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Dynamic Analysis of Iran's Long-Run Import Demand (AIDS) (1969-2007)

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Abstract. Considering the significance of import role on the country's overall demand process during the last decades, the long-run import demand function of the country would be evaluated as a demand system. Accordingly, the classification of the whole demand based on three groups of agricultural, industrial, and mineral commodities have been considered along with the domestic sales group (goods which are produced and consumed in domestic of country).
According to the consistency of demand system variables in the first-order difference to identify the long-run equilibrium relationship, a General Almost Ideal Demand System (AIDS), Error Correction Model (GAECM) has been used during 1969-2007.
After confirming the long-run equilibrium relationship using F bounded test presented by Pesaron (2001). The achievement of an estimation of long-run demand equilibrium relationships of the country through Autoregressive Distributed Lag Model (ARDL) would be obtained. The statistical hypothesis test results represents on one side, the rejection of separable, homogeneous, and symmetrical hypothesis for long-run demand model, and on the other side, three luxury groups of import agricultural, industrial, and mineral commodities as well as the necessity of domestic sales. The price elasticity (compensated and non-compensated) is an estimation of two groups of agricultural, and industrial import commodities having elasticity and two other mineral import and domestic groups not having elasticity as well as being complementary between the domestic sales of imported agricultural and mining groups and agriculture industry imported groups.

Keywords: Almost Ideal Demand System, General AIDS Error Correction Model, Autoregressive Distributed Lag Model. Commodity Categories Import Demand System

1. Introduction

With increasing tendency in developing countries to enter the world trade organization, following the acceleration of economic globalization in recent decades, there has been more attention to the foreign sector. Therefore, identification of import demand will be (will sound) very important for all developing countries, especially, Iran.

So the analysis of structure of Iran's import demand with respect to its importance in economic growth with a system of aggregate demand and various aspect including different source of foreign suppliers, group of commodities such as capital, intermediate and consumption goods or agricultural and industrial products for importing, in addition the goods which are produced and consumed in domestic of country can be lead to a better understanding of necessary trade policy.

For this order, Almost Ideal demand system (AIDS) introduced by Deaton and Muellbauer (1980) as a good behavior model with data and also possible for test the demand the article demand hypotheses such as homogenous and symmetrical relation can be selected as one of the best options for this study. Almost Ideal demand system for the first time used by winters (1984) in compilation with Armington model for British's

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import demand pattern from various foreign suppliers sources with domestic sales. After that, Michelini and Chatterrjee (1995) and Parikh (1988) also used static model of AIDS to bilateral trade relations and access to the import demand in aggregate form. This trend continued by Debouer (2000) that for the first time in their study about effect of Spain to European Union on country's import demand structure offered three dynamic modes of AIDS model base on adaptive expectations processes and autoregressive Distributed lag model and Error Correction model.

However, many researchers applied the static AIDS model and different types of its dynamic pattern such as the model based on the process of consumer habits provided by Blanciforti and Green (1983) or the long-run memory mode provided by Holt and Goodwen (1997) or other type of dynamic AIDS pattern as the model used by Champers and Nowman, a more generalized form of Autoregressive Distributed lag model provided by Boonsaeng and Wohlgenant (2006) , For analysis of expenditures for different commodity group or examine the different types of a particular item demand were based on multi-stage Budgeting.

The formed demand system has been evaluated through making one of the most common demand models dynamic based on the error correction model that is the General Almost Ideal Demand system (AIDS) Error correction Model (GAECM) and Autoregressive Distributed Lag one. In order to achieve the purpose of the article, the following hypotheses have been examined:

- Long run imports of the country are independent of the domestic sales price.
- Long run imports of the country are independent of the income.
- Long run imports of the country are homogeneous (relative to the price variables) functions.
- Long run imports of the country are symmetrical (relative to the price variables) functions.
- Country's imports elasticity in each group of considering commodities, relative to the expenditure (incomes) are ineffective.
- Country's imports elasticity in each group of considered commodities, relative to the imports price in each commodity group and local price are ineffective.

Various and widespread studying in imports demand are based on the almost ideal demand in the world. Among them, a few studies can be mentioned which have been done inside and outside of the country.

2. Estimation Method

Co-integration method is a new substitution approach for dynamic import demand system. These methods have been used by Atfield (1997). Karagianise et al. (2000), Kabian and Gill (2001), as well as Faneli and Mazuchi (2002) have studied the dynamic AIDS model which results from Error Correction Model (ECM) and it is related to ARDL model in their articles separately, to obtain long-run behavior through short-run behavior. In this study, in order to reach long-run demand behavior, static AIDS model using co-integration method and based on ARDL and ECM model would be converted to dynamic model. Accordingly, AIDS model can be defined as ARDL model as the following relation:

$$w_{it} = \alpha_i + \sum_{k=1}^{r} \varphi_k w_{it-k} + \sum_{m=0}^{s} \sum_j \gamma^*_{ijm} ln(P_j)_{t-m} + \sum_{m=1}^{s} \beta^*_{im} ln(\frac{E}{P^*})_{t-k} + u_{it} \quad (1)$$

Therefore, share variation model would be as the following relation:

$$\begin{aligned} \Delta w_{it} &= \sum_{k=1}^{r-1} \acute{\varphi}_{ik}\, w_{it-k} + \sum_j \gamma^*_{ij0}\, \Delta Ln(p_j)_t + \sum_j \gamma^*_{ij}\, \Delta Ln(p_j)_{t-1} \\ &+ \sum_{m=1}^{s-1} \sum_j \acute{\gamma}_{ijm}\, \Delta Ln(p_j)_{t-m} + \beta^*_{i0} \Delta Ln(\frac{E}{p^*})_t + \sum_{m=1}^{s-1} \sum_j \acute{\beta}_{im}\, \Delta Ln(\frac{E}{p^*})_{t-m} \\ &+ (\varphi_i - 1)[w_{it-1} - (\alpha_i^0 + \sum_j \gamma_{ij}^0\, \Delta Ln(p_j)_{t-1} + \beta_i^0 Ln(\frac{E}{p^*})_t)] + \widetilde{u_{it}} \end{aligned} \quad (2)$$

(Statistical model is described in the author)

The obtained model would be General Almost Ideal Demand System Error Correction Model (GAECM). This model shows not only a long-run relationship between w_{it} and independent variables but also has the effect of previous deviations of those variables to reach long-run equilibrium. In fact, habits consumption which is not shown in static AIDS model can be presented in this model through budget share difference lags(Δw_{it-k}). Therefore, disequilibrium caused by consumption habits, modification expenses, incomplete information, and uncertainty, can be directed to the long-run equilibrium by GAECM. According to the economic theories, the assumed constraints in GAECM model would be as:

$\sum_{i=1}^{n} \alpha_i^{\circ} = 1$, $\sum_{i=1}^{n} \gamma_{ij}^{\circ} = 0$, $\sum_{i=1}^{n} \beta_i^{\circ} = 0$, $\Delta w_{it} = 0$, Adding up Constrain

$$\sum_j \gamma^*_{ij0} = 0\,, \qquad \sum_{m=1}^{s-1}\sum_j \acute{\gamma}_{ijm} = 0\,, \quad \beta^*_{i0} = 0\,, \qquad \sum_{m=1}^{s-1} \acute{\beta}_{im} = 0\,, (\varphi_i - 1) = 0$$

$\sum_{j=1}^{n} \gamma^{\circ}_{ij} = 0$ $\qquad \gamma^{\circ}_{ij} = \gamma^{\circ}_{ji}$ Homogeneous and Symmetric Constraint

3. Data Description and Model Specification

Model estimation has been done using annual information of foreign trade presented by International Trade statistic Year book published by Islamic Republic of Iran's custom organization as well as information of Iran's national accounts presented by the central bank of Islamic Republic of Iran during 1969-2007.

Accordingly, the required variables have been extracted through statistical resources as the following expressions:

a. Import expenditure share of agricultural commodities: would be obtained by dividing the summation of import values for two-digit international trade tariffs code of 01 to 04 into the total expenditure.
b. Import expenditure share of industrial commodities: would be obtained by dividing the summation of import values for two-digit international trade tariffs code of 06 to 12, 16 and up to 21 into the total expenditure.
c. Import expenditure share of mineral commodities: would be obtained by dividing the summation of import values for two-digit international trade tariffs code of 05, 13 up to 15 into the whole expense.
d. Expenditure share of domestic sales: would be obtained by dividing the value of produced and consumed commodities inside (domestic gross production minus export) into the total expenditure.
e. Total expenditure index: would be obtained through the domestic gross production minus export plus import at the constant price in 2007, and then index on base year 1997 equal to unit.
f. Meanwhile, price of each three groups of import commodities would be obtained by dividing the import value of each group into each group weighting factor, and then would be converted to the price index with the base year (1997) equal to unit.
g. In order to determine domestic sales price, the price index of commodities produced and consumer in domestic based on the base year (1997) equal to unit has been used.

The long-run relationship of each four groups share has been considered separately as follows:

Long-run relationship of agricultural group share, industrial group share, mineral group share, domestic sales group share: (Long-run relationship)

$$W_{1t} = \alpha^{\circ}{}_1 + \gamma^{\circ}_{11} LnP_{1t} + \gamma^{\circ}_{12} LnP_{2t} + \gamma^{\circ}_{13} LnP_3 + \gamma^{\circ}_{14} LnP_{4t} + \beta^{\circ}_1 LnADP_t + \theta_1 Trend \qquad (3)$$

$$W_{2t} = \alpha^{\circ}{}_2 + \gamma^{\circ}_{21} LnP_{2t} + \gamma^{\circ}_{22} LnP_{2t} + \gamma^{\circ}_{23} LnP_{2t} + \gamma^{\circ}_{24} LnP_{2t} + \beta^{\circ}_2 LnADP_t + \theta_2 D \qquad (4)$$

$$W_{3t} = \alpha^{\circ}{}_3 + \gamma^{\circ}_{31} LnP_{3t} + \gamma^{\circ}_{32} LnP_{3t} + \gamma^{\circ}_{33} LnP_{3t} + \gamma^{\circ}_{34} LnP_{3t} + \beta^{\circ}_3 LnADP_t + \theta_3 D \qquad (5)$$

$$W_{4t} = \alpha^{\circ}{}_4 + \gamma^{\circ}_{41} LnP_{4t} + \gamma^{\circ}_{42} LnP_{4t} + \gamma^{\circ}_{43} LnP_{4t} + \gamma^{\circ}_{44} LnP_4 + \beta^{\circ}_4 LnADP_t + \theta_4 D \qquad (6)$$

where, Trend, is the co-integration variable, D, is the Dummy variable of revolution as during 1969-1978 the value of this variable is 0 and for other years is 1.

4. Model Estimation and Results Analysis

The reported results of this test which has been shown in Table 1, reveal that first-order difference of variables are stationary, and all variables are of stationary order of 1 (I(1)). This is because ADF statistics of all variables at the critical level are greater than 5 percent the critical value of MacKinnon. The possibility of long-run relationship could be studied between available variables in each share relationship following Pesaran et al. (2001) and through F bounded test on General AIDS Error Correction model (GAECM) introduce in equation 8. Accordingly, by determining the number of optimized lags (p) through the maximum value of Akaike Information Criterion (AIC) in the estimated equation by the usual least square method for each expenditure share of agricultural, industrial, and mineral commodities, F bounded test has been used to study the long-run relationship through null hypothesis for each equation.

Table1. The unit root test of variables with intercept and trend

Variable	(W_1)	(W_1)	(W_3)	(W_4)	LN P_1	LN P_2	LN P_3	LN P_4	ADP
ADF variable	-1.3241	-1.7117	-1.7739	-1.6341	-2.3119	-1.0415	-3.0103	-1.589	-1.485

level									
ADF first-order difference	-7.0021	-5.4117	-5.2468	-5.4271	-8.6402	-10.1612	-8.0103	-7.207	-5.783

Source: Research findings Critical value of 5% of MacKinnon for variable level and first-order difference as -3.5348 and -3.5386 respectively.

The values of F statistics for existence of the long-run relationship hypothesis test for each of three industrial, agricultural, mineral import groups with optimized lag of order 2 and based on the maximum value of Akaike Information Criterion are 3.2154, 3.2161, 3.3755 respectively. Therefore, the presented long-run relationship of every three equations of demand system with considering top limit of critical points from table ($F_{\%95}$=2.66 with 6 restrictions) for the number of explanatory variables of three equations would be confirmed at 5% percent level of error.

The results of equations based on dynamic AIDS model and estimation of ARDL to the group's separation have been presented in Table 2.

Table 2: The dynamic equation for triple import commodity groups

Variable	C	$W_{1,t-1}$	$W_{2,t-1}$	$W_{3,t-1}$	$P_{1,t}$	$P_{1,t-1}$	$P_{1,t-2}$	$P_{2,t}$	$P_{3,t}$	$P_{4,t}$	ADP_t	ADP_{t-1}	ADP_{t-2}	T	D
Agricultural import equation	0.20716** (2.3997)	0.3897** (2.2568)	-	-	0.006* (1.75)	0.0025 (0.49)	-0.01** (-3.3)	0.007** (2.04)	0.02* (1.7)	-0.005 (-1.5)	0.03** (3.03)	-	-	-0.006** (-2.3)	
Industrial Import equation	0.1221** (3.6652)	-	0.52** (4.55)	-	0.03** (2.64)	-0.031* (-1.83)	-0.38** (-2.13)	0.27** (2.8)	-0.01 (-0.8)	0.011 (0.8)	0.5485 (1.6)	-	-	-	-0.08** (-3.01)
Mineral Import equation	0.0132** (3.8063)	-	-	0.5897** (5.34)	0.0023 (1.608)	-0.0006 (-0.34)	-0.006** (-3.69)	0.006** (3.6)	0.001** (-2.07)	0.0014 (1.022)	0.02** (4.498)	-0.02** (-3.5)	0.01** (2.3)	-	-0.1** (-3.5)

Source: Research findings. Numbers in parentheses represent statistics t-student *, ** indicate significant at 0.1, 0.05 error level respectively

According to the optimized lags, 2, for each quadratic groups and following Pesaran et al. (2001), Autoregressive Distributed Lag model for agricultural (W_1) and industrial (W_2) import commodities groups presenting the selection of ARDL (1,2,0,0,0,0) model, as well as mineral import commodities group presenting the selection of ARDL (1,2,0,0,0,2) model have been estimated. The results of long-run estimated coefficients have been shown in table 3.

Table 3: The long-run equation for quadratic commodity groups

Variable	$P_{1,t}$	$P_{2,t}$	$P_{3,t}$	$P_{4,t}$	ADP_t	C	D	T	R^2	$\bar{R}^2$
Agricultural import equation	-0.011 (-1.11)	0.012** (2.7775)	0.035** (2.49)	-0.009 (-1.37)	0.057** (3.1999)	0.33** (3.7395)	-	-0.010** (-3.54)	0.899	0.8612
Industrial Import equation	-0.075* (-1.641)	-0.057** (2.917)	-0.021 (-0.911)	0.024 (0.845)	0.116** (2.8383)	0.25** (5.7588)	-0.17** (-4.0525)	-	0. 8529	0. 8039
Mineral Import equation	-0.012* (-1.9836)	0.015** (2.3414)	-0.006* (-1.912)	0.003 (0.9966)	0.033** (2.9459)	0.032** (4.312)	-0.024* (-1.9836)	-	0. 9272	0.8908
domestic sales	4.74	-8.0359	0.32901	0.4894	-8.9832	12.8103	-	-	-	-

Source: Research findings. Numbers in parentheses represent statistics t-student *, ** indicate significant at 0.1, 0.05 error level respectively

Table 4: The error correction equation for triple commodity groups

Variable	$dP_{1,t}$	$dP_{1,t-1}$	$dP_{2,t}$	$dP_{3,t}$	$dP_{4,t}$	$dADP_t$	dC	dT	dD	ECM_{t-1}
Agricultural import equation	0.006* (1.76)	0.015** (3.31)	0.007** (2.049)	0.02 (1.75)	-0.005* (-1.5)	0.035** (3.03)	0.2** (2.39)	-0.006** (-2.34)	-	-0.61** (-3.53)
Industrial Import equation	0.034* (2.64)	0.038** (2.13)	-0.027** (2.87)	-0.01 (-0.85)	0.011 (0.88)	0.054** (2.61)	0.0548** (3.665)	-	-0.081** (-3.01)	-0.47** (4.066)
Mineral Import equation	0.0023* (1.608)	0.0067** (3.69)	0.0063** (3.61)	-0.002** (-2.07)	0.001 (1.02)	0.023** (4.49)	0.013** (3.8)	-	-0.1** (-3.5)	-0.41** (-3.75)

Source: Research findings. Numbers in parentheses represent statistics t-student *, ** indicate significant at 0.1, 0.05 error level respectively

While the estimation results of error correction equations in table 4 show that most of the short-run dynamics of long-run relationships are statistically significant as well as ECM_{t-1} which are specified to theoretical assumptions. The ECM_{t-1} coefficients of error correction equations are present which 61, 47 and 41 percentages of each short-run deviation are removed in first year to have converged with agricultural, industrial and mineral import long-run equilibrium relationship respectively.

According to the result of Marshalian and Hicksian price elasticities, there is a strong complementary relationship (two-sided) between industrial import commodity group and agricultural import commodity group, as well as mineral import commodity group and domestic sales group. There is also a weak complementary (one side) relationship between agricultural import commodities and domestic sales group that shows an increase in agricultural commodity price which causes each of the commodity demand to decrease.

Table 5: Marshalian and Hicksian price elasticity and income elasticity for quadratic commodity groups

groups	Compensated price (Hicksian) elasticity				Non-compensated price (Marshalian) elasticity				Income (expensive) elasticity
	agricultural	industrial	mineral	domestic sales	agricultural	industrial	mineral	domestic sales	
agricultural	-1.448** (2.021)	-0.36** (2.23)	0.32 (0.27)	-0.41** (3.95)	-1.47** (2.053)	-0.23** (2.02)	0.35 (.013)	-0.56** (3.83)	2.1145** (3.203)
industrial	-0.68* (1.87)	-1.61 (1.51)	0.2 (0.23)	-1.06 (0.433)	-0.63** (3.51)	-1.62** (2.35)	0.206 (0.11)	-1.07 (0.127)	2.015** (3.663)
mineral	-1.38 (0.11)	1.58 (0.91)	-0.63** (3.62)	-3.59** (2.55)	-1.45 (0.48)	1.28 (0.654)	-0.65** (3.12)	-3.91** (2.28)	4.644** (3.035)
domestic sales	0.08 (082)	-0.22 (0.18)	-0.03** (3.22)	-0.83** (2.89)	0.122 (0.95)	-0.173 (0.19)	-0.02** (3.7)	-075** (3.32)	0.797** (8.47)

Source: Research findings. Numbers in parentheses represent statistics t-student *, ** indicate significant at 0.1, 0.05 error level respectively

The results of table 5 according to the theoretical expectations show that the total income expenditure elasticities are positive and statistically at the level of 95 percent confidence level is significant. According to the results of income elasticity, can conclude that the total import commodity group (agricultural, industrial, and mineral) are part of luxury commodities and domestic sales (locally produced and consumed commodities) are part of necessary commodities.

Then, separation hypothesis would be rejected when Normalized Akaike Information Criterion model has domestic sales price is greater than this model without this variable[1]. Therefore, the value of normalized Akaike for the model with and without the domestic price is 18.5502 and 19.3421 respectively, which shows the rejection of null hypothesis that means the import demand of domestic sales is separable. In other words, this confirms the one-step budgeting of consumers demand.

5. Conclusion

According to dynamic model estimation and import demand period for quadratic groups as well as the results of price estimation elasticity (compensated and non-compensated) and income, which reveal being complementary between cross price elasticity of domestic sales with agricultural and mineral import groups as well as agricultural-industrial import groups, economic policy makers have suggested to investigate the commercial liberalization process in order to be joint with the universal commercial organization. This is because the price decrease of import commodities resulting from tariffs decrease would cause domestic sales to increase and this can be accounted as the effective factor on the unemployment decrease and the country's economic growth increase. On the other hand, according to the income elasticity resulting from the luxury import commodities and the requirement of domestic sales, economic authorities have been suggested in the case of presenting economy (income policy) it should be noted that society income increase would cause demand share of local sales in favor of import commodities share to decrease. It is required to do such policies and supportive activities in order to conserve demand share of domestic sales.

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