workers' remittances increased, and trade sanctions were removed, improving Pakistan's access to the international market. This turn of events led to an unprecedented high level of foreign resource inflows. According to a careful estimate, between FY2002 and 2007, Pakistan received a total of US\$ 62.2 billion—equivalent to 80 percent of the country's exports and 60 percent of its imports. This recovery then resulted in a sharp rise in imports and, therefore, became the backdrop to the 2008 BOP crisis (see Haque, 2010).

To test this hypothesis, we have carried out a subsidiary regression analysis for the period post-1980. Two import demand functions are estimated: one for 1980–2000 and the other for 2001–2012. One limitation of this analysis is that, because we have very few data points for the post-2000 period, we cannot use the more sophisticated time-series techniques such as the VECM because of the limited degrees of freedom. Instead, we apply OLS to the stationary series of dependent and independent variables to test our hypothesis.

The determinants in this case are net capital inflows—a BOP account that includes mainly foreign direct investment, portfolio investment, net public borrowing, remittances, etc.—in addition to the conventional import demand parameters. Interestingly, net capital inflows are significant only for the years between 1980 and 2000 and insignificant thereafter as anticipated (see Table 9).¹ This finding validates our hypothesis that Pakistan's imports were constrained by the availability of sufficient foreign resource inflows.

As far as the other determinants are concerned, relative prices were found to be insignificant in both periods, whereas real GDP is significant throughout. However, its sign is negative for the entire period as the falling imports-to-GDP ratio with rising income is a dominant trend post-1980s. The sign is reversed in the regression estimates for 2000–12 when imports as a percentage of GDP begin to pick up rapidly, eventually leading the economy into the 2008 BOP crisis.

Table 9: Regression estimates for import demand function: 1980–2012

Coefficients	Dependent variable = imports-to-GDP ratio		
	1980–2012 (1)	1980–2000 (2)	2000–12 (3)
$\Delta \ln Y_t$	-0.18***	-0.166***	0.612**
	0.043	0.043	0.058
$\Delta \ln RP_t$	0.045	0.102	0.058
	0.121	0.152	0.138
NCI_t^\dagger	0.027***	0.068***	0.016
	5.80E-06	1.62E-05	0.071

† NCI = net foreign resource inflows. It is not first-differenced because its level series was stationary.

Source: Authors' calculations.

¹ Net foreign resource inflows retain their significance for this specific period even when additional determinants such as TOT and foreign exchange availability are added to the regression equation, thus marking their validity as a determinant of import demand solely for this period.

7. Conclusion and Policy Implications

There has been a tremendous rise in Pakistan's level of imports over the last few years, especially following the liberalization regime of the 1990s. In addition, the economy has experienced a rise in foreign exchange reserves and economic growth. However, as a result of its limited export profile, Pakistan's trade deficit has worsened. In light of these circumstances, it has become essential to determine which factors explain the abrupt variations and continuous growth in imports for Pakistan. This paper has tried to do so by empirically estimating the determinants of imports in the long run and short run using a VECM. Our main findings indicate that there is a long-run equilibrium relationship between import demand and real GDP, relative prices, the terms of trade, and foreign exchange reserves availability, signifying the relevance of additional determinants for the conventional import demand equation.

These findings obviously have implications for the trade balance. The import volume would rise significantly if real income were to increase, and that too at a rate higher than the rate of growth of real income, thus causing the trade balance to deteriorate. To prevent this, exports must grow in tandem with imports. With a stagnant export growth rate and a very high import growth rate, the trade balance will keep worsening. Foreign exchange reserves are also statistically significant, affecting import demand both in the short run and the long run. Moreover, import demand is elastic with respect to foreign exchange reserves availability. Omitting such an important variable can cause the misspecification of the model and overemphasize the influence of the other variables included.

We have shown this empirically by estimating two separate models for import demand: a conventional import demand function, to which we then added other variables of import demand. Import demand is inelastic with respect to relative prices, even though relative prices have a negative impact on import demand. The small coefficient implies that Pakistan's export market is noncompetitive: despite the rising prices of imports, this has not led to a significant substitution of exports for imports. This effect marks the inability of the domestic market to provide substitutes that can compete with imports. Finally, the coefficient of the terms of trade is positive and greater than 1. This means that a favorable change in the terms of trade (i.e., an increase in the price of exports) should help domestic consumers buy more imports for each unit of exports. However, this may also imply a worsening trade balance if exports fall because they have become relatively more expensive.

Our estimates of the elasticity of import demand with respect to the terms of trade are greater than 1, suggesting that an increase in the price of imports should lead to a fall in imports at a rate greater than the rate at which the terms of trade improve. For Pakistan, however, even with the constant devaluation of the rupee, a fall in the price of exports and a corresponding rise in the price of imports have not improved the trade balance.

Again, this has to do with the nature of imports. Without suitable substitutes to control import growth, the trade deficit will not improve. Our post-1980s analysis reveals that Pakistan's imports-to-GDP ratio was falling at a time when those of other rapidly growing developing countries (which are now far ahead) were increasing. Import growth is an essential development that takes place alongside economic growth. Pakistan's trade balance is the mirror image of its imports, implying that any variation in the balance of trade comes mostly from imports. Policy propositions to reduce imports and improve the trade balance are, therefore, common.

The real concern, however, is to improve the trade balance without having to reduce imports. If recovery is to come from anywhere, it must come from the export side, given the nature of Pakistan's imports and the fact that it is not self-sufficient in producing what it currently has to import.

References

- Afzal, M. (2001). Import functions for Pakistan: A simultaneous equation approach. *Lahore Journal of Economics*, 6(2), 109–116.
- Afzal, M. (2004). Exports-economic growth nexus: Pakistan's experience. *Indian Journal of Business and Economics*, 3(2), 315–340.
- Afzal, M., & Ali, K. (2008). An historical evaluation of "export-led growth" policy in Pakistan. *Lahore Journal of Policy Studies*, 2(1), 69–82.
- Arize, A. C., Malindretos, J., & Grivoyannis, E. (2004). Foreign exchange reserves and import demand in a developing country: The case of Pakistan. *International Economic Journal*, 18(2), 259–274.
- Arize, A. C., & Malindretos, J. (2012). Foreign exchange reserve in Asia and its impact on import demand. *International Journal of Economics and Finance*, 4(3), 21–32.
- Aziz, N., & Horsewood, N. J. (2008). *Determinants of aggregate import demand of Bangladesh: Cointegration and error correction modeling* (Conference Paper No. 1114). Kingsville, TX: International Trade and Finance Association.
- Bahmani-Oskooee, M. (1998). Cointegration approach to estimate the long-run trade elasticities in LDCs. *International Economic Journal*, 12(3), 89–96.
- Doroodian, K., Koshal, R. K., & Al-Muhanna, S. (1994). An examination of the traditional aggregate import demand function for Saudi Arabia. *Applied Economics*, 26(9), 909–991.
- Fida, B. A., Khan, M. M., & Sohail, M. K. (2011). Revisiting aggregate import demand function in Pakistan using ARDL methodology. *American Journal of Scientific Research*, 33, 5–12.
- Haque, I. (2010). *Pakistan: Causes and management of the 2008 economic crisis* (Global Economy Series No. 22). Penang: Third World Network.
- Rashid, A., & Razzaq, T. (2010). *Estimating import-demand function in ARDL framework: The case of Pakistan* (MPRA Paper No. 23702). Retrieved from <http://mpra.ub.uni->

muenchen.de/23702/1/ESTIMATION_OF_IMPORT_DEMAND_FUNCTION_FOR_PAKISTAN.pdf

- Rehman, H. (2007). An econometric estimation of traditional import demand function for Pakistan. *Pakistan Economic and Social Review*, 45, 245–256.
- Sarmad, K., & Mahmood, R. (1985). Price and income elasticities of consumer goods imports of Pakistan. *Pakistan Development Review*, 24(3–4), 453–461.
- Sultan, Z. A. (2011). Foreign exchange reserves and India's import demand: A cointegration and vector error correction analysis. *International Journal of Business and Management*, 6(7), 69–76.