Iran's Industrial Import Demand

Roohollah Mohammadi[1] Bijan Bidabad[2] Mahshid sherafati[3]

Abstract

In this paper, we study the level of efficacy of different factors on industrial import, including oil and gas export foreign exchange revenue, real effective exchange rate, and import control policy in short term and long run. The results demonstrate that oil revenue highly affects industrial imports in long run. Moreover, industrial import was inelastic. In comparison with long-run, the short term import price elasticity was relatively lower. This reflects the fact that there is higher flexibility in domestic industries for import substitution in long term in Iran.

Keywords**:** Demand function, Industrial import, Real effective exchange rate, Oil revenue

Introduction

Experimental studies were concerned with two types of import demand functions: the first type is the traditional estimation of import demand function, in which the demanded import is related to real domestic income as well as relative import price (the proportion of import prices to domestic prices). In the second type, currency limitations are directly involved in the function.

The majority of the performed studies have used the import demand pattern in currency limitation conditions for estimating this function. Some of the studies include: Bidabad (1997), Kiani et al (1997), Mohseni (2006), Quatmiri (1997), Shahi (2006), Tavakoli (1992), Abrishami (2001),Poor Moghim (2000). Most researches conducted import demand as a single-equation basis and sometimes estimated the export supply and import demand simultaneously in a framework of simultaneous system of equations. In the most models, import is specified as a function of income and relative prices. Table 1 summarizes some of the studies performed.

[1] CEO of Novin Pajoohan Research Institute, Tehran, Iran. rmohamadi58@gmail.com
[2] Professor of Economics and Chief Economic Advisor to Bank Melli Iran. bijan@bidabad.com
http://www.bidabad.com
[3] MBA Department, Management Faculty, Multimedia University, Malaysia. mahshidsherafati@yahoo.com

Table (1) Summary of studies performed in Iran and the world

Name of researchers	Research title	Countries and date of study	Explanatory variables	Model and methods of estimation	Summary of results
Houthakker, H., and Stephen Magee	Income and price elasticities in world trade	26 countries - 1959	National income - relative prices	Logarithmic - OLS	In most cases, coefficients were smaller than one and relative price elasticity was low
Cristine, Moran	Imports under a foreign exchange constraint	21 developing countries - 1989	Similar as Hamfield's model - income and relative prices	Pooled cross-section time series estimation and OLS	Significant effects of foreign exchange resource restrictions were observed
Magnus Frimpong, Joseph, Oteng-Abayie, Eric Fosu	Aggregate import demand and expenditure components in Ghana: an econometrics analysis	Ghana - 2003	National income - relative prices - exports and investment	ARDL	Relative prices with low elasticity. Major influential factors
Tang, T.C.	An empirical analysis of China's aggregate import demand function	China - 2003	GDP, GDP minus export-national cash flow and final demand components	Linear-Log - OLS	Long-run equilibrium – price and income inelasticities - exports was major effective factor

Specification

Iran's foreign exchange earnings play a decisive role in the demand for imports. A major part of Iran's foreign exchange revenues comes from oil and gas exports. Moreover, the national income and export revenues from oil and gas exports are closely correlated. Therefore, in estimation of industrial import demand function, we have preferably replaced the national income with foreign exchange revenue derived from oil and gas exports. In fact, Iran's foreign exchange revenue, as a financial constraint in international payments, affects the quantity of imports. During the oil price booms in global market and rises of foreign exchange revenues of Iran due to oil and gas exports, the amount of imports has boosted due to the foreign currency increase. This variable will be considered in dollar currency and the price index of OECD countries in the same year will be used to get real import at constant prices.

Effective exchange rate will be included separately in the model in form of import foreign exchange rate. Ratio of imported goods price index to domestic produced and consumed goods price index is included as the relative price variable. This issue is quiet important, because during some years, industrial imports have benefited from low price (governmental) foreign currency, which consequently has affected the level of imports in those years.

According to abovementioned approach, the demand relation for long-term industrial import is as follows:

$$IM\$R^L = f(GDP, \overline{OR\$}, EM, {}^{PM}\!/_{PD})$$

In this relation, GDP was included in the equation as the income variable in the demand function. Although, OR (Oil Revenue) as foreign exchange revenue of oil and gas exports has similar effects as GDP, but was specified to cover the financial resource effects in creating important demand.

EM is the import foreign exchange rate that varies in different years due to the different foreign currency policies of the government.

PM is imported goods price index. PD is the price index of domestically produced and consumed goods. The ratio of PM/PD is in fact the relative prices of imported to domestic goods. Import tariff reflects its effect in increasing the price of imported goods in the numerator of the ratio.

The short-term relationship will be as follows:

$$\Delta IM\$R^S = f[\Delta GDP, \Delta\overline{OR\$}, \Delta EM, \Delta({}^{PM}\!/_{PD}), (IM\$R^S - IM\$R^L)]$$

The above equation implies that in the short-run, import is affected by the changes in the aforementioned variables and deviation of short-term from long-run import. The latter expression actually is an adjustment factor in the model.

Trade policies effects such as tariff changes affect import through changing price of imported goods in the specified model. Foreign exchange policy (such as assimilating exchange rates) directly impacts on the price of imported goods through changing nominal exchange rate in the model. Decisions of monetary authorities to devaluate the Iranian Rial against foreign currencies leads to heighten the import goods prices and thus, reduces imports. However, if Rial depreciation increases prices of imported goods and in other words, domestic inflation will increase the numerator of the ratio of the specified function. No direct variable was specified for non-tariff barriers. Effects of such policies will be included in the model by inserting dummy variables.

Estimation

The specified functions were estimated for the period of 1981-2009 using Ordinary Least Squares. The data source is Central Bank of Iran and WTO. Logarithms of the variables used to preserve stationary variables. The estimated model for a long-time period will be as follows:

Ln (im) = c + Ln(p) + Ln (Roil(1)) + Ln (Roil(-1)) + Dum7379 + Dum5968 + u

im: Industrial import[4]
Roil: Oil and gas revenue
p: Real effective exchange rate
Dum7379: Dummy variable. For the period of 1973-1979 it is one; otherwise zero.
Dum5968: Dummy variable. For the period of 1959-1968 it is one; otherwise zero.

The dummy variables adopted for structural changes in the model. As mentioned above, oil export revenue has been replaced by GDP because of their high correlation. When the oil and gas

[4] In new classification of WTO, imported goods are categorized into three groups: agricultural, fuel and mineral and manufactured.

export revenues increase, financial restrictions in international payments will be less and consequently will increase import demand.

The lag of Roil variable in the model actually adjusts the time-overlap between the years of revenue acquired and the year it was consumed. That is the interruption of revenue accumulation in Central Bank and its allocation. Moreover, the expectation about the future oil revenue is a significant element in the import demand. Thus, Roil(-1) adjusts the time-effects in the model.

Prior to estimation, unit root tests were done to make sure the stationary of variables. Tests showed that all variables have unit roots. Results of estimation for long-run model are as follow:

Ln(im) = 4.58 - 0.13 Ln(p) + 0.34 Ln(Roil(1)) + 0.46 Ln(Roil(-1)) - 0.26 Dum7379 -0.57 Dum5968

All estimated coefficients are meaningful and significant at 99%. F statistic and Adjusted R^2 shows high explanatory power of the model as are shown in table (2).

Table (2) Estimation of the long-run model

Dependent Variable: LIM
Method: Least Squares
Date: 08/29/08 Time: 14:08
Sample (adjusted): 1358 1384
Included observations: 27 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	4.578132	1.763062	2.596694	0.0168
LP	-0.132301	0.024384	-5.425825	0.0000
ROIL(1)	0.341264	0.086768	3.933072	0.0008
ROIL(-1)	0.460204	0.075534	6.092714	0.0000
DUM5968	-0.570376	0.090759	-6.284509	0.0000
DUM7379	-0.263481	0.089679	-2.938055	0.0079

R-squared	0.912922	Mean dependent var	19.06395
Adjusted R-squared	0.892189	S.D. dependent var	0.470185
S.E. of regression	0.154383	Akaike info criterion	-0.705626
Sum squared resid	0.500518	Schwarz criterion	-0.417663
Log likelihood	15.52595	F-statistic	44.03250
Durbin-Watson stat	1.938625	Prob(F-statistic)	0.000000

Cointegration of the variables was studied to avoid spurious regression. For this purpose, we tested the hypothesis of the existence of unit root in residuals. The result of Augmented Dickey-Fuller test is as follows:

Table (3) Residuals unit root test

Null Hypothesis: RESID01 has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic based on SIC, MAXLAG=6)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.492053	0.0071
Test critical values:	1% level	-4.339330	
	5% level	-3.587527	
	10% level	-3.229230	

*MacKinnon (1996) one-sided p-values.

The cited test rejects the existence of unit root, which means that the regression is not spurious and the variables are cointegrated. Diagram of Correlogram confirms the results as shown on table (4).

Table (4) – Correlogram of the residuals of long-run model

Date: 08/29/08 Time: 19:33
Sample: 1357 1385
Included observations: 28

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	0.087	0.087	0.2341	0.629
		2	0.025	0.017	0.2541	0.881
		3	-0.108	-0.112	0.6435	0.886
		4	-0.096	-0.079	0.9670	0.915
		5	0.001	0.021	0.9670	0.965
		6	-0.039	-0.048	1.0243	0.985
		7	-0.073	-0.089	1.2397	0.990
		8	0.002	0.012	1.2399	0.996
		9	-0.040	-0.044	1.3092	0.998
		10	0.097	0.080	1.7472	0.998
		11	0.055	0.033	1.8984	0.999
		12	0.022	0.002	1.9232	1.000
		13	-0.038	-0.039	2.0047	1.000
		14	0.000	0.028	2.0047	1.000
		15	0.000	0.006	2.0047	1.000

The following linear model is used for estimating short-term demand import demand using Error Correction Model (ECM):

$$\Delta Ln(\mathrm{Im}) = \Delta Ln(p) + \Delta(GDP) + \mathrm{Re}\, sidL(-1) + Dum61 + Dum64 + Dum7374 + u$$

In this model, GDP has been replaced the oil revenue in order to explain short-term changes in import demand. Since, in short run, due to the typical economic inflexibilities, it is expected that the domestic variables such as GDP have greater explanatory power than foreign ones (such as oil revenue).

Changes of import demand in short run depend on the difference of long-run and short-run import demands. Such short-term changes that express an imbalance are shown as Resid01(-1) in the model.

Dummy variable Dum61 indicates the beginning of recession and decrease in oil revenues, while Dum64 stands for the end of recession and oil price reduction. Dummy variable Dum7374 presents the beginning of imports control and restriction policies. The estimated model is as follows:

$$\Delta Ln(\mathrm{Im}) = -0.11\Delta Ln(p) + 3.05\Delta(GDP) - 0.54\,RESID01(-1)$$
$$-0.48\,Dum61 - 0.42\,Dum64 - 0.3\,Dum7374$$

All the estimated coefficients are significant at 99% level and the statistics show that the model has high explanatory power as shown by Table (5).

Table (5) Estimating of the short-term import demand function

Dependent Variable: D(LIM)
Method: Least Squares
Date: 08/29/08 Time: 17:32
Sample (adjusted): 1359 1385
Included observations: 27 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LP)	-0.111097	0.034505	-3.219734	0.0041
D(GDP)	3.055871	0.356413	8.573972	0.0000
DUM7374	-0.303306	0.088012	-3.446187	0.0024
RESID01(-1)	-0.545422	0.168822	-3.230740	0.0040
DUM61	-0.479088	0.138312	-3.463815	0.0023
DUM64	-0.421071	0.120667	-3.489516	0.0022

R-squared	0.846554	Mean dependent var	-0.023468
Adjusted R-squared	0.810020	S.D. dependent var	0.275680
S.E. of regression	0.120160	Akaike info criterion	-1.206855
Sum squared resid	0.303207	Schwarz criterion	-0.918891
Log likelihood	22.29254	Durbin-Watson stat	1.872925

Long-term Analysis

According to economic theory, it is expected that an increase in relative import price will result in a decrease in import demand. In other words, it is expected that P variable would be negative (the estimated coefficient in the long-run model verifies this expectation). Additionally, the estimated coefficient of Roil variable is positive, which show that increase of oil and gas foreign exchange revenues positively affects import demand.

In order to study the non-systemic and structural factors effects on import demand, the two dummy variables of war and import control and barriers policies have been entered in the model. During wartime, governments usually follow self-sufficiency strategy and this introvert strategy decreases import. Moreover, during wartime and due to economic depression, import of industrial goods decreased and foods and agricultural goods increased. The coefficient of dummy variable Dum5968 is negative as excepted. Value of the coefficient (-0.57) also shows that wartime has had a noticeable impact on industrial imports.

Severe non-tariff import barriers and control policies during 1994 to 2000 and privatization and structural adjustment policies of development plans, due to lack of required preparation and coordination of executive body of government, increased foreign debts and ended up to balance of payment deficit. As a result, import substitution policy was adopted and domestic production was supported by tariff and non-tariff regulations. The dummy variable Dum7379 was included in the model to explain the structural change. It is expected that such restrictions could decrease import. Coefficient of the dummy variable (-0.26) confirms it and shows that it noticeably affected import.

Import price elasticity is defined as the percentage changes of import demand to the percentage changes of relative import price. In other words:

$$e_{IM,P} = \frac{\%\Delta im}{\%\Delta P}$$

One of the characteristics of double-logs models is that the estimated coefficients are constant elasticities for the whole period as well. Thus, import price elasticity in long run equals to -0.13. That is, a 10% increase in the relative import price decreases import demand by approximately 1.5%. That is demand for industrial goods is price-inelastic in Iran. This fact demonstrates that there are no viable substitutes for such goods in Iran's domestic market.

Import income elasticity is defined as percentage change of import demand to the percentage changes in income (here foreign exchange revenue from oil and gas exports):

$$e_{IM,Roil(-1)} = \frac{\%\ \Delta\ im}{\%\ \Delta\ Roil\ (-1)}$$

Import income elasticity for long-run model (+0.46) shows the considerable effect of oil revenue on industrial imports. As a result, a 10% increase in oil and gas export foreign exchange revenue can increase industrial import by nearly 4.5% and it can be concluded that industrial goods are mostly necessary goods in Iran.

Coefficient of Roil(1) is equal to 0.34, which exhibits that relative certainty about future foreign exchange earnings meaningfully affects import demand. For instance, it can be stated that 10% percent increase in oil revenue increases industrial import demand by about 3.5% in next year.

Short-term Analysis

The estimated coefficients for the short-term model are fulfilled theoretically. Relative import price coefficient is negative and reversely affects the level of import. Moreover, the estimated coefficient for GDP is positive and expresses that economic burgeoning positively affects industrial import demand. Dummy variables Dum61, Dum64 and Dum7374 used in the model analyze the effects of non-systemic and structural changes of short run import demand.

Dummy variable Dum61 shows the beginning of depression in oil markets and beginning of recession of Iran's oil revenue that negatively affects import in the short run as expected. The

calculated coefficient is -0.48 and shows that the changes in oil market revenue in short run noticeably affects industrial import demand.

Dummy variable Dum7374 is for the years of intense non-tariff and quantitative import restriction policies. The estimated coefficient is negative (-0.30) and shows that these restrictions have decreased industrial import in the short run noticeably.

The price elasticity of industrial goods import in short run is -0.11. This value shows that imported industrial goods -due to lack of suitable domestic substitute- is inelastic. This elasticity is lower than long-term price elasticity and shows that domestic industries are more flexible in manufacturing substitutes for imported goods in long run. In fact, import substitution policy can be formed in long run and is time-consuming.

Income elasticity of industrial import in the short run is nearly 3 that shows the high impact of economic boom on industrial import demand in short run. In fact, when economy flourishes, in short run, the demand for industrial import increases so much. Regarding to the estimated income elasticity, it can be said that this demand is mostly for luxurious industrial goods. However, in the long run, the demand is a function of oil and gas export foreign exchange revenue that mostly influence necessary industrial goods.

It can be expressed generally that economic expansion increases industrial import and the result of increased import and economic growth will move economy towards capital industrial goods import. Hence, as a policy conclusion, it can be claimed that regarding to the high impact of foreign exchange revenue on long-run imports and uncertainties of oil revenues, non-oil exports should be increased to provide sufficient foreign currency resources for importation in the long run and on the other side, it is required to increase the capital industrial imports that could assist economic development and burgeoning.

Conclusion

Import statistics of recent years shows that a great portion of imports has been for intermediary and capital goods. Import of intermediary goods increases domestic production, and capital goods develop investment. Fixed capital formation in this part is critical to create value-added. On the other hand, commercial policies should direct the combination of importation towards productive goods to induce economic efficiency. Along with the necessity of importing capital goods, to increase manufacturing activities, dependency on importation of consuming goods should be reduced and dependency of services and construction sectors on importation of intermediary goods should be relatively decreased. In fact, industrial sector should be able to benefit from capital and intermediary imports to strengthen inter-industrial linkages with other sectors.

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Corresponding Author:
Mahshid sherafati, International campus of Sharif university, Department of Science and Technology, Management Faculty ,Kish Island, Iran, Email Address: mahshidsherafati@yahoo.com