# THE MAIN METHODS FOR EVALUATING THE FUNCTION OF IMPORTS: THEORETICAL REVIEW

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**Abstract:**

Object of study of this paper is to present a review of the main methods used to assess the demand for imports. The attention is focused on the application of the models of Vector Error Correction in order to assess the demand for imports. Firstly we present the theoretical derivation of these models and then submitted applications in different studies. The attention is concentrated on the regression models, gravity model and VAR (Vector Autoregressive) models and VECM (vector error correction model) models, making a comparative analysis of the specifications and restrictions that each model offers.

The chapter ends with the conclusions and providing relevant suggestions

**Key words:** the demand function for imports; gravity model; intra-industry trade; comparative advantages, vector error correction model.

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### 1.An assessment of demand for imports - the theoretical foundations

The various econometric modeling studies on the behavior of imports takes in consideration the principals of three main schools of international trade theory: the classical theory (the theory of comparative advantage), neoclassical (**Heckscher-Ohlin** (HO) theory of proportional factors), as well as new theories on trade, based on the similarity of overlapping preferences and demand, economics of scale and product differentiation etc. Neoclassical trade theory, represented by H-O model, as an extension of classical Ricardian theory, focuses attention on the fact that how international trade, its volume and direction affects influenced by changes in relative prices, variables which on the other hand are influenced by differences in ownership factors between countries. The employment rate is always assumed fixed and the product is assumed to always be in the production possibility frontier.

Through the application of general equilibrium model of the global economy, neoclassical form of analytic function of demand for imports is defined as follows (W. Either (1983) and A. Dixit and V. Norman (1980)):

$$M(P) = D(P, E(P, u)) - S(P)$$

where M is the demand for real imports, P relative price of imports, D is the total demand for imported goods derived from the assumption of optimality of the customer; E are the costs for a given level of relative prices (P) and level (u) of utility, S is the domestic supply of imported goods. Costs are perceived equal to income, thus:

$$E(P, u) = y(P)$$

In elasticity form, this relation is as follows:

$$\frac{P}{M} \cdot \frac{dM}{dP} = \frac{P}{M} \cdot \frac{\partial D}{\partial P} - \frac{P}{M} \cdot \frac{PdS}{MdP} - P \cdot \frac{\partial D}{\partial E}$$

The new trade theory, called the theory of imperfect competition, focuses on intra trade industry (IIT), which is not fully explained by the theory of comparative advantage. The new trade theory explains the effects of economies of scale, product differentiation and monopolistic competition in international trade. Analytical form of this theory depends on specific assumptions about market structure, which is based on increasing returns. Details about basic empirical studies

focused on this theory can be found in A. Dixit and V. Norman (1980), W. Either (1979), E. Helpman (1981), Krugman (1987), G. Grossman (1992). Implications about this theory seem to have created a new link between trade and income. According to this theory, the income variable is considered as a proxy for the degree of product (output). The role of income in explaining imports goes beyond domed neoclassical model used in the demand for imports, a pattern in which income plays only the role of purchasing power.

Based on theoretical analysis, there are two factors which are considered particularly important for imports: income and relative prices. As noted above, the role of income and price in the determinants of trade is explained by different ways in this theoretical framework. Other important factors that are reflected in differences in relative prices between partner countries in trade are foreign exchange rates, the level of trade liberalization, economic size of partner countries in trade, preferences, market structure, transportation costs, etc.

From numerous studies, through different regression models done by foreign authors results that in the behavior of imports of various countries such factors as real income, trade restrictions and terms of trade are determinant. Authors like OZO - Eson (1984) have included in their econometric analysis even the impact of other factors such as real money stock, proving that they are significant in explaining imports. Komolafe (1994) further explained that, factors such as real imports, foreign currency reserves, and real income are factors that strongly determine the behavior of imports. Other authors have continued to conduct further analysis of imports, taking into account the degree of liberalization of the economy (especially in developing countries, where the degree of trade liberalization has been widened significantly in recent years). These works have further expanded the range of factors that influence the behavior of imports, including in this group even the effective exchange rate in nominal and real terms. Traditional economic theory on foreign trade presents a relation of long – term demand for imports with the increase of domestic income, with the developments in domestic and foreign prices, and at the same time with the change in value of the local currency.

In subsequent studies, particularly during the implementation of flexible exchange rates, the conclusion emerged that floating exchange rates are important determinants of flows of imports and exports. In this context, it is worth mentioning the study work of Kreinin and Warner (1983). In their study, these authors, divided the variable of relative prices in two components, named the (a) the component of prices and the component of exchange rate, thus getting more accurate

results than in the case of using a unique variable of relative prices. Based on a comparative analysis of the development of imports and exports in some major economies, before and after the operation of the Bretton Woods system, they concluded that floating exchange rates are an important determinant of imports and exports.

Wilson and Takacs (1979) were two other authors who made valuable efforts in finding empirical evidence on the impact of exchange rates and prices on imports and exports. Based on the assumption of a fixed exchange rate, based on the Bretton Woods system for the study period 1957-1971, and using data from six major industrial countries, they concluded to two important conclusions. First: Complete response of imports and exports to changes in exchange rates tended to be shorter than to changes in prices; and second, trade flows were initially more sensitive to fluctuations in the exchange rate than to changes in prices. However, due to the assumption of fixed exchange rates, the degree and extent of the reaction may not be very convincing.

Other authors as Bahmani - Oskooee (1986), aimed to assess the speed and magnitude of the impact of relative prices and the exchange rate for the period 1971-1980, for a group of developing countries such as Greece, Brazil, Israel, India, Korea, South Africa and Thailand. Although, much empirical evidence found in this study, correspond with the findings of Wilson and Takacs (1979), the rate and extent of reaction calculated by Bahmani-Oskooee (1986), unlike the results of Wilson and Takacs (1979), showed that demand for imports and exports in these countries reacted more quickly to changes in prices than to exchange rate fluctuations.

In particular, the function of the demand for imports, both in developed countries and in developing countries, has been subject of study by different authors as Khan, 1974, Goldstein and Khan, 1985; Warner and Kreinin, 1983, Haynes and Stone, 1976; Marquez, 1990. The general conclusion of these studies is that the price and income elasticity are significant factors considered in imports, even though the price elasticity is likely to be lower than the income elasticity (in many studies under unit, different by the income elasticity, which tends to be more than the unit). Also, there are a few studies that analyze the impact of trade liberalization on imports behavior (Bertola and Faini, 1991).

One of the earliest studies on the impact of trade liberalization in the demand for imports was introduced by the Faini, Pritchett (1992). The authors assume two types of imports such as: imports that are subject of quantitative restrictions and imports that can enter freely in the

economy. They suggest that the estimated elasticity with respect to income is generally greater than 1 and that the relative prices (approximated by REER[1]) are significant and with an elasticity less than unit. The authors also found that the real effects of changes in income and price on the behavior of the imports are more evident when the analysis also includes the impact of the control of imports and/or liberalization policies. Consequently, studies on the demand for imports, which do not assess the impact of changes in import policy, should be interpreted with caution.

## 2. The main methods for evaluating the function of imports

Most empirical studies of international trade are built on two main models: models of "incomplete substitutes" and the gravity model.

**(i)      Models of incomplete substitution**

Various empirical studies in this field, by various authors as Goldstein and Kahn (1985), Knetter (1992), Marquez (1993), Hooper and Marquez (1995), are constantly focused on these types of models. As pointed out by Hooper and Marquez (1995), most of the research in this area has been focused on the relationship between exchange rates and trade prices. Summing empirical studies of the impact of price and income in foreign trade, Goldstein and Kahn (1985) presented two business models: models of incomplete substitutes and complete substitution patterns. The first model is one of the most widely used models to study the imports of industrial goods and aggregate imports. While the second one is used mainly for homogeneous goods trade. The main assumption of the incomplete substitute's models is that exports and imports are not considered complete substitute for domestic goods. The basic model contains eight equations for the quantities and prices of trade between a country and the rest of the world. In this context, the function of the demand for imports, defined as follows:

$$M_i = f\left(Y_i, PM_i, P_i\right)$$

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[1] REER is Real Effective Exchange Rate

where $M_i$ is the demand for real imports of the country i; $Y_i$ is the nominal income; $PM_i$ is the index of import prices in local currency; and $P_i$ is the price index for domestically produced goods.

Under the restriction of homogeneity, the above equation is usually expressed as:

$$M_i = f\left(Y_i, \frac{PM_i}{P_i}\right)$$

where $Y_i$ is the real incomes.

This function is the most widely used form in empirical studies on the behavior of imports. In empirical studies, the equation above is almost always treated in log-linear form. Taking into account the costs of adaptation, distribution lags (lag-s) specified and estimated always a time delay structure. Traditional treatment on the specification of lags structure usually consists on a polynomial or geometric distribution (Almon).

(ii)     **Structural models VAR and VECM**

Various treatments have been used to investigate the demand for imports for countries in transition: Descriptive and comparative analysis, structural macroeconomic models, structural analysis VAR and SVAR, co integration analysis. The strengths and weaknesses of these models and their assumptions and limitations, are summarized in Table 4.1 / a, 4.1 / B. VAR structural models have already been used, being popular among different researchers. These models investigate the impact of short-term effects of various factors on the demand for imports. Also, unrestricted VAR models or reduced forms of it are used to investigate the statistical relationships (non-random) in foreign trade, and particularly in demand for imports. While in recent years, the use of VECM models to assess the demand for imports is widely applied. The advantages of using the models are associated with the evaluation of the connections between short-term and long-term demand for imports and factors affecting it (through analysis of "impulse responses" and cointegration vectors). However, the choice of methodology includes and is based on inverse relationships between specific characteristics and limitations that each model brings to the investigation and analysis. Since 1990, models based on cointegration techniques and error correction began to be used widely in the assessment of import elasticity on

prices and income. As several studies show the last years, the estimated elasticity coefficients of the modeling techniques and error correction does not significantly change from estimations by conventional methods. For example, Clarida (1991) concluded that the cointegration relationship between imports, income and relative prices to the United States, showed almost the same levels of flexibility on prices and incomes with those estimated by Helkie and Hooper (1988) and Cline (1989), who did not use cointegration techniques. In more recent studies, Carone (1996), estimated total aggregate demand for imports of the United States using cointegration techniques and error correction model. His estimations, which showed a relatively high level of elasticity of demand for imports respect to income and relatively low to prices, were substantially similar to the results of previous studies, which were based on traditional econometric methods. The only difference was that the elasticity estimated with cointegration methods, showed no significant change in time, while some previous studies with traditional econometric techniques have shown the opposite result.

| Table 4.1/A. Methodology review | | |
|---|---|---|
| **Methodology** | **Specifications** | **Restrictions** |
| Analysis and descriptive methodology | Characterized by the use of comparative analysis, graphical and descriptive analysis of variables associated with the demand for imports | Implications of less formal analysis are usually less convincing and less value to policy makers. |
| Structural models | Specification of the model based on the theory. The inclusion or exclusion of each variable based on the theoretical framework and it has a significant role in the model. Identification of the model based on restrictions made on the basis of the theory. | Requires full specification of the theoretical model before the empirical analysis. Transition economies usually deviate from traditional economic theories based economies; therefore appropriate adjustments required prior theoretical empirical analysis. |
| Unrestricted | All variables are assumed | Estimated parameters do not |

| | | |
|---|---|---|
| VAR | endogenous and explanatory variables are lagged of endogenous variables. The model is specifically identified because the endogenous variables are included in regression only on predetermined variables (endogenous variables lagged) Methodological framework is flexible enough to include exogenous and deterministic variables (intercept, dummy variables for structural factors) | explain the coincidence. Residuals of specific equations of VAR are correlated. Does not consider long run effects and ignores the possible co integration if the variables are I (1). |
| Structural VAR | Does not require strict theoretical explanations for the added or eliminated variables. All variables are assumed endogenous and explanatory variables are lagged with endogenous variables and their simultaneous effects. Methodological framework is flexible enough to include exogenous and deterministic variables (intercept, dummy variables for structural factors) | Does not take into account long-term effects if the variables are I (1), These variables can be co integrated. If the variables are I (1), and also co integrated, then before the estimated first level differences are biased and also the level of assessment is inefficient. |

| **Table 4.1/B. Methodology review (continuation)** | | |
|---|---|---|
| **Methodology** | **Specifications** | **Restrictions** |
| Structural | For more than reduced VAR, | |

| VAR (SVAR) | SVAR considers the simultaneous effects of endogenous variables. However, because it is less identified, further restrictions on the model for a more accurate identification are requested. Limitations are mainly based on theory. | |
|---|---|---|
| VECM | Considers and assesses both short-term and long-term bonds. Long term bonds or cointegration vectors (CV) are usually explained by the theory. Inclusion of long-term relationships contributes to a better specification of short term connections of the model. Methodological framework is flexible enough to include exogenous and deterministic variables (intercept, dummy variables for structural factors) Allows the analysis of structural severance in CV and in the basic VAR model. | Requires long time series of data, which can be difficult in countries in transition. It doesn't takes into account the simultaneous short-term effects. Inclusion of incorrectly specified long term links will cause erroneous specifications of short term relationships in the model. |
| SVEC | Give something more than VECM because it allows for the analysis of simultaneous short-term effects in the VAR model component. | Requires long time series of data, which can be difficult in countries in transition. |

### (iii)    Trade Gravity Model

While in complete substitution models, as discussed above, are focused on the determinants of international trade aggregates, with particular emphasis on structural parameters and implications of economic policies; the gravity model focuses on the determinants of bilateral trade flows, with special attention to the localization factors and implications of geo-political and geo-economic policies. Gravity model, developed in the 60 'by Tinbergen (1962) and Pöyhönen (1963), has resurfaced in recent years towards the debate on regionalization versus multilaterals point of view. For example, Frankel (1994) used this model to show that a preferential trade agreement in APEC countries, was naturally consistent the "law of gravity" (first in economic liberal views, as assumed in this model) [2]. The gravity model of international trade concludes that trade between two countries is proportionally related to their economic size (GDP) and inversely proportional to the distance between them. The typical form of the model is as follows:

$$\text{T}_{ij} = kY_i^{\alpha}Y_j^{\beta}D_{ij}^{-\varepsilon}$$

where k is a constant.

This model is extended by other authors, who evaluated the presence of other variables in the model, like those of economic nature (GDP per capita, population) and those non-economic (common borders, cultural similarities, etc.). This model is applied on the basis of panel data (for several countries simultaneously) and mainly applied to assess the effects of trade liberalization on trade flows and trade potentials of countries.

### Conclusions

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In Economic Literature, many studies have been focused on traditional import demand function, in static as well as dynamic forms. Their goals were seeking for variables and factors that determine the level of aggregate demand import and estimating the long and short run elasticity coefficients. These studies followed two approaches. The first one was the traditional estimation by single equation, whereas the second followed the recent development of time series technique.

One of the most important techniques used in analyzing the behavior of the aggregate import demand function is by using time series techniques, namely: Cointegration and Error Correction Mechanism. The advantages of using these models are associated with the evaluation of the relations between short-term and long-term demand for imports and factors affecting it (through analysis of "impulse responses" and cointegration vectors).

Generally econometrics argue that the estimation of import demand functions have some problems resulting from pricing behavior of imports and estimation methods of other related variables. The most important factors qualifying the imports flows are presented as follows: the real income, the level of import prices, the real effective exchange rate, the liberalization level, etc.

The VECM technique consist on using two stages Engel-Granger approach for cointegration finding if variables of import, income and prices are non-stationary or stationary time series, and on the Johansen's test to find out if there is any cointegrating vectors in concluding if the structure of demand is co integrated during the studying period.

The wide literature presents different methods on the estimation of import demand but at the end the choice of methodology will be based on inverse relationships between specific characteristics and limitations that each model brings to the investigation and analysis.

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