Journal of Applied Sciences

ISSN 1812-5654

science alert

ANSInet
an open access publisher
http://ansinet.com

Journal of Applied Sciences 9 (6): 1175-1179, 2009
ISSN 1812-5654

Application Pesaran and Shin Method for Estimating Irans' Import Demand Function

M. Ghorbani and M. Motallebi
Department of Agricultural Economics,
College of Agriculture, Ferdowsi University of Mashhad, Mashhad, Iran

Abstract: In this study, import demand function of Iran has been analyzed with Pesaran and Shin method for 1960-2005. The results showed import demand is elastic related to increasing in gross domestic income. Thus, increasing in economic growth and national income increase balance of trade deficit and government could decrease balance of trade deficit with economic growth, simultaneously, so that imposes suitable fiscal polices like reducing in expenditure. Import growth because of increasing in gross domestic income showed Iran is going to open economy but it wouldn't be cause of decreasing in production and competition power of domestic firms and producers.

Key words: Balance payment, error correction model, elasticity, government

INTRODUCTION

International trade has very important role in economical development of countries (Todaro, 2003). Most of developing countries gain their exchange incomes by primary goods and raw materials exports, but the market of these kinds of goods is not stable, exports dependency on these goods faces with a danger of instability in one hand and these countries need this exchange incomes for preparing money for raw materials, machinery and capital, consumption, intermediate and durable goods imports on the other hand. Because most of developing countries provide money for imports by exports of raw and primary goods, they always have deficit in balance of trade. Deficit in balance of trade produces international money saving reduction. It is clear that the deficit in terms of trade adjustments is one of the fundamental bases of economical growth and development limitation. It is vivid that in all models of development models, international trade fulfils a crucial role for all countries and it is applicable for Iran too. Iran's imports completely depend on petroleum incomes and the affect of the other incomes on imports is not mentionable. During 1989-2003, 327.9 million ton goods were imported whose value was 276.1 billion dollars. The maximum and minimum of imports is related to 2003 with 30 billion ton and 1994 with 16 million ton, respectively. With considering to 2004, the value of import had been 311.3 billion dollars in these periods. In these periods the value of imports was 5.2 times more than non petroleum export income and the balance of trade deficit was covered export of petroleum whose value 252.8 billion dollars. With considering 2003, the deficit of Iran's balance of trade had been 251.1 billion dollars. In other words, because of each ton of import, 5.7 ton petroleum was exported. Intensive imports returns exchange incomes that was produced by petroleum export to developed countries which most of Iran's trade and imports are happened by them. This reality changes consumption pattern to foreign goods and prevents domestic produce process. Production reduction will decrease employment in Iran. Because of all reasons which have been told, focusing on import demand function is one of the most important subjects which must be estimated by decision makers in every society. In this decade, a lot of researches have been done in developing countries on import function and price and income elasticity of it. Toufighi and Mehrabian (2002) by using vector autoregressive (VAR) model showed petroleum income and gross domestic income without petroleum have positive effect and relative price (imported goods price to the price of domestic goods ratio) have negative effect on import demand (total, intermediate, capital and consumption goods imports). Mohseni (2006) investigated the effect of liberalization on import function with using panel data. The results showed reduction of tariffs and imposing trade liberalization parameters on demand function have a positive and significant effect on imports growth of developing countries like Iran. Bahmani-Oskooee *et al.* (2005) have studied the effect of exchange rate on Canada bilateral

Corresponding Author: M. Ghorbani, Department of Agricultural Economics, College of Agriculture, Ferdowsi University of Mashhad, Mashhad, Iran

in-payments and out-payments by using Unrestricted Error Correction model (UECM). Results showed although the value of export in Canada is not sensitive to exchange rate, but is sensitive to the value of import. Yousefi and Wirjanto (2003) investigated that 10% reduction in the exchange rate of the US dollar, will decrease export value of Iran, Saudi Arabia and Venezuela as 3.9, 7.7 and 1.2%, respectively. Since, the mark-up of Saudi Arabia is lese than Iran and Venezuela in marketing. This country can achieve to bigger part of petroleum market with reduction in the exchange rate of the US dollar. Truett and Truett (2003) by estimated translog cost function for South Africa showed while capital is a substitution for domestic labor and imported inputs, import inputs and domestic labor are complement. Mah (2000) by using UECM showed that the response of the demand for imported information technological goods related to variation of price and income is negative and positive, respectively. Therefore, with decreasing of tariffs, demand for importing of these goods will pile up. Tang (2003a-c) believed that there is a long-run relationship between GDP, GDP without export and private sector expenditure and government expenditure with imported goods price index to domestic price index ratio in Japan. By estimating UECM model showed that the demand for import regards to mentioned factors is inelastic. Hamori and Matsubayashi (2001) assessed the long-run relationship between real import, real GDP and relative price in Japan with using Engel-Granger and Johnson-Juseleous co-integration test and showed there is not long-run relation between mentioned variables. Moreover Garigori-Hanson test didn't show long-run relationship between real import, real GDP and relative price in Japan in the condition of structural changes.

Regarding to earlier studies on the function of Iran's import demand it is completely vivid that recognition of structure of import in Iran is necessary in long-run due to changing the direction of economic to an economy which is based on production and industry instead of petroleum based economy. In fact, import of commodities in Iran is a key component for planning in domestic production, allocation of resources to domestic commodity, investment in industry or other sectors and use of foreign exchange. In other hand, several factors effect import of commodity that must determine role of each variable on import. This study tries to estimate Iran's import demand for 1960-2005 and compute elasticity of significant variables. Therefore, in this study for investigating Iran's import demand Pesaran *et al.* (1996) method is estimated. After estimation of import demand, elasticity of variable will compute and interpret ate. Results of this study can help to policy making in trade field for controlling or adjusting of imports of commodities and key variable influencing on it.

MATERIALS AND METHODS

Data: This study focused on the application of Pesaran *et al.* (1996) method for estimating Iran's import demand function. For this aim Iran center bank data of 1960-2005 have been used. Variables were the value of import (IMP), Gross Domestic Product (GDP), imported price index to domestic price index ratio (P^*/P), partial productivity of labor (here gross national product to the number of labor ratio) (PRO) and the official Exchange Rate (ER). Equations have been estimated by Microfit 4.0 Software. All variables are changed to constant of 1997.

Model: With regard to sample size (relatively small), this study used the bound testing approach to co-integration and were explored by Pesaran *et al.* (1996) to examine the long-run relationship between import and the independent variables. Pesaran *et al.* (1996) suggested Unrestricted Error Correction Model (UECM) for testing co-integration between variables and showed this method is suitable for small sample. Pesaran *et al.* (1996) suggested their method based on Auto Regressive Distributed Lag (ARDL) and separated it to two part: (1) Co-integration test and (2) estimate the long-run coefficients. In first stage the relationship between variables is tested and in the second stage the coefficients are estimated. So, ARDL model is changed to error correction model like below:

$$\Delta Y_t = \alpha_0 + \alpha_1^t + \sum_{j=1}^{p} \Phi_j \Delta Y_{t-j} + \sum_{j=0}^{q} \beta_j \Delta X_{t-j} + \Psi_0 Y_{t-1} + \sum_{i=1}^{k} \Psi_i X_{i,t-1} + \varepsilon_t \quad (1)$$

where, K is the number of variables, Δ is the difference operator, α_0 is drift, α_1 is the time's coefficient, Φ and β are long-run multipliers. The co-integration test hypothesis is:

$$H_0: \Psi_i = 0, \quad i = 0, 1, ..., k$$

If the null hypotheses is rejected, then there is long-run relation between variables, but it is accepted, there is not any long-run relationship between variables. The F-test which has a non- standard distribution depends upon: the non-stationary properties of the data, the number of independent variables and the sample size.

Two sets of critical values are generated. One set refers to I(1) series and the other for I(0) series. Here, the critical values for I(1) series are referred to as the upper bound critical values while the critical values for I(0) series are referred to as the lower bound critical values. When the calculated F-statistic is greater than the upper bound critical values, the null hypotheses of no co-integration is rejected and when the calculated F-statistic is lower than the lower bound critical values, the null hypotheses of no co-integration is accepted (Abrishami and Mehrara, 2002). The UECM method has several advantages over alternatives such as Engle-Granger and Johansen- Juselius methods. These advantages are:

- The variables can be I(0) or I(1)
- It is really more suitable than another method for small sample size
- It can distinguish dependent and independent variables

For instance, in this study UECM is following:

$$\begin{aligned}\Delta IMP = {} & b_0 + \sum_{i=0}^{q} b_{1i}\Delta GDP_{t-i} + \sum_{i=0}^{q} b_{2i}\Delta ER_{t-i} \\ & + \sum b_{3i}\Delta\left(\frac{P^*}{P}\right)_{t-i} + \sum_{i=0}^{q} b_{4i}\Delta PRO_{t-i} \\ & + \sum_{i=1}^{q} b_{5i}\Delta IMP_{t-i} + b_6 IMP_{t-i} + b_7 GDP_{t-1} \\ & + b_8 ER_{t-1} + b_9\left(\frac{P^*}{P}\right)_{t-1} + b_{10} PRO_{t-1} + \varepsilon_t\end{aligned} \quad (2)$$

where, IMP, GDP, P^*/P, PRO and ER have mentioned explain. ε_t is error term and b_i are model parameters. Null hypothesis for co-integration is:

$$H_0: b_6 = b_7 = b_8 = b_9 = b_{10} = 0$$

Stationary test: in testing for a unit root in an autoregressive (AR) model that allows for a linear time trend, Elliot *et al.* (1996) showed that a modified Dickey-Fuller test, referred to as the DF-GLS test can achieve a substantial gain in power over conventional unit-root tests. In addition, the DF-GLS test displays good power and little size distortion in finite samples with dependent errors. They explicitly derived the asymptotic power envelope by analyzing the sequence of Neyman-Pearson tests of the unit-root null hypothesis ($\alpha = 1$) against the alternative of $\bar{\alpha} = 1 + \bar{c}/T$ in the finite-sample Gaussian AR ($p + 1$) model, in which T is the sample size and $\bar{c}$ is some fixed constant (DeJong *et al.*, 1992; Harris and Sollis, 2003; Cheung and Laib, 1994).

Let Z_t be the variable under examination. The DF-GLS test is carried out based on the following regression:

$$\Delta Z_t^d = \varphi_0^* Z_{t-1}^d + \varphi_1^* \Delta Z_{t-1}^d + \ldots\ldots\ldots\ldots + \varphi_{p-1}^* \Delta Z_{t-p-1}^d + v_t$$

where, L is the usual lag operator, v_t is error term and Z^d is the de-trended variable under the local alternative of $\bar{\alpha}$ is given by:

$$Z_t^d = Z_t - \hat{\Psi}' W_t$$

With $W_t = (1, t)'$ and $\hat{\Psi}$ being the regression coefficient of $\bar{Z}$, on $\bar{W}$, for which:

$$\bar{Z} = (Z_1, (1 - \bar{\alpha}L)Z_2, \ldots\ldots\ldots\ldots (1 - \bar{\alpha}L)Z_T)$$
$$\bar{W} = (W_1, (1 - \bar{\alpha}L)W_2, \ldots\ldots\ldots\ldots (1 - \bar{\alpha}L)W_T)$$

The DF-GLS test statistic is given by the usual t-statistic testing H_0: $\varphi_0^* = 0$ against the alternative of H_1: $\varphi_0^* < 0$ in regression. Elliot *et al.* (1996) recommend that the parameter $\bar{c}$, which is responsible for defining the local alternative through $\bar{\alpha} = 1 + \bar{c}/T$, be set equal to -13.5 when Z_t is stationary with a trend and it is equal to -7 when it is stationary without trend (Ghorbani *et al.*, 2007).

RESULTS AND DISCUSSION

Stationary test: Ouattara (2004a, b) believed if the variables in UECM would be I(2), F-statistic is not valid. For being sure about that which our variables are I(0) or I(1) after de-trending variable by Elliot *et al.* (1996) method, stationary was examined by using DF-GLS test. Results show IMP, ER and PRO are stationary in their level (I(0)), but GDP and P^*/P are stationary in their first level (I(1)) (Table 1).

Estimated model: Table 2 shows the results of UECM estimation. F-statistic of our model is 3.75 (F = 3.75) which is more than F-statistic in upper level of table that was suggested by Pesaran *et al.* (1996) by considering the trend and 5 variable.

Table 1: Results of DF-GLS test for stationary

Variables	DF-GLS statistic	H_0
IMP	-4.319*	Rejected
GDP	0.4449	Not rejected
ER	-4.2568*	Rejected
P*/P	-0.26083	Not rejected
PRO	-3.8986*	Rejected
DGDP	-4.69*	Rejected
D(P*/P)	-10.439*	Rejected

*Significance at 5% level

Table 2: Results of UECM for Iran's import demand function

Variables	Coefficient	t-statistic
C	17470.6	1.0106
DIMP(-1)	0.43524	1.0406
DIMP(-2)	0.57710	1.7179*
DIMP(-3)	0.00873	0.04212
DGDP	-0.48004	-1.6777*
DGDP(-1)	-0.41257	-1.2014
DGDP(-2)	-0.81235	-2.5806**
DGDP(-3)	-0.89548	-3.9780**
DER	-3.0193	-0.29128
DER(-1)	14.2925	0.76011
DER(-2)	5.8434	0.39845
DER(-3)	9.8998	0.85107
D(P*/P)	-0.69241	-0.07647
D(P*/P)(-1)	4.8739	1.5086
D(P*/P)(-2)	-9.7432	-0.9286
D(P*/P)(-3)	-7.4182	-0.8934
DPRO	1.52×10^{7}	3.7660*
DPRO(-1)	8560421	1.2881
DPRO(-2)	6195935	1.1189
DPRO(-3)	8063233	2.6925**
IMP(-1)	-1.5182	-3.0428**
GDP(-1)	0.78626	1.8548*
ER(-1)	-25.0420	-1.0589
P*/P (-1)	-7.1524	-1.4965
PRO(-1)	1728387	0.1939
R^2	0.85	

*Significant at 5% level, **Significant at 1% level

With considering Table 2, it reveals that while the coefficients of GDP (-1) and PRO (-1) are 0.78626 and 1728387, respectively, the coefficients of P^*/P and ER(-1) are negative, which show the affects of gross domestic product and partial productivity on import function are positive but the affects of imported price index to domestic price index ratio (P^*/P) and official exchange rate on import are negative. R^2 is 0.85 that shows 85% of the variations of import are explained with significant independent variables in the model. F-statistic of Lagrangh coefficient for testing the autocorrelation of residuals was 1.11 that show the equation's residuals don't have any autocorrelation. Also, the F-statistic for Ramsey's reset test was 4.14 which is lower than critical point at 5% significance level, therefore this model doesn't have specification error and model misspecification error. Moreover, test for heteroscedasticity, F-statistic was 0.922 thus heteroscedasticity was rejected. CUSUM and CUSUMSQ tests show that estimated coefficients are stable at 5% significant level. The results of CUSUM and CUSUMSQ tests are shown in Fig. 1.

Elasticity estimation: Table 3 show by increasing 1% in GDP, import will increase 1.96%. In other words, increasing income in Iran will create more tendencies for import. Thus economic growth in Iran will create deficit in balance of trade. Most of Iran's incomes are because of selling petroleum and the incomes of that which is not a base factor for making fundamental facilities. Also, it is a factor for increasing import with a consumption direction without creating desirable production.

Table 3: Long-run elasticity of import demand variables

Variables	Elasticity
GDP	1.96
ER	-0.46
P*/P	-0.16
PRO	0.32

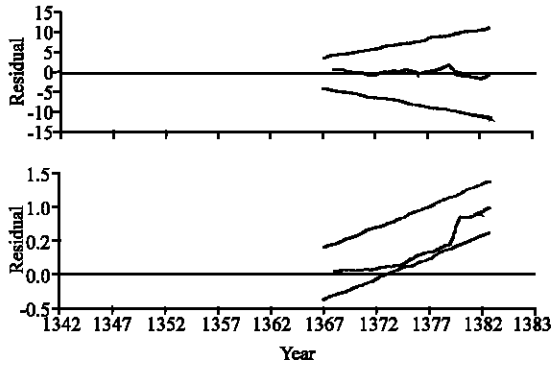

Fig. 1: CUSUM and CUSUMSQ tests for stability of coefficients. (a) Plot of cumulative sum of rescursive residuals. (b) Plot of cumulative sum of squares of recusive residuals. The strait lines represent critical bounds at 5% significance level

By increasing 1% in P^*/P, the amount of import will reduce 0.16%. it is vivid that when foreign prices index is more than domestic prices index, the amount of import will decrease, thus with considering the price policies which are related to domestic production, when in domestic prices are decreased, the level of import will reduce too. Being import function related to P^*/P inelastic show most of Iran's imported goods are necessary goods. Regarding the Table 3 indicate that by increasing 1% in exchange rate, import will pill down 0.46% which means when the value of money decrease, country has to pay more money for importing commodities. Thus, decreasing the value of money and increasing exchange rate is not a good policy in long-run, it will cause reduction in import. Table 3 show with labour productivity promotion, the import of goods will increase, thus in this model increasing 1% in labour productivity, will pile up import of goods by the rate of 0.32%. The most important reason is with increasing productivity, labours' wages will rise and then people will demand more commodities. Thus increasing labours' productivity, will make more demand for import.

CONCLUSION

The purpose of this study was the estimation of Iran's import demand function by using UECM which has

been suggested by Pesaran *et al*. (1996). Results show that demand for import is really elastic regarding to GDP. It means with increasing GDP growth, the amount of import pile up and it makes deficit in balance of payment. In this condition, the best way for government in order to encounter this problem is downsizing to decreasing the expenditure and the amount of imports which are related to the government expenditure. Moreover, the import increasing because of the growth of economic show Iran is going to the open economy but this trend should not be a factor for reducing the possibility and power of domestic firms face to foreign goods imports. Gafer (1988) determined the price elasticity of import demand in Trinidad and Tobago which was -0.05 to -0.15 and concluded reforming of exchange rate policies will improve and decrease instability in balance of payment. Estimated the price elasticity of import demand in Iran is -0.16 which is close to Gafer (1988) estimation. Thus exchange rate reformation will be useful for decreasing deficit in balance of payment, because increasing exchange rate will make expensive the value of imports and it will improve the deficit in balance of payment.

REFERENCES

Abrishami, H. and M. Mehrara, 2002. Applied Econometrica: A New Approach. 1st Edn., Tehran University Press, Tehran.

Bahmani-Oskooee, M., G.G. Goswamil and B.K. Talukar, 2005. Exchange rate of the Canada bilateral inpayments and outpayments. Econ. Model, 22: 745-757.

Cheung, Y.W. and K.S. Laib, 1994. Mean reversion in real exchange rates. Econ. Lett., 46: 251-256.

DeJong, D.N., J.C. Nankervis and N.E. Savin, 1992. Integration versus trend stationary in time series. Econometrica, 60: 423-433.

Elliot, G. and T.J. Rothenberg and J.H. Stock, 1996. Efficient tests for an autoregressive unit root. Econometrica, 64: 813-836.

Gafer, J.S., 1988. The determinants of import demand in Trinidad and Tobago: 1967-84. Appl. Econ., 20: 303-313.

Ghorbani, M., A. Shokri and M. Motallebi, 2007. Application of unrestricted error correction model in determining of factors influencing on private investment of Iran. Sci. Dev. J., 20: 111-124.

Hamori, S. and Y. Matsubayashi, 2001. An empirical analysis on the stability of Japan's aggregate import demand function. Japan World Econ., 13: 135-144.

Harris, R. and R. Sollis, 2003. Applied Time Series Modeling and Forecasting. 1st Edn., Wiley, West Sussex, ISBN: 978-0-470-84443-4.

Mah, J., 2000. An empirical examination of the disaggregated import demand of Korea-the case of information technology products. J. Asian Econ., 11: 237-244.

Mohseni, R., 2006. The affects of trade liberalization on import demand. Panel Anal. Iran's Econ. J., 25: 127-152.

Ouattara, B., 2004a. Modeling the long run determinants of private investment in Senegal. www.nottingham.ac.uk/economics/credit/research/papers/cp.04.05.pdf.

Ouattara, B., 2004b. The impact of project aid and programme aid on domestic savings: A case study of cÔte d'ivoire. Center for the study of African economics Conference on Growth, Poverty Reduction and Human Development in Africa, April 2004. pp: 1-12. http://www.csae.ox.ac.uk/conferences/2004-GPRaHDiA/papers/1m-Ouattar-CSAE2004.pdf.

Pesaran, H., Y. Shin and R.J. Smith, 1996. Testing for the existence of a long-run relationship. Unpublished Manuscript. Department of Applied Economics. Working Paper, No. 9622. University of Cambridge.

Tang, T.C., 2003a. An empirical analysis of China's aggregate import demand function. China Econ. Rev., 14: 142-163.

Tang, T.C., 2003b. Japanese aggregate import demand function: Reassessment from the Bound testing approach. Japan. World Econ., 15: 419-436.

Tang, T.C., 2003c. Determinants of import demand in Thai.

Todaro, M., 2003. Economic Development in the 3rd World. In: Translated, Farjadi, Gh. (Ed.). Kohsar Publications, Iran.

Toufighi, H. and A. Mehrabian, 2002. Exploring the effective factors on import demand for consumption, capital and intermediate goods. Iran's Econ. J., 13: 57-74.

Truett, L.J. and D.B. Truett, 2003. A cost function analysis of import demand and growth in South Africa. J. Devel. Econ., 70: 425-442.

Yousefi, A. and T.S. Wirjanto, 2003. Exchange rate of the US dollar and the J curve: The case of oil exporting countries. Energy Econ., 25: 741-765.