Demand For Imports In The G.C.C.

Countries

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Demand for Imports in the GCC Countries

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Abstract
Investigating the import demand function has been one of the most active research areas in international economics. The reason for this popularity is its applications to a wide range of important macroeconomic policy issues. These include the international transmission of domestic disturbances, the impact of expenditure switching through exchange rate management and commercial policy on a country's trade balance and the degree to which the external balance affects the economy's growth. Moreover, knowledge of import demand function is highly useful in understanding the fluctuations of imports over the course of a business cycle and in the choice of economic policy options aimed at managing imports and balance of payments issues. Finally, the estimated demand elasticities are of vital importance when it comes to evaluating the effect of price changes in a partial equilibrium framework.

This empirical study investigates the process of adjustment of imports to changes in the level of domestic economic activity (in-
come) and the relative prices in the Gulf Cooperation Council (GCC) Countries. The aim is to provide new estimates of aggregate demand for imports in these countries over the last two decades, applying standard econometric techniques complemented by appropriate diagnostic tests based on recent and by now widely used dynamic modeling and cointegration techniques. In addition, estimates of short run and long run income and price elasticities of the individual countries within the GCC are obtained.

The results indicate that the demand for imports in the majority of the GCC countries is inelastic with respect to income at a given price level in the short run. However, in the long run, income elasticity becomes greater than one while the relative price elasticity remains less than one. Thus, indicating that imports are generally considered a necessity.

1-Introduction

Investigating the import demand function has been one of the most active research areas in international economics. The reason for this popularity is its applications to a wide range of important macroeconomic policy issues. These include the international transmission of domestic disturbances, the impact of exchange rate switching through exchange rate management and commercial policy on a country's trade balance and the degree to which the external balance affects the economy's growth. Moreover, knowledge of import demand function is highly useful in understanding fluctuations of imports over the course of a business cycle, the choice of economic policy options aimed at managing the current and balance of payments issues. Finally, the estimated elasticities are of vital importance when it comes to evaluating the effects of price changes in a partial equilibrium framework.

The economies of the GCC countries are characterized by a high degree of interdependence with the rest of the world. As
they are heavily reliant on imports as a means of sustaining their standard of living and providing the various needs of their populations. Despite the above fact and the vital importance of imports for the GCC countries, limited empirical work has been carried out to delineate the structure of demand for imports. Two recent papers that deal with the issue of import demand in Kuwait are Mohammad (1998) and Elsamadisy (1995). Relevant research dealing with other countries in the region includes Shaltout (1987) for the UAE, Doroodian et al. (1994) for Saudi Arabia. Moreover, Asseery and Perdikis (1993) studied the import demand for five of the six GCC countries (Bahrain was not included). Other studies for the GCC include Metwelly (1987) and Metwelly and Abdel-Rahman (1985).


The purpose of this empirical study is to investigate the process of adjustment of imports to changes in the level of domestic economic activity (income) and relative prices in the Gulf Cooperation Council (GCC) countries. The aim is to provide new estimates of the aggregate demand for imports in these countries over the last two decades, applying standard econometric techniques complemented by appropriate diagnostic tests based on recent and by now widely used dynamic modeling and cointegration techniques. In addition, to obtain estimates of short run and long run income and price elasticities for the individual countries within the GCC.

The remaining part of this paper is organized as follows: Section two briefly discusses the role of trade in the GCC economies. Section three contains a detailed review of the literature that pertains to the GCC countries. Section four discusses some theoretical issues
dealing with the demand for imports. The empirical results are presented and extensively discussed in section five. Finally, the conclusions are presented in section six.

2- Trade in the GCC Economies

The Gulf Cooperation Council Countries (GCC), which consist of Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and United Emirates (UAE), are characterized by a high degree of dependence with the rest of the world. This arises from the fact that these countries rely heavily on a single exportable commodity (crude oil), as the main source of foreign exchange earnings. Moreover, due to the developing nature of these economies and the limited availability of indigenous resources (other than oil), they are heavily reliant on imports as a means of sustaining the standard of living and providing for the various needs of their population as well as for development projects.

Due to the virtual dependence of GCC on oil revenues, the extent of these countries' interdependence with the rest of the world was dramatically increased after the 1973-1974 oil price revolution and again due to the 1979-1980 upheaval in the oil market caused by the Iranian revolution and the subsequent Iran-Iraq war.

To ascertain the significance of the foreign sector in the GCC economies, we calculated the ratios of imports to GDP, exports to GDP and the average of imports plus exports to GDP respectively. These ratios are presented in table (1) below for the various countries of the GCC and for the indicated time intervals.

It is clear from table (1) that the GCC countries differ in degree of dependence on foreign trade. In fact, while the ratio of imports to GDP remains near 100 percent for Bahrain during the entire observation period, it was found to be about 40% for the country of Oman. Concerning the other countries, this ratio stays close to the 20% - 30% range for Kuwait, Qatar, Saudi Arabia and the
ed Arab Emirates. It should be noted that the observed variations in this ratio among the various countries reflect the structure of these economies and their degree of diversification. Nonetheless, all these countries rely to a significant degree on the outside world for their import needs.

Concerning the exports to GDP indicator, it is noted that it is uniformly high for all GCC countries. No doubt, this is a reflection of the dominance of crude oil exports in their economies. According to the data in table (1), this ratio is the largest in the case of Bahrain (87 percent) and it is similar in magnitude for Kuwait, Oman, Qatar and United Arab Emirates (50-70 percent). In contrast, Saudi Arabia has the smallest ratio among the entire group (35 percent). It should be mentioned that Saudi Arabia, Bahrain, Oman and UAE enjoy a somewhat more diversified export base as compared to Kuwait, and Qatar.

Finally, we turn to the average of imports plus exports to GDP which is called the "Degree of Openness" indicator or the degree of "Outward Orientation". According to the data presented in table (1), Bahrain exhibits the greatest degree of openness. In fact, its measure of openness is found to be very large (89.92 percent). Moreover, the degree of openness is fairly large for other GCC countries such as Kuwait, Oman, Qatar and United Arab Emirates (50-60 percent). In contrast, the ratio for Saudi Arabia is rather small and stands at 28.81 percent. Here, it is worthy to caution that a small value for this indicator does not imply the insignificance of trade in the structure of the economy, but merely a reflection of the diversified nature of the economy.

Regarding the changes in these ratios over time, a careful examination of the data revealed no specific trend but merely fluctuations in exports and imports reflecting the developments in the oil market and its impact on these economies. From the brief discussion above, it can be concluded that the GCC countries rely
heavily on foreign trade and consequently imports constitute an important element in these economies and play an important role in the welfare of these societies.

Table (1): Trade Indicators for the GCC Countries (Percentages) *(Average Value over Sample)*

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Bahrain</td>
<td>91.88</td>
<td>87.27</td>
<td>89.9</td>
<td>(1975-1996)</td>
</tr>
<tr>
<td>Kuwait</td>
<td>26.85</td>
<td>54.50</td>
<td>40.5</td>
<td>(1970-1996)</td>
</tr>
<tr>
<td>Oman</td>
<td>39.46</td>
<td>57.47</td>
<td>48.6</td>
<td>(1970-1992)</td>
</tr>
<tr>
<td>Qatar</td>
<td>23.30</td>
<td>61.90</td>
<td>43.2</td>
<td>(1975-1994)</td>
</tr>
</tbody>
</table>

* Numbers in parentheses indicate the time interval.
3- Literature Review

Despite the vital importance of imports for the economies of the GCC countries, only a handful of empirical work has been carried out to investigate the determinants of import demand in these countries.

Early studies on total demand for imports in the member states of the Gulf Cooperation Council assumed that the demand for imports is highly price inelastic. Hence these studies specified the demand for imports to be only a function of real incomes, see Metwally and Abdel-Rahman (1985).

Subsequent investigations of the demand for imports in these countries have applied a typical conventional specification, where the quantity of imports is assumed to depend on economic activity variable and on relative prices defined as the ratio of price of imports index to an overall domestic price index. It was found that the relative prices are an important determinant of imports in the GCC countries. These studies include Shaltout (1987), Assery and Perdikis, (1990,1993), Elsamadisy (1995), Doroodian et al. (1994) and Mohammad (1998).

Concerning the functional form, both Shaltout (1987) and Mohammed (1998) assumed a log-linear form for the demand for imports in Kuwait. Using more formal tests, Elsamadisy(1995) established the superiority of the log-linear form over the conventional linear specification of the demand for imports in Kuwait. The same conclusion was reached for Saudi Arabia by Doroodian, et.al. (1994) after an extensive econometric investigation of the issue.

In contrast to the above-mentioned studies, Asseery and Perdikis (1993) obtained mixed results in the case of the GCC countries. Using the Box-Cox (1964) transformation, they favored the linear specification in the case of Kuwait and Oman, while the log-linear
form was preferred for the case of Qatar, Saudi Arabia, and (Bahrain was not included in their study).

In one of the early studies of import demand, Shaltout (1987) utilized a log-linear functional form for estimating the demand for imports in the UAE. The results indicated that demand for imports is inelastic both with respect to income (0.939) and relative prices (0.278).

With regards to dynamics, Shaltout (1987) concluded that the adjustment lag in the case of UAE is shorter than one year. However, no estimates of the long run elasticities were obtained. A distinguishing feature, however, of this study is its disaggregated nature.

A study of import demand in Kuwait by Mohammad (1998) found the response of demand for imports to be inelastic with respect to income both in the short-run and the long run. Concerning the responsiveness of the demand for imports to prices, he found the own-price elasticity of imports to be also inelastic in both the short run and long run.

Elsamadisy (1995) developed a generalized specification for demand for total imports in Kuwait. Instead of using the conventional relative prices of both imports and import substitutes, he used the prices of tradable and nontradable goods as proxies for relative prices. Since these indices were not readily available, Elsamadisy constructed them for tradables and nontradables in Kuwait using the GDP deflator concept. By dividing the Kuwaiti economy into sectors and dichotomizing these sectors into tradables and nontradables, he calculated the GDP deflator for each sector and used the resulting prices as indices.

The essential problem with the indices used by Elsamadisy is that they were based on highly aggregated data series. Thus, a classification of tradables and nontradables was not possible at this scale of sectorally aggregated data. Hence the generated series of relative prices are not necessarily accurate and may
some doubts on his results.

An additional limitation of these results is that Elasmadisy used several dummy variables. In fact, he arbitrarily used a dummy variable that takes the value of one during the period 1975-1989 as a proxy for wealth. However, this is not accurate because the oil price slumps started in 1983 resulting in a budget deficit much earlier than suggested by the author.

The author also included the war shock effect in his model through the use of a dummy variable for the year 1981 to represent the war between Iraq and Iran. In fact he failed to consider a potential similar impact from the Iraqi invasion of Kuwait in 1990. His results, however, show that the war shock dummy variable carried a highly significant negative sign, indicating a temporary decline in import demand. This result is not supported in reality, because the price of oil surged to unprecedented levels due to the Iraq-Iran war and consequently import demand in most of the GCC countries increased.

In a study about Saudi Arabia, Doroodian, et.al. (1994), found the short run and long run income elasticities to be less than one. In fact they estimated the income elasticity to be 0.22 in the short run and 0.47 in the long run. On the other hand, they found that the own price elasticity of imports in the short run to be -0.68 and -1.45 in the long run. Cross price elasticity (response of import demand to the price of domestic substitutes) was found to be elastic in both the short run and long run. Their results indicated a cross elasticity of 1.3 in the short run and 2.9 in the long run.

The results obtained by Asseery and Perdikis (1993) show that the demand for imports is price inelastic for Kuwait, Oman, Qatar and UAE, while the demand for imports was found to be price elastic for Saudi Arabia. On the other hand, the demand for imports was found to be income elastic for the case of Kuwait, Oman and UAE, while found to be inelastic for the case of Qatar and Saudi
Arabia. Asseery and Perdikis (1993) offered no justification for these differences in price and income elasticities among the states of the GCC.

The work of Asseery and Perdikis (1993) suffers from several shortcomings. First, they did not seriously tackle the problem of autocorrelation at least in the case of Kuwait and Saudi Arabia. Second, they assumed a long run equilibrium structure for import demand and ignored the short run dynamics of the demand for imports. Third, they did not pay attention to the analysis of stationarity. Finally, they did not evaluate the structural stability parameters estimated by their model.

With regards to the dynamics in the import demand function, Mohammad (1998) estimated the magnitude of the coefficient of adjustment at (0.5490). This suggests that the comparison of the price and income elasticities with respective short-run elasticities would reveal that most of the relative price and income adjustments take place within a one-year period. This suggests that the adjustment of actual level of imports to its desired level is instantaneous. This result is in line with the estimates reached by Asseery and Perdikis (1990) and Doroodian et al. (1994) for Arabia.

Elsamadisy, however, reached different conclusions about the speed of adjustment of desired import demand levels to actual levels. He found that adjustment is rather slow and may take up to five years for actual import demand to adjust to its desired levels. Metwally & Rahman (1985) obtained similar results for Kuwait.

4- The Demand for Imports: Some Theoretical Issues

The sensitivity of imports to changes in income is of particular interest for predicting the behavior of imports over the course of the business cycle. In addition, the various price elasticities are important because imports will change over time when foreign prices
and domestic prices change. Finally such estimates are necessary to predict possible changes in imports that may occur as a result of changes in trade policy or exchange rates.

The traditional demand for import function can be written in terms of domestic income and price levels as:

\[ m_t = f(y, p); \]  

(1)

with: \( f_1 \geq 0, f_2 < 0 \)

where \( m, y, \) and \( p \) are respectively, the real quantity of imports, real domestic income, and a vector of different prices. The signs indicated for the partial derivatives are those customarily assumed in the literature see: e.g. Goldstein and Khan (1985).

Though the sign of the partial derivative of the import demand with respect to income is expected to be positive, a negative sign can not be ruled out. For example, if imports represent the difference between domestic consumption and domestic production of importable goods, production may rise faster/slower than consumption in response to rise in real income. Hence imports could fall/rise as the real income increases, resulting in a negative/positive sign for the income parameter (Goldstein and Khan (1976)).

This above general specification has dominated the empirical literature on the demand for imports in both developed and developing countries because of its empirical success. Senhadji (1997), however, has criticized this specification of the demand for imports function on microeconomic grounds. The thrust of his argument is based on the fact that this functional form has been derived from a utility maximization process.

With regard to the variables included in the model, most studies have employed some measure of real income as their activity variable. This choice raises at least two important issues - both derived from standard consumption theory- which are often not addressed (King (1993)). The first relates to the role of permanent versus cur-
rent income levels in determining consumption - including it consumption. Permanent income is probably the more appro-
appropriate of the two in theory, but in practice, it is difficult to quantify.
MORE specifically, it is impossible to establish objectively what the appropriate lag structure is between current and permanent income in order for the latter - which is not observable - estimated using the former.

The second issue is that income is not simply allocated between imports and import substitutes, but is spread over all goods consumed within the economy. This makes it necessary to include an additional price measure, i.e., the price of all other goods. Specifically, there are three distinct ways to incorporate the relative prices into the demand for import function. One option allows relative prices to enter in an unrestricted form. This approach expresses this type of models.

\[ m_t = a_0 + a_1 y_t + a_2 P_d t + a_3 P_m t; \]  (2)

Under the absence of money illusion, import demand function will be homogeneous of degree zero in prices and money income. Therefore, the demand for imports can be expressed in terms of real income and relative prices. Such homogeneity is stressed including a single relative price variable that explains why economic agents switch their demand between imports and domestic products, see Carone (1996). This specification imposes the restriction that the influences of the two price variables are equal in magnitude but opposite in sign. This is known as the homogeneity restriction (i.e. \( a_2 + a_3 = 0 \)). Hence equation (2) becomes:

\[ m_t = \beta_0 + \beta_1 y + \beta_2 (P_m / P_d) t; \]
This form is popular in the literature because it offers an important advantage in the estimation stage. Specifically, it eliminates the multicollinearity problems that could exist in the formulation suggested under equation (2) due to the correlation between the domestic and import prices especially in the case of small open economies such as the GCC economies. A list of previous studies utilizing this approach includes: Athukorala and Menon (1995), Gafar (1995, 1988), Assery and Perdikis (1993), Koshal et al. (1993), Assery and Peel (1991), Bahmani-Oskooee (1986), Melo and Vogt (1984), Boylan et al. (1980), Khan and Ross (1977) and Khan (1974).

It should be mentioned, however, that if the underlying import demand function is not homogeneous of degree zero, i.e. consumers respond differently to changes in \( Pm \) and \( Pd \), the use of the relative prices may obscure the responsiveness of imports to changes in these individual variables. Clearly, this could lead to misspecification of the regression equation with all the associated problems.

Finally import prices are sometimes decomposed into foreign import prices and the exchange rate in order to directly observe how changes in the exchange rate may affect import demand. This means that equation (3) is presented in the following form:

\[
    m_1 = \beta_0 + \beta_1 y + \beta_2 \left( \frac{Pm}{Pd} \right) \theta
\]

Where \( \theta \) is the exchange rate? Deyak, Sawyer, and Sprinkle (1993) adopted this approach among others.

It should be mentioned that none of the three specifications is clearly superior from a theoretical point of view. Empirically, however, as mentioned above, estimates based on equation (2) are unsatisfactory due to possible problems of multicollinearity.
Generally, these specifications represent long run equilibrium import demand. While the long run effects of the determination of import demand are of interest, the short run adjustment of imports to changes in these variables is also frequently important, especially in a policy sense.

The simple equilibrium relationships represented by equations (2) through (4) are not suitable for estimation because they imply the dynamic adjustment behavior of import demand. The basic assumptions of these equations is that importers are always following a change in any of their determinants. However, it is generally recognized that importers do not immediately adjust to their long run equilibrium following a change in any of their determinants.

In his synthesis of the various approaches to the balance of payments, Johnson (1977, p. 225) argues that: "it is not legitimate to express the demand for imports as a function of only disposable income, and domestic price of imports relative to export prices. One could, of course, introduce a stock adjustment-term in the import demand equation".

To take into account the slow reaction of the economic agent to changes in the explanatory variables due to adjustment costs, inertia, habit, or lags in perceiving changes, actual level of import demand observed in any period is commonly expressed as a function of lagged dependent variable.

In general, the relaxation of the equilibrium hypothesis of the import demand function has been achieved by specifying a dynamic model within the framework of a distributed lag model with symmetrically declining weights, such as Koyck's model. Alternatively, following Almon's model which assumes that distributed lag coefficients lie on an exact polynomial.
In the existing literature on import demand modeling, the method of introducing a dynamic specification has been to superimpose a predetermined lag structure on the estimated equation. In general, the partial adjustment specification has been most popular. In some cases, the Almon polynomial method has been utilized (Goldstein & Khan (1985)). The problem with these approaches is that the estimates may be subject to misspecification bias due to the arbitrary truncation of the lag structure.

Tegene (1989) used a distributed lag function, where the lag length was determined by using the final prediction error, that is, the lag length which minimizes the final prediction error was considered the relevant lag length. In general, care must be exercised in the selection of the type of the dynamic specification because it can affect the sign, size and stability of parameter estimates. In this paper, a partial adjustment mechanism is adopted as a method of introducing dynamic structure in the model of import demand. This approach yields the term $M(t-1)$ in the estimated equations.

From the previous discussion the simple desired import demand function may be written as:

$$m^* = \phi_0 + \phi_1 y_t + \phi_2 p_t + \epsilon_t;$$

(5)

Where, $m^*$ = the desired real import demand.

Since $m^*$ is not observable, it is assumed that actual imports adjust partially to the long-run desired level. Thus, only a fraction of the desired change will be realized. Therefore, it takes more than one period for full adjustment of actual imports to their long-run desired level. This is the familiar partial adjustment approach, which could be written, in real form as:

$$(m_t - m_{t-1}) = \lambda (m^*_t - m_{t-1}); \quad 0 < \lambda < 1.$$  

(6)

Where, $\lambda$ is the coefficient of adjustment, which shows the speed of adjustment of actual imports to their desired levels.
By substituting (5) into (6) and rearranging, the lagged dependent variable becomes an independent variable as shown in equation (7) below.

\[ m_t = \lambda \phi_0 + \lambda \phi_1 y_t + \lambda \phi_2 p_t + (1 - \lambda) m_{t-1} + \lambda \epsilon_t; \]

According to equation (7), there may be a lag in the adjustment process measured by \((1 - \lambda)\), and the mean adjustment lag would be \((1 - \lambda)/\lambda\). In essence, equation (7) stipulates that any diversion of actual imports from desired imports is corrected partially each period. Full adjustment to any shock will depend in this case upon the speed of adjustment. Knowledge of the speed of adjustment is essential for macroeconomic policy making as well as calculating various long-run elasticities of demand.

Regarding the functional form issue, choice must be made between linear and Log-Linear forms. Neither theory nor empirical research stipulates a specific form of the demand for imports or, for that matter, of any other. Both linear and log-linear formulation of this function were used in applied research. The choice of the appropriate functional form of the demand for imports is generally left to be a empirical issue and is resolved on the basis of goodness of fit. Nonetheless, in some studies, the choice was based on empirical results established by earlier research or by the application of advanced statistical techniques such as that developed by Boyanowicz (1964).

The empirical evidence in the literature, however, supports the logarithmic form of import demand function. Thursby and Thirgood (1984) present evidence in support of log-linear form for the U.S. import demand. Khan and Ross (1977) present similar evidence for the US, Canadian, and Japanese import demand functions. Moreover, Boylan et al. (1980) concluded that the log-linear form is the most appropriate formulation for studying the economy.
three small European countries, (Ireland, Denmark, and Belgium). More recently, Doroodian et al. (1994) reached the same conclusion for Saudi Arabia.

A comprehensive review of the import demand literature by Marquez (1992), showed that out of 100 studies written over the period 1941-1991, 74 assume a logarithmic formulation. In contrast to the above-mentioned studies, Asseery and Perdikis (1993) obtained mixed results in the case of the GCC countries. Based on their empirical results, they concluded that linear formulation was best suited for Kuwait and Oman, while, a log-linear form was best for Qatar, Saudi Arabia and the United Arab Emirates. Alternatively, Elasmadisy (1995) reported that results of various statistical tests indicated the superiority of the log-linear form for the conventional specifications. Clearly, there is no consensus and the issue remains an empirical one.

Statistical implications of each form are, however, different. For example, the linear specification of the demand for imports implies decreasing price elasticity and increasing income elasticity. Alternatively, the log-linear specification implies constant elasticities. This is one of the reasons why the import demand equation is usually specified in logarithmic form. The logarithmic form allows imports to react proportionally to any rise or fall in the explanatory variables, that is, on the assumption of constant elasticity, the logarithmic form avoids the problem of changes in the elasticities as import quantities change (Goldstein and Khan, 1976).

Finally, since imports of the GCC States represent a fraction of world imports, the assumption of small country holds. This implies that the supply of imports to the GCC can be assumed infinitely elastic. The plausibility of the infinite import supply elasticity assumption is further strengthened by the highly liberal GCC trade policy. Therefore, quantity demanded of imports is demand determined and price of imports is exogenous. This in essence jus-
tifies the use of single equation estimation procedure in the empirical determination of the import demand function.

5 - Empirical Results

As mentioned in the previous section, the assumption of absence of money illusion, or homogeneity in prices implies symmetric responses of imports to the foreign and domestic prices. These import responses can be estimated in terms of relative prices put out in equation (3). This form, necessarily eases estimation problems because it reduces multicollinearity and consequently minimizes standard errors. To choose the appropriate functional form, we resort to the Box-Cox procedure, which proposes testing for the value of \( \lambda \) in the following formula.

\[
M^\lambda - 1/\lambda = \alpha_0 + \alpha_1 y^\lambda - 1/\lambda + \alpha_2 p^\lambda - 1/\lambda + \varepsilon
\]

If the estimated value of \( \lambda = 0 \), the import demand equation reduces to a log-linear form. Alternatively, if \( \lambda = 1 \) the equation reduces to a linear form.

In order to empirically determine the specification of the import demand function in the GCC countries we use the power form represented by equation (8) above. The model was estimated from the maximum likelihood procedure. We found that the estimated maximum values of \( \lambda \) for all cases are in general close to zero, as shown in table (2). This means that we accept the log-linear form of the demand for imports in all the GCC countries.
Table (2): Estimates of Box-Cox Transformation ($\lambda$).

<table>
<thead>
<tr>
<th>Country</th>
<th>Estimated $\lambda$</th>
<th>log of likelihood</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bahrain</td>
<td>-0.439</td>
<td>-35.38***</td>
</tr>
<tr>
<td>Kuwait</td>
<td>-0.216</td>
<td>-91.49***</td>
</tr>
<tr>
<td>Oman</td>
<td>0.376</td>
<td>-39.25***</td>
</tr>
<tr>
<td>Qatar</td>
<td>0.316</td>
<td>-62.53***</td>
</tr>
<tr>
<td>Saudi Arabia</td>
<td>0.158</td>
<td>-171.39***</td>
</tr>
<tr>
<td>United Arab Emirates</td>
<td>0.396</td>
<td>-79.91***</td>
</tr>
</tbody>
</table>

*** Significant at 1% level

As mentioned above, we will apply the partial adjustment scheme. One reason to use the simple partial adjustment scheme is that we use relatively short time series data. Alternative specifications of the dynamic structure in the model mean that the degrees of freedom will be reduced substantially. Kleinbaum et al. (1988) mention that the weakest requirement is for a minimum of approximately 10 degrees of freedom (or $n - k - 1 \geq 10$).

Another rule of thumb that has been suggested is for any regression to have at least 5 (or 10) observations for each predictor (i.e. $n \geq 5k$ or $n \geq 10k$). Another reason is that other dynamic schemes require prior arbitrary judgment about the lag length because it is almost impossible to determine the appropriate length.

Concerning the definition of the variables, the choice or a proxy for the price index for domestic tradable goods is one of the most controversial issues of empirical estimation of the demand for imports. The price index of imports is often used to express import
prices. In cases where price indexes are lacking, the price index of the major trade partner is used, e.g., the US price index. An alternative is to use the average price index of industrial countries or the world price index. Wholesale price index was also used as a proxy of the price of import substitutes in some instances. Sources are mentioned in Appendix 1.

Empirical studies use a variety of definitions for the activity variable. Real GDP is used as a measure of the real domestic income (y). Using a utility function to generate the demand for imports, Senhadji (1997) derived an import demand function where the activity variable is the gross domestic product minus exports.

In a study about Australia, Athukorala and Menon (1995) estimated the ratio of stocks to average sales volume, as a measure of stock scarcity of domestic supplies, to the main two sets of arguments (relative prices and economic activity). They used this variable as a control variable to capture any cyclical demand effects. The results show the importance of allowing for cyclical demand in order to obtain meaningful activity elasticity estimates.

Another empirical issue, which has to be considered, is stability. Generally, if the estimated coefficients are not stable, estimated import demand functions will be of little help to policy makers. Stability of the demand for imports is very crucial for effective trade policy. Deliberate trade policy actions will affect policy such as balance of payments and exchange rates. To predict effects with some degree of certainty, the import demand function must be stable. Instability will make it difficult to predict the magnitude and direction of trade policy actions. If import demand is the focus of short run stabilization policy, and the demand for imports was unstable, then short run stabilization policy will be successful. This is true because different levels of economic activities and prices, in this case, will be consistent with a given demand for imports at different points of time.
Import demand specifications presented above by their very nature, entail the use of variables in levels only. Given that most macroeconomic variables tend to be nonstationary, there is the potential danger of capturing spurious relations (Harvey, 1990). This problem is largely ignored in the literature. Nonstationarity invalidates the standard estimation procedures and makes the classical asymptotic theory inapplicable. However, it is conceivable that individual variables are not stationary, but that a linear combination of them is. These variables are then said to be cointegrated. The theory of cointegration reconciles findings of non-stationarity with the possibility of testing relationships among the levels of economic variables, see: Doroodian (1994) for more elaboration on this subject as it applies to import demand equation.

Before estimating levels regressions, it is thus essential to carry out the appropriate tests to ensure all data used are stationary and are of the same order of integration to avoid spurious regression results.

5/1- Stationarity and Cointegration Tests

In light of recent advances in time-series econometrics, we began the estimation process by testing the time-series properties of the data before proceeding to present the estimation results. The diagnostic tests include stationarity and cointegration.

In order to test for the stationarity of the variables included in the model, the Dickey-Fuller (DF) and the Augmented Dickey-Fuller (ADF) tests of stationarity were applied to each variable, see: Dickey and Fuller (1979,1981). This procedure determines the stationarity of a variable by applying the Dickey-Fuller unit root test, which reduces to testing the significance of the t statistic. If the resulting t statistic is significant, the null hypothesis of non-stationarity of a variable is rejected and the model can be estimated in levels. If the resulting t statistics are not significant, then the test is repeated for the first difference of the variables. If, again, sta-
tionarity is rejected, differences of higher order are taken and test performed until stationarity is achieved. The critical values at the 1%, 5%, and 10% significance levels are determined to be 2.93 and 2.60 respectively.

Table (3) shows that except for the relative prices in the countries of Bahrain and Saudi Arabia, all the variables are non-stationary at levels. We repeated the tests for the first difference of the variables. As shown in the table, the null hypothesis of non-stationarity of the variables is rejected and thus the estimated demand for imports function must be implemented using the first difference of the variables.

Table (3): Stationarity Tests

<table>
<thead>
<tr>
<th>country</th>
<th>variable</th>
<th>Levels</th>
<th>1st Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>DF</td>
<td>ADF</td>
</tr>
<tr>
<td>Bahrain</td>
<td>real imports</td>
<td>-0.150</td>
<td>-0.431</td>
</tr>
<tr>
<td></td>
<td>real gdp</td>
<td>-1.189</td>
<td>-1.902</td>
</tr>
<tr>
<td></td>
<td>relative prices</td>
<td>-5.242***</td>
<td>-3.293**</td>
</tr>
<tr>
<td>Kuwait</td>
<td>real imports</td>
<td>-0.685</td>
<td>-0.612</td>
</tr>
<tr>
<td></td>
<td>real gdp</td>
<td>-0.419</td>
<td>-0.689</td>
</tr>
<tr>
<td></td>
<td>relative prices</td>
<td>-0.218</td>
<td>-0.020</td>
</tr>
<tr>
<td>Oman</td>
<td>real imports</td>
<td>0.193</td>
<td>0.033</td>
</tr>
<tr>
<td></td>
<td>real gdp</td>
<td>1.507</td>
<td>0.635</td>
</tr>
<tr>
<td></td>
<td>relative prices</td>
<td>1.357</td>
<td>0.380</td>
</tr>
<tr>
<td>Qatar</td>
<td>real imports</td>
<td>0.893</td>
<td>0.442</td>
</tr>
<tr>
<td></td>
<td>real gdp</td>
<td>1.092</td>
<td>0.208</td>
</tr>
<tr>
<td></td>
<td>relative prices</td>
<td>0.501</td>
<td>0.270</td>
</tr>
<tr>
<td>Saudi Arabia</td>
<td>real imports</td>
<td>1.954</td>
<td>0.894</td>
</tr>
<tr>
<td></td>
<td>real gdp</td>
<td>1.395</td>
<td>0.753</td>
</tr>
<tr>
<td></td>
<td>relative prices</td>
<td>4.201***</td>
<td>2.735***</td>
</tr>
<tr>
<td>United Arab Emirates</td>
<td>real imports</td>
<td>2.145</td>
<td>0.466</td>
</tr>
<tr>
<td></td>
<td>real gdp</td>
<td>1.065</td>
<td>0.841</td>
</tr>
<tr>
<td></td>
<td>relative prices</td>
<td>5.810***</td>
<td>2.960</td>
</tr>
</tbody>
</table>

*** Significant at 1% level  
** Significant at 5% level  
* Significant at 10% level
Proceeding to check for cointegration among the variables, both DF and ADF tests were applied to the model to be estimated. The critical values for the 1%, 5% and 10% significance levels are determined to be 4.87, 4.11 and 3.73 respectively. As shown in table (4), though the variables are non-stationary, they are cointegrated in levels. Therefore, a long run relationship exists among the variables in the model and level estimates can be used, thus, eliminating the need for differencing the data which may destroy the long run relationship among the variable

Table (4): Cointegration Tests

<table>
<thead>
<tr>
<th>Country</th>
<th>DF</th>
<th>ADF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bahrain</td>
<td>-3.933*</td>
<td>-3.942*</td>
</tr>
<tr>
<td>Kuwait</td>
<td>-6.354***</td>
<td>-4.710**</td>
</tr>
<tr>
<td>Oman</td>
<td>-8.351***</td>
<td>-4.560**</td>
</tr>
<tr>
<td>Qatar</td>
<td>-5.607***</td>
<td>-3.754*</td>
</tr>
<tr>
<td>Saudi Arabia</td>
<td>-3.835**</td>
<td>-5.142***</td>
</tr>
<tr>
<td>United Arab Emirates</td>
<td>-5.502***</td>
<td>-3.760*</td>
</tr>
</tbody>
</table>

*** Significant at 1% level  
**  Significant at 5% level  
*  Significant at 10% level

5/2 - Model Estimation Results

Utilizing the available data we proceeded to estimate the regression equations for individual GCC countries. Our rationale for not pooling the data to estimate an aggregate import function for the entire GCC members is that these countries are different in many respects despite the existence of some similarities stemming from their dependence on exports of crude oil as the main source
of income. An additional benefit from estimating individual models is that we can make more definitive statements about each country.

In essence, our reported results represent the best regression model estimated among the multitude of forms examined.

The final parsimonious model for each country is listed in (5) along with standard goodness of fit statistics. Since we use logarithmic form for all countries, the reported coefficients can be interpreted as elasticities of imports to the corresponding variables.

Referring to table (5), it is clear that all the reported regressions enjoy a reasonably good degree of fit as exemplified in the high R-squared values and F-statistics. Moreover, various coefficients of the independent variables are in general significant according to t-statistics. Serial correlation was found to exist in the case of Bahrain, Qatar and United Arab Emirates. For this reason regressions were corrected for serial correlation of the first order using the Durbin-Lu grid technique. Clearly, the conventional Cochrane-Orcutt technique would not be efficient because the estimated model contained the lagged dependent variable.

The model was found to fit all the countries of GCC, i.e. imports are found to depend on real GDP, relative prices, and lagged real imports. With regards to Bahrain and Qatar, the dynamic structure of the model did not fit well the data of the demand for imports. It was found that lagged imports do not significantly affect the current levels of real imports. Moreover, the results for the case of Kuwait and the United Arab Emirates indicate that relative prices do not significantly affect the demand for imports.

Turning to the actual results, it is obvious that various countries exhibit significantly different responses to the independent variables. Table (6) summarizes the short run and long run elasticities in a compact form. Only in the case of Bahrain was income found to be elastic. Estimated short run elasticity found to be 0.592 for Kuwait, 0.594 for Qatar, 0.237 for Saudi
bia and 0.477 for the United Arab Emirates. The results indicate that imports are a necessity in these countries. Almost a unitary income elasticity of the demand for imports was found in the case of Oman. Specifically, the estimated short run elasticity was found to be 0.928, which indicates a transitional state.

Table (5): Regression Results for the Import Demand Function

<table>
<thead>
<tr>
<th>Country</th>
<th>Bahrain</th>
<th>Kuwait</th>
<th>Oman</th>
<th>Qatar</th>
<th>Saudi Arabia</th>
<th>United Arab Emirates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ind. Var.</td>
<td>C</td>
<td>Lrldp</td>
<td>Lrelp</td>
<td>Lrimp</td>
<td>RHO</td>
<td></td>
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<tr>
<td></td>
<td>-1.750</td>
<td>1.857</td>
<td>-0.198</td>
<td>0.065</td>
<td>0.500</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(-2.21)**</td>
<td>(5.57)***</td>
<td>(-2.61)***</td>
<td>(0.41)</td>
<td>(2.43)***</td>
<td></td>
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<tr>
<td></td>
<td>0.037</td>
<td>0.592</td>
<td>-0.663</td>
<td>0.652</td>
<td>0.526</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.045)</td>
<td>(4.19)***</td>
<td>(-1.36)***</td>
<td>(5.73)***</td>
<td>(2.10)***</td>
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<tr>
<td></td>
<td>-1.360</td>
<td>0.928</td>
<td>-0.209</td>
<td>0.307</td>
<td>-3.000</td>
<td>7.000</td>
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<td></td>
<td>(-3.09)***</td>
<td>(3.99)***</td>
<td>(-2.45)***</td>
<td>(1.57)</td>
<td>(12.5)***</td>
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<tr>
<td></td>
<td>1.122</td>
<td>0.594</td>
<td>-1.848</td>
<td>0.363</td>
<td>(0.82)</td>
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<td></td>
<td>(1.78)*</td>
<td>(2.42)***</td>
<td>(3.74)***</td>
<td>(1.77)*</td>
<td>(1.95)***</td>
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<tr>
<td></td>
<td>-0.468</td>
<td>0.237</td>
<td>-0.070</td>
<td>0.823</td>
<td>(1.77)</td>
<td></td>
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<tr>
<td></td>
<td>(-0.67)</td>
<td>(1.95)***</td>
<td>(-1.77)*</td>
<td>(0.39)</td>
<td>(1.92)***</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-1.050</td>
<td>0.477</td>
<td>-0.233</td>
<td>0.526</td>
<td>0.177</td>
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<tr>
<td></td>
<td>(0.44)</td>
<td>(1.92)***</td>
<td>(0.39)</td>
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<tr>
<td>Note: t-statistics are reported in parentheses below the estimated coefficients.</td>
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</tr>
<tr>
<td>*** Significant at 1% level</td>
<td></td>
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<td></td>
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<tr>
<td>**  Significant at 5% level</td>
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<td></td>
</tr>
<tr>
<td>*   Significant at 10% level</td>
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</tbody>
</table>
Long run income elasticity was found to be unitary for the of UAE and almost unitary for Qatar. Demand for imports however, found to be elastic with respect to income in the long for the rest of GCC countries. Long run income elasticities found to be 1.99 for Bahrain, 1.70 for Kuwait, 1.339 for Oman and Saudi Arabia (see table (6)).

Table (6): Short Run and Long Run Elasticities

<table>
<thead>
<tr>
<th>Country</th>
<th>Income Elasticities</th>
<th>Price Elasticities</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Short Run</td>
<td>Long Run</td>
</tr>
<tr>
<td>Bahrain</td>
<td>1.857</td>
<td>1.986</td>
</tr>
<tr>
<td>Kuwait</td>
<td>0.592</td>
<td>1.701</td>
</tr>
<tr>
<td>Oman</td>
<td>0.928</td>
<td>1.339</td>
</tr>
<tr>
<td>Qatar</td>
<td>0.594</td>
<td>0.932</td>
</tr>
<tr>
<td>Saudi Arabia</td>
<td>0.237</td>
<td>1.339</td>
</tr>
<tr>
<td>UAE</td>
<td>0.477</td>
<td>1.006</td>
</tr>
</tbody>
</table>

With regard to the response of the demand for imports to relative prices, we found that except for Qatar, the demand for imports with respect to relative prices was found to be inelastic. Price elasticity for Saudi Arabia was found to be very low (0.070). In the long run however, price elasticity was found to be elastic for Kuwait and Qatar, and continued to be inelastic for the rest of GCC.

Finally, it is observed that imports in the majority of countries (i.e. Kuwait, Oman, Qatar and Saudi Arabia) are gradually as evidenced by significant impact of the lagged dependent variable in their estimated equations. However, the rate of adjustment differs substantially among them. According
ble (7), the speed of adjustment was found to be very slow in the case of Saudi Arabia (about 4.7 years). This means that given a shock to the demand for imports, it will take about 4.7 years for actual levels of imports to fully adjust to their desired levels. The adjustment lag was found to be shorter in the case of Kuwait and UAE, though it still takes more than one year for actual imports to adjust to desired levels. Specifically, the adjustment lag for Kuwait was found to be about 1.9 years, while full adjustment is achieved in 1.1 years in UAE.

Table (7): Coefficients of Adjustment and Mean Adjustment Lags

<table>
<thead>
<tr>
<th>Country</th>
<th>Coefficient of Adjustment $\lambda$</th>
<th>Mean Adjustment Lag (years) $(1-\lambda)/\lambda$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bahrain</td>
<td>0.935</td>
<td>0.070</td>
</tr>
<tr>
<td>Kuwait</td>
<td>0.348</td>
<td>1.873</td>
</tr>
<tr>
<td>Oman</td>
<td>0.693</td>
<td>0.443</td>
</tr>
<tr>
<td>Qatar</td>
<td>0.637</td>
<td>0.570</td>
</tr>
<tr>
<td>Saudi Arabia</td>
<td>0.177</td>
<td>4.650</td>
</tr>
<tr>
<td>UAE</td>
<td>0.474</td>
<td>1.110</td>
</tr>
</tbody>
</table>

Vary short adjustment lags were found in the cases of both Oman and Qatar. Estimated adjustment lags were 0.4 and 0.6 years respectively. In the case of Bahrain, almost instantaneous adjustment of actual imports to their desired levels. Finally, figures (1) - (6) in Appendix 2 show the actual and fitted imports using the model we applied to the demand for imports in the GCC countries. It is clear that our estimated regression lines fit the data very well.
6 - Conclusions

In this paper we estimated the import demand equations of various GCC countries using time series data extending over two decades. Several issues were examined and resolved through careful consideration of the estimation results. Among these, first, the time series characteristics of the variables and the existence of a long-term relation among them were explored. To this end, the results proved the nonstationarity of the variables, they did not confirm the existence of a cointegrating vector. Second, the choice of the functional form was explored in detail and the empirical evidence confirmed that the relative price formulation of the tractable import demand function is an appropriate form for the GCC countries.

Moreover, it was established that the log-linear formulation is superior to the linear form. Third, the results confirmed the need for the inclusion of a dynamic structure in the import demand equation to reflect the stock adjustment characteristics. However, an average adjustment lag was found to vary among the various countries.

The empirical results also indicated that the demand for imports in all GCC countries (except Bahrain) is inelastic with respect to income in the short run. However, this relation becomes highly elastic in the long run except for Qatar, which remains inelastic concerning the responsiveness of the demand for imports to their relative prices in the short run, it was also found to be relatively inelastic in all GCC countries with the exception of Qatar. In the long run, however, only Kuwait and Qatar exhibit an elastic response to relative prices while the remaining countries continue to show inelastic response. These results seem to confirm the necessity of a structure of imports in the GCC countries. Given the nature and economic structure of these countries as explained earlier, this is not look surprising.
References:


- Box, G.E.P. and Cox, D.R. (1964), "An Analysis of Trans-


- Khan, M.S. (1974), "Import and Export Demand in Developing Countries", *IMF Staff Papers*, No. 21, pp. 678 - 693.


Appendix 1

Data Sources and Definitions
Imports: nominal imports measured in domestic currency of respective countries.
(IMF, International Financial Statistics, Various issues)

Income: gross domestic product GDP, measured in domestic currency of respective countries.
(IMF, International Financial Statistics, various issues)


Appendix 2

Actual and Fitted Imports
Figure 1. Actual and Fitted Imports
Bahrain

Figure 2. Actual and Fitted Imports
Kuwait
Figure 3. Actual and Fitted Imports
Oman

Figure 4. Actual and Fitted Imports
Qatar
Figure 5. Actual and Fitted Imports
Saudi Arabia

Figure 6. Actual and Fitted Imports
United Arab Emirates