AGGREGATE IMPORTS AND EXPENDITURE COMPONENTS IN PAKISTAN: AN EMPIRICAL ANALYSIS

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Abstract

The main purpose of this study is to examine the determinants of imports in case of Pakistan by using the cointegration method. It investigates the long-run relationship between Pakistan's aggregate imports and the major macroeconomic components of final expenditure (GDP aggregate expenditure). This study is divided into two parts. In the first part this study examines the total aggregate import demand function, and in the second part the disaggregate import demand functions are investigated (i.e. import demand function of raw material, fuel and machinery). This study uses Abbott et al. (1996) framework for empirical evidence. The empirical finding shows that private consumption expenditure is the major determinant of import demand in Pakistan for all categories of import except for vehicle import.

Key Words: Import demand function, cointegation, ECM, Pakistan

JEL Classification**:** F1, F4

I. Introduction

In the present decade the size of aggregate import has become very large so that the trade deficit has became alarming for Pakistan. In the case of Pakistan, GDP growth has been strongly associated with import growth particularly of machinery technical know-how, fuel and essential food items. Over the last few years Pakistan's import bill has been high for engineering

goods, but this was not due to large capital good imports. It was high due to imported automobiles imported by rich people.

According to several empirical studies the basic import demand model relates import demand to relative prices and gross domestic product. It is assumed that the import content of public and private expenditure is the same. But, if different components of total national expenditure have different import content, then the use of a single variable in aggregate demand function will lead to aggregation bias (Abbott and Seddighi, 1996).

There are many research studies which attempt to examine the linkage between aggregate imports and macroeconomic components of expenditure such as private and public consumption expenditure, investment and export expenditures. In these studies authors have estimated import elasticities both at the aggregate and disaggregated levels for developed and developing countries.

Disaggregated estimates of import elasticities are important for quantifying the influence of the various determinants of import demand and to provide a scientific basis for policy decisions, particularly for those related to demand restraint, devaluation, tariffs, etc.(Sarmad , 1989).

When each macro-component of final expenditure has a specific import content, different compositions of expenditure correspond to different aggregate propensities to import. But in most economies, this composition of total expenditure tends to change over time and there is no stable relationship between imports and aggregate expenditures as measured by GDP.

The organization of the paper is as follows. In Section II, we present an eclectic literature review. Section III develops the theoretical framework, and Section IV presents empirical results. In Section V, we highlight the main findings and conclusions.

II. Literature Review

This section presents a brief review of some of the studies which examine the aggregate import demand function for Pakistan and some other countries.

Hafeez ur Rehman (2007) has conducted a similar study for Pakistan. This study attempts to estimate the aggregate import demand function for Pakistan by employing the Johenson and Juselius cointegration technique using annual data during 1975 - 2005. He followed the Doroodian *et al.* (1994) model for import demand. This is a log linear model in which he regressed the volume of import on real income, import prices, domestic prices, and legged volume of imports. He applied ADF test and the Phillips Parren (PP) test to determine the order of integration. Both trace and eigenvalue tests give the same results i.e. the null hypothesis of no cointegration is rejected for r =0 at 5% level of significance. He also applied an ECM to estimate short run as well as long-run elasticities. The results indicate that only real income (0.06947) and import price (-0.3602) elasticities are significant in the long run. The inelastic long run income elasticity implies that aggregate imports can be regarded as necessary goods in Pakistan. But in the short run the level of imports is not affected by the level of real income, domestic prices level, and import prices.

Rehman also applied CUSUM and CUSUM of square (Brown, Durbin and Evans 1975) tests and Recursive coefficients to estimate stability of the import demand function. The results of the stability tests show that the import demand functions remain stable during the sample period.

Mohammad Afzal (2006) presented a study estimating long-run trade elasticities in Pakistan using the cointegration approach. The objective of the paper was to estimate the Marshall-Lerner condition for Pakistan by employing the cointegration technique using annual data for the period 1960-2003. In this study he developed two models in log linear form, one for export demand and other for import demand.

In the export demand model real exports are regressed on the ratio of unit value of Pakistan's export in US dollars to unit value of world exports in US dollars, to world real income, and to nominal exchange rate (domestic price of the foreign currency).

In the import demand model he regressed real value of import on relative price ratio of unit value of imports to wholesale price index of Pakistan; and to Pakistan's real GDP (1990 =100 base) and to nominal exchange rate (domestic price of the foreign currency). All variables were in natural logarithm and in constant (1989-90 =100) prices.

The empirical findings show that for export demand function, relative price elasiticity is -2.92; and world real income elasticity is 3.78; and nominal exchange rate has elasticity of 0.043. The import demand function shows that Pakistan's Real GDP has elasticity of 3.19; relative price ratio of - 5.26 and nominal exchange rate has -2.27.

The result of this study found that devaluation should improve the trade balance in Pakistan. But empirical evidence shows that following devaluation trade balance usually does not improve. This may be because devaluation sets in motion other forces that tend to neutralize the positive effect of devaluation on the trade balance. Some studies have reported that devaluation would improve the trade balance and is expansionary; while others concluded that devaluation is contractionary and will not improve the trade balance.

Sarmad (1989) examined the factors influencing the demand for Pakistan's imports both at aggregate and disaggregate level during the period 1959-60 to 1985-86. The functional form of the import equations was determined empirically. The results show that there is strong evidence to support the use of the log-linear form as the appropriate functional form of the import equation, both at the aggregate and disaggregated levels.

Empirical findings show that the income, relative price, and foreign exchange availability elasticities have the 'right' sign.

The vast majority of them are significantly different from zero at the 10% level of significance. The aggregate income and price elasticities are on the low side, 0.631 and -0.669 respectively, while the foreign exchange elasticities is only 0.191. At the disaggregated level, the income elasticity ranges from 1.4 for import of oils and fats to as low as 0.45 for import of fuels. The relative price elasticities range from -1.2 for imports of machinery and transport to -0.42 for imports of oils and fats.

Abbott and Seddighi (1996) used the cointegration approach of (Johansen and Juselius, 1990) and error correction models (Engel and Granger, 1987) to estimate an import demand model for the UK. Their results show that consumption expenditure has the largest impact on import demand with elasticity of 1.3, followed by investment expenditure with elasticity 0.3 and expenditure on exports has the elasticity of 0.1. The relative import price ratio to domestic price also has an elasticity of 0.1.

Dutta and Ahmed (1999) used Engle-Granger's (1987) and Johansen's multivariate approaches to estimate the aggregate import demand function for Bangladesh using quarterly data from 1974 to 1994. In this study, Bangladesh's aggregate import demand and its determinants, real import prices, real gross domestic product (GDP) and real foreign exchange reserves, were cointegrated. The estimated long-run elasticities of the explanatory variables based on Engle-Granger's (1987) approach were –0.52 (for relative prices), 1.63 (for real GDP) and –0.10 (for real foreign exchange reserves, but this variable was insignificant at the 10 percent level). A dummy variable was incorporated for the introduction of liberalization policies, but it was found to be insignificant.

Mohammed and Tang (2000) estimated the determinants of aggregate import demand for Malaysia by using Johansen and Juselius cointegration technique over the period 1970-1998. The empirical results show that all expenditure components have elasticities less than 1 and have inelastic effect on import demand in the long run. Investment expenditure had the elasticity of 0.78

with imports followed by final consumption expenditure with elasticity of 0.72. For expenditure on exports, it was found that it had the smallest elasticity of 0.38 with import demand. For relative prices they found a negative and inelastic relationship with elasticity of -0.69 with import demand.

Tang and Nair (2002) re-investigated the aggregate import demand function for Malaysia using the bounds testing approach (Pesaran et al., 1996). This study used annual data from 1970 to 1998 as employed by Tang and Alias (2000). The result of the bounds test indicated that the volume of imports, real income and relative price were cointegrated. The empirical results show that the estimated income and price elasticities were 1.5 and –1.3, respectively. The positive sign of income elasticity shows that an increase in income leads to increased imports, but as it is elastic this means that imports are not regarded as necessary goods in Malaysia. The estimated parameter elasticities were consistent with those of Tang and Alias (2000). However, Tang and Alias (2000) found that import volume, real income and relative price were not cointegrated based on the insignificance of the estimated error correction term (see Kremers et al., 1992).

Sinha's (1997) study found one cointegrating vector in Thailand's aggregate import demand function using Johansen's multivariate procedure for the period 1953 to 1990. The study found that Thailand's aggregate import demand was price inelastic (-0.77) and cross-price inelastic (0.3) but highly income elastic (2.15).

Bahmani-Oskooee (1998) estimated import and export demand equations for six developing countries (Greece, Korea, Pakistan, the Philippines, Singapore and South Africa) using a long-run approach (Johansen'sapproach). In this study, the volume of imports was related to relative prices, domestic income and the nominal effective exchange rate. The sample period covered quarterly data from 1973 to 1990.

The study concluded that the Marshall-Lerner condition was satisfied and revealed that devaluation could improve the

trade balances of these countries. The import demand for these countries was found to be price elastic except for Singapore (0.15, with incorrect sign). The real income variable was found to be elastic, but not in the case of Korea (0.31, and insignificant). The import demand for these countries was exchange rate inelastic (between 0.002 and 0.33) except for Singapore (-1.66, with incorrect sign).

Mohammad *et al.* (2001) examined the long-run relationship between imports and expenditure components of five ASEAN countries (Malaysia, Indonesia, the Philippines, Singapore and Thailand) through the use of Johansen multivariate cointegration analysis (Johansen 1988; Johansen *et al.* 1991). Annual data for the period 1968-1998 were used for the countries (except Singapore, with a shorter period 1974-1998). The disaggregated model, in which the final demand expenditure is split up into three major components, is used. The results reveal that import demand is cointegrated with its determinants for all five countries.

Min *et al.* (2002) estimated South Korea's import demand function using the Johansen and Juselius (1990) approach over the 1963-1998 period. They found evidence for the existence of a long run elastic (1.04) impact of final consumption expenditure on import demand and inelastic (0.49) impact of export expenditure on import demand. Both results were statistically significant at the 1 percent level. However, the impact of investment expenditure was found it to be negatively related with import demand, but it was statistically insignificant.

Tang (2003) estimated China's import demand function using the bounds testing approach to cointegration. In the long run, he found expenditure on exports having the largest elasticity with imports (0.51), followed by investment expenditure (0.40) and final consumption expenditure (0.17). The relative price variable appeared with a coefficient of 0.6, implying that an increase in relative prices induces a 0.6 per cent fall in the demand for imports.

Ho (2004) has estimated the import demand function of Macao by testing both aggregated and disaggregated import demand models with the components of aggregate expenditure using quarterly

data over the 1970 to 1986 period. Using JJ-Maximum likelihood cointegration and error correction techniques, Ho (2004) found significant partial elasticities of import demand with respect to investment (0.1396), exports (1.4810) and relative prices (-0.3041) with their expected signs implied by economic theory in the disaggregated model.

Narayan and Narayan (2005) applied the bounds testing approach to cointegration to estimate the long-run disaggregated import demand model for Fiji using relative prices, total consumption, investment expenditure, and export expenditure variables over the period 1970 to 2000. Their results indicated a long run cointegration relationship among the variables when import demand is the dependent variable. The results revealed long run elasticities of 0.69 for both export expenditure and total consumption expenditure respectively, followed by relative prices (0.38) and investment expenditure (0.17).

III. The Model And Data

In this study we follow the formulation used by (Abbott at el. 1996), according to which import demand function is as follows:

$$M = f(CG, INVT, EXPT, (Pm / Pd)) \quad \ldots\ldots (1)$$

Where M is imports at constant prices. The variable CG is the sum of private and public consumption expenditures; INVT is expenditure on investment goods including gross domestic fixed capital formation. EXPT is export expenditure. The variable Pm/Pd is the relative price ratio. Pm is the import price deflator defined as ratio of imports in current prices over imports in constant prices and Pd is an index of domestic prices measured by the GDP deflator. For export expenditure we use another variable" Export as a capacity to import" as proxy.

We applied this model for Pakistan with a little modification in which we further decomposed total consumption expenditure CG into private and public consumption expenditure.

This will show the partial effect on both components. Another important change in this study is that, EXPT is representing a new variable known as 'Export as a capacity to import'. Export as a capacity to import equals the current price value of exports of goods and services deflated by the import price index.

The reason for using this variable is that we want to know how much our export earnings contribute to aggregate import demand i.e. whether this has significant relationship with import demand or not.

The model in logarithmic form in which all the variables are measured at constant prices can be expressed in equation as follows:

$$Ln\ M = \beta 0 + \beta 1\ ln\ PCE + \beta 2\ ln\ GCE + \beta 3\ ln\ INVT + \beta 4\ ln\ EXPT + \beta 5\ ln(Pm/Pd) \quad \ldots\ldots\ldots\ldots\ (2).$$

Where M is measuring the volume of imports at constant prices. The PCE is measuring private consumption expenditures at constant prices; GCE is the public consumption expenditures at constant prices; and INVT is expenditure on investment goods including gross domestic fixed capital formation at constant prices. The variable EXPT is measuring export as a capacity to import. The calculated data values for this variable are available and taken from the World Development Indicators of the World Bank. Pm is the import price deflator defined as ratio of imports in current prices over imports in constant prices and Pd is an index of domestic prices measured by the GDP deflator. The data used in this study is annual data in billion Rs. from 1970 to 2008. The values are based on 2000 = 100 prices.

Data for macroeconomic components of expenditure is mostly taken from WDI 2009 and as well as from some issues of Economic Surveys. Data also collected from the Economic Survey 2008-09. Data for raw material, fuel, machinery and vehicle is taken from 25 years Statistics of Pakistan, various issues of Statistical Year Book of Pakistan, Monthly Billiton of Statistics, Statistics Division; and from various issues of Foreign Trade

Statistics of Pakistan, FBS; Handbook of Statistics on Pakistan Economy, SBP Pakistan.

IV. Results

IV. 1. Long Run Behavior of Pakistan's Aggregate Imports

Using cointegration analysis, the import demand function can be estimated to show whether there exists a long run "equilibrium" relationship linking the import demand variable to the variables defined in the model in equation (2).

For a long-run relationship to exist all the variables included in the model must form a unique cointegrating vector, which could be investigated by employing the maximum likelihood estimation technique developed by Johansen. We applied this technique sequentially.

The first step in the cointegration analysis is to test the order of integration for each variable of the model. For this purpose we used the standard ADF test. The empirical findings of the ADF test are shown in Table 1.

The ADF test provides strong evidence to reject the null hypothesis that the estimated residual has a unit root. This implies that the residuals are stationary.

Table-1 Unit root test results for all variables.

Variables	ADF test at 5%
Volume of Import (M)	0.65775 (-2.941145)
Δ M	-5.131627 (-3.536601)
Private Consumption Expenditure (PCE)	-0.183370 (-2.943427)
Δ PCE	-5.688068 (-2.945842)
Govt. Consumption Expenditure (GCE)	-1.228889 (-3.536601)
Exp on Investment (INVT)	--1.487548 (-3.533083)
Δ INVT	-4.353280 (-3.536601)
Exp on Export (EXPT)	-0.319727 (-2.943427)
Δ EXPT	-6.181654 (-2.948404)
Relative Price Ratio (PmPd)	--1.575283 (-2.943427)
Δ PmPd	--5.648813 (-3.548490)
Raw Material Import (RMAT)	-0.737734 (-2.945842)
Δ RMAT	-8.187054 (-2.945842)
Fuel Import (FUEL)	-0.007166 (-2.941145)
Δ FUEL	-6.034673 (-2.943427)
Machinery Import (MACH)	-2.029540 (-2.945842)
Δ MACH	-6.415746 (-2.945842)
Vehicle Import (VECH)	-2.520568 (-3.533083)
Δ VECH	-5.581319 (-3.536601)

Note: t-values are given in the parenthesis. ( )

The null hypothesis in each case is that the variable in question is I (1): the 95% critical values are given in brackets and derived from Fuller. From the result of test it is clear that all level variables are integrated of order one, ~ I (1). i.e., first differencing is required to ensure a stationary process. ADF tests for each variable confirm that the first differences are stationary.

After confirming that each variable in the model is I(1), we were in a position to carry out the cointegration tests with the use of the Johensen technique. The choice of lag length was based on the Schwarz Criteria and the optimal lag length was 2 years.

Table 2 presents the results of the trace test derived from the Johansen maximum likelihood procedure. Here we proceeded sequentially, first testing for Ho: $r \leq 0$, and than for $r \leq 1$ and so on, until the null hypothesis could be rejected, where r is the number of cointegrating vectors.

Table 2: Result of JJ cointegration

Test Statistics	Null Hypothesis	Cointegration Test Statistics	Critical Value at 5%
Trace Statistics	Ho : r = 0	237.457	107.346
	Ho : r ≤ 1	138.543	79.341
	Ho : r ≤ 2	80.811	55.245
	Ho : r ≤ 3	43.305	35.011
	Ho : r ≤ 4	16.132	18.397
	H0 : r ≤ 5	5.481	3.841
	Ho : r = 0	98.913	43.419
Maximal-eigenvalue	Ho : r ≤ 1	57.733	37.163
Statistics	Ho : r ≤ 2	37.504	30.815
	Ho : r ≤ 3	27.172	24.252
	Ho : r ≤ 4	10.651	17.147
	H0 : r ≤ 5	5.481	3.841

Note: According to the optimum model selection criteria, the JJ Assumption-5 is selected.

Both tests indicate that there are four cointegrating vectors with respect to the variables defined in the model at 5% level of significance. Table 3 shows the long run coefficient estimates.

Table 3 : Long Run Coefficients

Dependent Variable = M		
Regressors	Coefficients	T-statistic
PCE	1.981	12.329
GCE	0.621	13.637
LINVT	0.248	2.804
EXPT	-0.471	-9.149
PMPD	-1.017	-20.873

Table 3 above shows the values of long run coefficient estimates of each independent variable with their respective significant t-values.

On the basis of this unique cointegrating vector, which also presents coefficient estimates normalized on aggregate imports, the equation representing the long run relationship between variables identified in the model is

$$Ln\,M = 1.98158\ Ln\,PCE + 0.62039\ Ln\,GCE + 0.24813\ Ln\,INVT - 0.47127\ Ln\,EXPT - 1.01758\ Ln\,PmPd \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots \ldots(3)$$

Equation (3) shows the long run relationship between aggregate import and macroeconomic components of final expenditure. We see that all variables included in the model have coefficients with expected signs and with significant t – ratios except for the variable EXPT, i.e. "Export as a capacity to import". We used this variable to estimate exports contribution to import expenditure. This variable shows negative relationship with aggregate import demand.

Furthermore, the long run relationship also indicates that both private and public consumption expenditure contribute to aggregate import demand, but private consumption expenditure is the major determinant of Pakistan's aggregate

imports in the long run. It has positive elasticity value of almost 2 which indicates that an increase in private consumption expenditure leads to a relatively larger increase in import demand in the long run, compared to the increase in public expenditure.

On the other hand, the elasticity coefficient for public expenditure is only about one third of that for private consumption expenditure. This leads to the very significant findings that an increase in public consumption does not have a large impact on the growth of the trade deficit. Similarly, the elasticity coefficient of the investment variable is extremely low – one tenth of the value of private consumption import elasticity. Investment growth in Pakistan is thus not import dependent and is probably mainly domestically sourced – this is again a very significant finding.

The sign of price of imports to the prices of domestically produced goods shows a negative relationship with the level of imports in the long run. It is approximately unitary elastic with import demand.

IV. 2 The Short – Run Behavior of Pakistan Aggregate Imports

The short run behavior of Pakistan's aggregate imports can be studied by developing an ECM model. The general form of the ECM model is shown below. For this purpose the lagged residual error derived from the cointegrating vector was incorporated.
The general short run dynamic model is represented as follow:

$$\Delta Mt = \alpha o + \Sigma\alpha 1i\ \Delta PCE\,t\text{-}i + \Sigma\alpha 2i\ \Delta GCE\,t\text{-}i + \Sigma\alpha 3i\ \Delta INVTt\text{-}i + \Sigma\alpha 4i\ \Delta EXPT\,t\text{-}i + \Sigma\alpha 5i\,\Delta PmPdt\text{-}i + \Sigma\alpha 6i\ \Delta Mt\text{-}i + \alpha 7\,ECM\,t\text{-}1 + \text{error term} \ldots\ldots\ldots(4)$$

In the above equation all variables are the same as defined in equation 2 but here they are expressed in difference form and a lagged residual term is also included.

Error Correction Model Results

From the empirical results, we found that the short run ECM equation can be represented as

$$\Delta M_t = -0.054207 + \underset{(5.114)}{1.548805}\ \Delta PCE_t + \underset{(3.018)}{0.424425}\ \Delta GCE_t + \underset{(0.986)}{0.286773}\ \Delta INVT_t - \underset{(-0.166)}{0.022013}\ \Delta EXPT_t - \underset{(-3.050)}{0.358296}\ \Delta PmPd_t - \underset{(-2.015)}{0.340994}\ ECM_{t-1} \quad \ldots\ldots (5)$$

$R^2 = 0.70 \quad DW = 2.24$

We see that in the short run private and government consumption expenditures are positive determinants of aggregate imports, but elasticity coefficients of both private and government consumption expenditure have been reduced in the short run.

Furthermore, investment expenditure has no significant relationship to imports in the short run. Also export as a capacity to import has a negative sign of its elasticity coefficient and is insignificant in the short run. Relative import price variable also shows a negative sign and is significant over the short run.

IV. 3 Disaggregated Analyses

In this study we extended our findings to examine the long run relationship of aggregate imports of raw material, fuel, machinery, vehicle and the major macroeconomic components of final expenditure. The data for total imports of these categories is taken for the period 1970 to 2008 at constant prices of 2000.

Disaggregate Models

A. Raw Material Imports

For cointegration analysis, the empirical findings of the ADF test are shown in Table1. The ADF test provides strong evidence to reject the null hypothesis that the estimated residual has a unit root. This implies that the residuals are stationary.

After confirming that each variable included in the model is I (1), we now carry out the cointegration tests with use of the Johensen technique. The choice of lag length was based on the Schwarz Criteria and the optimal lag length was 2 years.

Table 4 presents the results of the trace test derived from the Johansen maximum likelihood procedure. Here we proceeded sequentially, first testing for Ho : $r \leq 0$, and than for $r \leq 1$ and so on, until the null hypothesis could be rejected, where r is the number of cointegrating vectors.

Table 4 : Result of JJ cointegration for Raw Material

Test Statistics	Null Hypothesis	Cointegration Test Statistics	Critical Value at 5%
Trace Statistics	Ho : r = 0	169.5195	103.84731
	Ho : $r \leq 1$	84.93969	76.97277
	Ho : $r \leq 2$	54.00418	54.07904
	Ho : $r \leq 3$	27.61599	35.19275
	Ho : $r \leq 4$	12.36021	20.26184
	H0 : $r \leq 5$	4.335075	9.16454

Note: Trend assumption: No deterministic trend (restricted constant)

The cointegration results for long run relationship are shown below.

Ln RMAT = Ln PCE + Ln GCE + Ln Expt + Ln INVT + LPmPd

Ln RMAT = 1.093 LnPCE - 0.517 Ln CGE + 0.627 Ln Expt +

(8.09) (-4.13) (4.93)

0.165 Ln INVT + 0.697 Ln PmPd .....(6)

(2.01) (4.23)

t-values in Parenthesis

The above equation shows the long run relationship between import of raw material and macro economiccomponents

of final expenditure. We see that the variables PCE (private consumption expenditure), EXPT (export as a capacity to import), INVT (expenditure on investment including fixed capital formation, PmPd (price of import to prices of domestically produced goods) have positive sign where as GCE (public consumption expenditure) has a negative sign.

The long run relationship also indicates that private consumption expenditures contribute to aggregate raw material import demand and is the major determinant of Pakistan's aggregate raw material imports in the long run. It has positive unit (1.1) elasticity value which indicates that an increase in private consumption expenditure leads to an equal increase in import demand in the long run.

The elasticity coefficient of the investment variable, though positive is extremely low – one tenth of the value of private consumption import elasticity. Investment growth in Pakistan is not significantly raw material import dependent. The sign of price of imports to the prices of domestically produced goods shows a positive relationship with the level of raw material imports in the long run and having the elasticity of 0.69.

B. Fuel Imports

The empirical findings of the ADF test are shown on Table 1. The ADF test provides strong evidence that the residuals are stationary. It confirms that each variable included in the model is I (1). We now carry out the cointegration tests with use of the Johensen technique. The choice of lag length was based on the Schwarz Criteria and the optimal lag length was 2 years.

Table 5 presents the results of the trace test derived from the Johansen maximum likelihood procedure. Here we proceeded sequentially, first testing for Ho : $r \leq 0$, and then for $r \leq 1$ and so on, until the null hypothesis could be rejected, where r is the number of cointegrating vectors.

Table 5 : Result of JJ cointegration for FUEL

Test Statistics	Null Hypothesis	Cointegration Test Statistics	Critical Value at 5%
Trace Statistics	Ho : r = 0	121.4798	95.75366
	Ho : r ≤ 1	72.04629	69.81889
	Ho : r ≤ 2	42.92568	47.85613
	Ho : r ≤ 3	24.69620	29.79707
	Ho : r ≤ 4	10.12278	15.49471
	H0 : r ≤ 5	2.700452	3.84146

Note : Trend assumption: Linear deterministic trend

The cointegration results for long run relationship are shown below.

Ln Fuel = Ln PCE + Ln GCE + Ln Expt + Ln INVT + Ln PmPd

Ln Fuel = 1.44 LnPCE + 0.035 Ln CGE - 0.445 Ln Expt +
(14.4) (0.35) (-4.45)

0.468 Ln INVT - 0.160 Ln PmPd ……(7)
(4.25) (-1.33)

t-values in Parenthesis

The above equation shows the long run relationship between aggregate fuel import and macroeconomic components of final expenditure. We see that variables PCE, GCE, and INVT in the model have positive coefficients with expected sign, but GCE has insignificant t-value. The coefficient of EXPT is negative with significant t – ratio.

The long run relationship also indicates that both private and public consumption expenditures contribute to aggregate fuel import demand, but private consumption expenditure is the major determinant of Pakistan's aggregate imports in the long run. It has positive elasticity value of 1.44 which indicates that an increase in private consumption expenditure leads to a relatively large increase in fuel import demand in the long run. GCE with elasiticity 0.035 indicates that an increase in government consumption expenditure leads to very low increase in fuel import demand in the long run. **O**n the other hand, the elasticity

coefficient for public expenditure is only about 1/30 of that for private consumption expenditure. This leads to the very significant findings that an increase in public consumption does not make a large impact on the growth of trade deficit. Similarly, the elasticity coefficient of the investment variable is low (0.47) – one third of the value of private consumption import elasticity. Investment growth in Pakistan is a little bit fuel import dependent and is mainly domestically sourced. It is again a significant finding.

The sign of price of imports to the prices of domestically produced goods shows a negative relationship with the level of fuel imports in the long run. It is inelastic with fuel import demand.

C. Machinery Imports

The empirical findings of the ADF test are shown on Table 1. The ADF test provides strong evidence that the residuals are stationary. It confirms that each variable included in the model is I (1). We now carry out the cointegration tests with use of the Johensen technique. The choice of lag length was based on the Schwarz Criteria and the optimal lag length was 2 years.

Table 6 presents the results of the trace test derived from the Johansen maximum likelihood procedure. Here we proceeded sequentially, first testing for Ho : $r \leq 0$, and then for $r \leq 1$ and so on, until the null hypothesis could be rejected, where r is the number of cointegrating vectors.

Table 6 : Result of JJ cointegration for Machinery

Test Statistics	Null Hypothesis	Cointegration Test Statistics	Critical Value at 5%
Trace Statistics	Ho : $r = 0$	131.6381	95.75366
	Ho : $r \leq 1$	81.90962	69.81889
	Ho : $r \leq 2$	52.55538	47.85613
	Ho : $r \leq 3$	24.81415	29.79707
	Ho : $r \leq 4$	9.689445	15.49471
	H0 : $r \leq 5$	1.686830	3.841466

Note: Trend assumption: Linear deterministic trend

The cointegration results for long run relationship are shown below.

Ln Mach = Ln PCE + Ln GCE + Ln Expt + Ln INVT + Ln PmPd

Ln Mach = 1.875 Ln PCE + 0.826 Ln CGE – 0.965 Ln Expt
(5.00) (2.39) (-9.08)

+ 1.677 Ln INVT - 0.728 Ln PmPd ……..(8)
(4.28) (-1.61)

t-values in Parenthesis

The above equation shows the long run relationship between aggregate machinery import and macroeconomic components of final expenditure. We see that all variables included in the model have coefficients with expected signs except the variable EXPT. This variable shows negative relationship with aggregate machinery imports.

Furthermore, the long run relationship also indicates that both private and public consumption expenditures contribute to aggregate machinery import demand, but private consumption expenditure is the major determinant of Pakistan's aggregate machinery imports in the long run. It has positive elasticity value of almost 2 which indicates that an increase in private consumption expenditure leads to a relatively large increase in machinery import demand in the long run.

On the other hand, the elasticity coefficient for public expenditure is only about half of that for private consumption expenditure. This leads to the very significant finding that an increase in public consumption does not have a large impact on the growth of trade deficit. The elasticity coefficient of the investment variable is relatively high (1.67). This shows that investment is another major determinant of Pakistan's aggregate machinery imports in the long run. Investment growth in Pakistan is machinery import dependent. The sign of price of imports to the prices of domestically produced goods shows a negative relationship with the level of machinery imports in the long run. It has the value of 0.72.

D. Vehicle Imports

The empirical findings of the ADF test are shown on Table 1. The ADF test provides strong evidence that the residuals are stationary. It confirms that each variable included in the model is I (1). We now carry out the cointegration tests with use of the Johensen technique. The choice of lag length was based on the Schwarz Criteria and the optimal lag length was 2 years.

Table 7 presents the results of the trace test derived from the Johansen maximum likelihood procedure. Here we proceeded sequentially, first testing for Ho : $r \leq 0$, and then for $r \leq 1$ and so on, until the null hypothesis could be rejected, where r is the number of cointegrating vectors.

Table 7 : Result of JJ cointegration

Test Statistics	Null Hypothesis	Cointegration Test Statistics	Critical Value at 5%
Trace Statistics	Ho : $r = 0$	134.7480	95.75366
	Ho : $r \leq 1$	80.53642	69.81889
	Ho : $r \leq 2$	50.10239	47.85613
	Ho : $r \leq 3$	24.89261	29.79707
	Ho : $r \leq 4$	11.82701	15.49471
	H0 : $r \leq 5$	1.70125	3.841466

Note: Trend assumption: Linear deterministic trend

The cointegration results for long run relationship are shown below:

Ln Vech = Ln PCE + Ln GCE + Ln Expt + Ln INVT + Ln PmPd

Ln Vech = 0.578 Ln PCE + 2.10 Ln CGE + 0.84 Ln Expt
(1.41) (5.38) (-11.34)

+3.714 Ln INVT – 2.328 Ln PmPd …….(9)
(8.18) (-4.79)

t-values in Parenthesis

The above equation shows the long run relationship between aggregate vehicle import and macroeconomic

components of final expenditure. We see that all variables included in the model have coefficients with expected signs. Although the variable PCE (private consumption expenditure) has positive elasticity coefficient (0.57). It has insignificant t – ratio, which means that private consumption expenditures is not a major determinant of aggregate vehicle import. The long run relationship also indicates that public consumption expenditures, export as capacity to import, and investment expenditures contribute to aggregate vehicle import demand, but investment expenditure is the major determinant having an elasticity value of 3.7. This shows that investment growth in Pakistan is vehicle import dependent. The sign of price of imports to the prices of domestically produced goods shows a negative relationship with the level of vehicle imports in the long run.

Two points may be made: Firstly, the small private consumption elasticity estimate may be explained by the fact that the consumption of people who buy vehicles as a proportion of total private consumption is very small – since people who buy vehicle are very few. Secondly, it would make sense to include auto loans as a determinant of vehicle import.

V. Summary and Conclusions

The purpose of this study was to make empirical analysis of the determinants of import at aggregate and disaggregate level in Pakistan. For this purpose we carried out a multivariate cointegration analysis to examine the long run relationship. An ECM model was used for assessing the short run relationship between aggregate imports and the main components of final expenditure. We divide our study into an aggregated and disaggregated level. Our empirical investigation suggests that at the aggregate level there exists a stable long-run relationship between aggregate imports and the main components of final expenditure and the relative price term. Private consumption expenditure, in particular appears to be the major determinant of Pakistan's aggregate imports. However, the exports expenditure for which we use a proxy varable" export as capacity to import" is not positively associated with aggregate imports demand. Also, both public consumption expenditure and aggregate investment have vey low import elasticities. In the short run, an error correction

model also suggests that private consumption expenditure is the major determinant of import demand.

At the disaggregated level, we developed an import demand model for raw materials, fuel, machinery and vehicles. Our findings show that, again private consumption expenditure is the major determinant except for vehicle imports. The variable public consumption expenditure is showing a negative relationship only with raw material import demand function. The variable export as a capacity to import is showing a negative relationship with fuel and machinery import demand function. The variable investment expenditure is showing a positive relationship with all the import demand functions, but has high elasticity value for machinery and vehicle import demand function.

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