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Exchange Rate Uncertainty and Imports: Evidence from Iran

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Abstract: Foreign trade of any country is considered as one of the major economic sector of that society as far as some refer trade growth as the "economics growth engine". Foreign exchange rate and its fluctuations is one of the effective factors in volume of foreign trade. The present research studies the method of effects of real exchange rate uncertainty on imports demands in the Iranian economy during 1979-2007. In this respect, first, among various criteria of real exchange rate uncertainty, by using auto-regressive conditional heteroskedasticity (ARCH) model to calculate the real exchange rate uncertainty; and the real exchange rate uncertainty variable along with other variables such as GDP were put into imports regression mode By performing co-integration test among existing variables in import model and certainty of existence of minimum one long-term relation among them, the vector error correction model was assessed by imposing a long-term vector auto-regression model. Based on the results, it was specified that the real exchange rate uncertainty during the concerned period had negative impact on imports. In addition, the variable of real exchange rate was affected from the negative impact on imports. Furthermore, the GDP experienced positive impacts on the imports of the country.

Key words: Exchange Rate · Imports · Uncertainty · Trade · ARCH · GARCH

INTRODUCTION

The imports variable is one of the most important effective variables on the economy of developing countries such as Iran. Economists have dissension on the effect of exchange rate and money supply on economic growth [1]. Most developing countries need importing raw materials, manufacturing machinery, capital goods and consumable products to expand their industries and meet the consuming demands of their people [2-3]. In addition, the technology needed by developing countries to pass from traditional production to industrial production stages and taking the economics development stages is provided by the technology concealed in imports [4]. The economics structure of Iran; to, as a developing country, is highly depended on imports; for that purpose, identifying the effective factors on imports are highly important for the Iranian economy. Among factors that affect imports, the real exchange rate uncertainty has been subject of fewer researches and this matter distinguishes the present research from other researches. The Iranian economics has been facing fluctuations in foreign exchange rate, due to changes in foreign exchange rate after the revolution, the experiences of putting foreign exchange rate subject of market and using same foreign exchange rates in 1993 and 2002 and taking managed floating foreign exchange rate policy since 2001. For that purpose, in present study, the impacts of real exchange rate uncertainty on the imports of country in the years following revolution have been considered. In this approach, by calculating the real exchange rate uncertainty through conditional variance model and inputting that variable as one of the independent variables in imports demand function, the real exchange rate uncertainty on the imports of the country will be studied.

Literature Review: Salmanpour *et al*. (2011) [5] investigated the exchange rate overshooting in Iran during 1959-2005. The value of the Iranian Rial has been depreciated per dollar in the recent decade and the exchange rate overshooting is said to be an important short-run phenomenon. This contribution studied the overshooting and undershooting of exchange rate in Iran by applying Dornbusch monetary model. In this study he has shown that whether or not the exchange rate in short-run deviates from long-run equilibrium magnitude and if it does so, by what velocity it runs towards long-run

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equilibrium magnitude. By using time series data for the period of 1995 to 2005, that important subject has been analyzed by employing error-correction and co-integration models. The econometric test results show that this theory works in Iran. Ariez (1998) [6] examines the effects of exchange rate volatility on U.S imports by using vector error correction method. The results of that research show that both in short-term time interval and long-term time, the impacts of foreign exchange rate volatility on inflation were negative. Based on that, it was concluded that exchange rate volatility on allocating resources has significant effects on allocating resources. Doroodian (1999) [7] in his research studied the impacts of real exchange rate uncertainty on the foreign trades of India, South Korea and Malaysia and his results showed that the real exchange rate uncertainty had negative and significant impacts on their foreign trade flow. Pollard (2003) [8] in his research titled "Expenses of imports and foreign exchange rate" showed that the relationship between foreign exchange rate and imports expenses was highly complicated as the fluctuation on foreign exchange rate left different impacts on the imports costs of various US industries. In addition, the price reaction depends on both the size and the path of effects of changes in foreign exchange rate. David (2010) [9] examines the impact of exchange rate fluctuations on the Nigerian manufacturing sector during a twenty (20) year period (1986-2005). The argument is that fluctuations in exchange rate adversely affect output of the manufacturing sector. This is because Nigerian manufacturing is highly dependent on import of inputs and capital goods. Fluctuations in exchange rate will cause instability in purchasing power and hence, negatively impact on investment in import of manufacturing inputs. Fluctuations in the rate of exchange are not favorable to economic activities in the manufacturing sector. It was discovered that the performance of the manufacturing sector was affected by factors such as high cost of foreign exchange for procuring raw materials and machineries required for production, availability of financial capital, technological underdevelopment, inadequate socio-economic infrastructure, shortage of technical manpower and foreign domination; following the implementation of exchange rate devaluation; the manufacturing sector has not performed any better because of the influence of the earlier mentioned factors which affect the manufacturing sector performance. Bahmani Oskooeea and Hanafiah (2011) [10] analyzed the trade flows between Malaysia and the U.S. After showing that exchange rate volatility has neither short run nor long-run effect on the trade flows between thw two countries, they disaggregate the trade data by industry and consider the experience of 101 U.S. exporting industries to Malaysia and 17 U.S. importing industries from Malaysia. While exchange rate volatility seems to have significant short-run effects on the trade flows of most industries, short-run effects translate into the long run only in a limited number of small industries. Rezazadehkarsalari and Haghiri (2011) [11] analyzed the relationship between economic activities and real exchange rate. Exchange rate fluctuations have always been one of the most important macroeconomic issues. In his paper, the asymmetric effects of exchange rate shocks (decomposed to negative and positive shocks) on GDP have been investigated by co-integration analysis in Iran economy during the period 1930-2008. The results showed that the negative shocks have much more effects on output than positive ones. The major finding was that, depreciation of the domestic currency can have positive and significant effects on real GDP by little increase of prices. But depreciation of the domestic currency has insignificant effect on real GDP and results in significant increase in prices in economy, in high price level. Thus, in order to increase the efficiency of exchange policy it is necessary to consider the economic condition of the country.

Barhoumi (2005) [12] examines the exchange rate pass-through into import prices in developing countries in a sample of 24 developing countries during 1980-2003 by estimating a pass-through equation determined by a combination of nominal effective exchange rate, the price of the competing domestic products, the exporter's costs and domestic demand conditions. He adopt non-stationary panel estimation techniques and tests for panel cointegration. He find that long-run pass-through was heterogeneous. Then, he proposed two macroeconomic determinant alternatives and showed that exchange regims and trad barriers can explain cross-country differences of long run exchange rate pass-through into import prices in developing countries. Tochitskaya (2008) [13] examines the "Impacts of fluctuations of foreign exchange rate on the trade balance of Belorussia" and reached the conclusion that lowering the value of national money both in long and short terms could have positive impacts on trade balance. Mundaka (2011) [14] in his research on "The exchange rate uncertainty and optimized participation in international trade" introduced a model to study the impacts of changeability of foreign exchange rate on the international trade. Based on the model presented by him, it was specified that fluctuations in foreign exchange rate increased the uncertainty of

international trade participants and that uncertainty leaves negative impacts both on the international trade and its participants and in turn, it has negative impacts on specialization in the international economy level.

Olga Arratibel *et al*. (2011) [15] analyzes the relation between nominal exchange rate volatility and several macroeconomic variables, namely real output growth, excess credit, foreign direct investment (FDI) and the current account balance, in the Central and Eastern European EU member states. Using panel estimations for the period between 1995 and 2008, he finds that lower exchange rate volatility is associated with higher growth, higher stocks of FDI, higher current account deficits and higher excess credit. Mehrabi and Javedan [16] (2011) in their research studied the impacts of real exchange rate uncertainty on the development of Iranian agriculture sector and for this purpose, they used the generalized auto-regressive conditional heteroskedasticity to indicate the real exchange rate uncertainty. The results of the research showed that are strong and significant short and long term relations among variables in the development model of Iranian agriculture sector and real exchange rate uncertainty has negative and significant impact on the short and long term growth of agriculture sector. Hosseini pour and Moghaddasi (2010) [17] investigated the impact of exchange rate volatility on aggregate and sectional Iranian export flows to the rest of the world, as well as on agriculture and industry sectors export. The ARDL bounds testing procedures were employed on annual data for the period 1970 to 2006 and various measures of volatility such as ARCH and GARCH models and moving sample standard deviation were employed. The results suggest that, depending on the measure of volatility used, either there exist no statistically significant relationship between Iranian exports flows and exchange rate volatility or when a significant relationship exists, it is positive. However this study found a strong evidence of a stationary long run cointegrating aggregate, agriculture, minerals, transport means and fats and oils exports demand functions but no evidence of a long run chemical exports demand relations were found. These results was however not robust as they showed great amount of sensitivity to different definitions of variable used. Finally they conclude that depending on the measure of volatility used, exchange rate volatility either does not have a significant impact on Iran's exports flow or it has a positive impact on agriculture, minerals, transport means and oils and fats exports and also on aggregate exports. Rasekhi *et al.* (2011) [18] examined the explaining power of the fundamental and technical models of exchange rates for Rial/USD used monthly data from January 1992 to December 2008. The results showed that according to mean square error (MSE), equilibrium exchange rate, sticky and flexible price models well explained the behavior of exchange rate. Therefore, it seems that fundamental models of exchange rate determination have higher explanatory power than technical models. In other words, exchange rate for the period 1992 to 2008 was affected by the fundamental variables, especially "net foreign assets", "commodity terms of trade" and "foreign and domestic money supply", not by its past values in Iran economy.

Data and Model: In this research, among various criteria for calculating foreign exchange rate uncertainty, an auto-regressive conditional heteroskedasticity model was used. It should be noted that in order to prevent problems caused by omitting important variables in the model, in addition to the explanatory variable of foreign exchange rate uncertainty, other explanatory variables such as GDP and real foreign exchange rate were considered in the regression function and regressed on the dependent import variable. The model used in this research is:

$$LIMP = f(LGDP, LREXCH, UNCERT) \quad (1)$$

As it could be seen in the above-mentioned function, the model is a logarithm type and the coefficients show the elasticity.

The variables of model are:

Dependent variable:
IMP: Volume of imports in Iran

Explanatory variable:
REXCH: Real Exchange Rate
Stage 1: The real exchange rate index is calculated by using the consumer's price index. The index is as follows:

$$REPCPI = ECPI / CPI \quad (2)$$

CPI: The consumer's price index in the country (Iran)
CPI (OECD): The consumer's price index in the foreign country
E: The nominal foreign exchange rate

Exchange rate uncertainty (UNCERT)
Stage 2: In order to calculate the real exchange rate uncertainty, first, the reliability test of the variable was

performed and based on the results (next slide) it was specified that the concerned variable is stable in the differentiation of first degree. Next, to assess the ARIMA model for real exchange rate, the relationship diagram of the differentiations of the variable was drawn and it was specified that the variable is of ARIMA (4, 1, 4) process. The results of coefficient assessment could be described as follows:

D Log (REXCH) =-0.011+0.854 AR(4)-0.989 MA (3)

In next stage and after assessing ARIMA model, the foreign exchange rate uncertainty could be assessed by using ordinary or generalized auto-regressive conditional heteroskedasticity model. In this connection, the conditional variance equation was assessed as GARCH (1 and 1) process, the results are as follows:

$$\delta^2 = 0.0029 + 0.59\varepsilon_{t-1}^2 + 0.62\delta_{t-1}^2 \quad (4)$$

The above-mentioned conditional variance equation was used to obtain the real foreign exchange rate uncertainty and that variable was used in assessing the impacts of real foreign exchange rate uncertainty on imports variables.

Gross domestic production of Iran (GDP)

Stage 3: In this research, in order to study the relationship between foreign exchange rate uncertainty and imports, the information and statistics of central bank of the Islamic Republic was used; however, due to lack of relevant seasonal data, the annual data of the central bank of the Islamic Republic of Iran was extracted by using BFL method.

Assessing the Estimation of the Result:

First Stage

The Research Variables Reliability Test: In present research, in order to test the stability of research variables, the Augmented Dickey-Fuller test was used. Following table lists the results of ADF test for research variables. With respect to the results, the unit root test on model variables area shows that the Null hypotheses concerning the non-stationary of those variables could not be rejected in 95% certainty level and therefore, those variables are non-stationary in surface. For that purpose, in the next stage, the unit root test was performed on first degree differentiation of those variables and the results showed that zero hypotheses concerning the first degree differentiation non-stationary of the above-mentioned

Table 1: Results obtained form the unit root test of research variables

Name of variable	Optimized lag	Tests statistic	Critical value in 95%
LMP	4	-1.8	-3.44
LGDP	10	-.0.50	-3.45
LREXCH	0	-2.09	-3.44
UNCERT	0	-3.02	-3.45
D(LIMP)	3	-5/61	-2.88
D(LGDP)	9	-5.02	-2.88
D(LREXCH)	0	-12.77	-2.88
D(UNCERT)	2	-9.25	-2.88

Source: Authors findings

Table 2: Determining optimized lag of VAR model

	Criterion for selecting optimized lag				
	AIC	SC	HQ	FPE	LR
Optimized lag	9	9	9	9	9

Source: Authors findings

Table 3: Results obtained from performing Trace test

Critical amount in 95% level	Trace statistic	Hypothesis of absence
47.85	53.55	Absence of long-term relations
29.79	22.45	Absence of minimum one long-term relation
15.49	6.45	Absence of minimum two long-term relations
3.84	2.3	Absence of minimum three long-term relations

Source: Authors findings

Table 4: Results obtained from performing Max. Eigen test

Critical amount in 95% level	Maximum Eigen value statistic	Hypothesis of absence
27.58	31.10	Absence of long-term relations
21.13	15.99	Absence of minimum one long-term relation
14.26	4.14	Absence of minimum two long-term relations
3.84	2.3	Absence of minimum three long-term relations

Source: Authors findings

Table 5: Results obtained from assessing long-term relations in VEC model

Independent variable	Coefficient	Statistic "t"
Intercept	-149.4	-
LGDP	0.32	4.49
LREXCH	-0.221	-4.05
UNCERT	-0.012	-4.38

LIMP dependent variablerce: Authors findings

variable could be rejected in 95% certainty level and therefore, the first degree differentiation of the variables of the model is stable. As it was shown from results of unit root test, all variables in the first degree differentiation are table.

Second Stage

Determining Optimized Lag of Var Model:

In the next stage, in order to become certain of absence of false regression among variables in the research, the cointegration test should be performed among variables; however, before the cointegration test, the VAR model should be assessed by enforcing optimized lag. For that purpose, the optimized lag test for VAR was performed by using Schwartz Information Criterion (SC), the Akaike Information Criterion (AIC), the final prediction error (EPF), the Hannan-Quinn information criterion (H) and the sequential modified LR test statistic (LR) were performed. In that line, the lag with least amount of above-mentioned statistic will be the optimized lag.

As the results of table shoe, optimized lag was determined to be "9" based on all the criterion mentioned above.

Third Stage

the Cointegration Test: As the above table shows, in first line in both tests, since the effect statistic and the maximum special value statistic are larger than the critical values of the two tests; the hypothesis of absence of long-term relations among research variables is rejected and the alternative hypothesis has been accepted. That is, there is a long-term relationship between the variables existing in the import equation; hence, after certainty of the existence of a long term relation among variables that exist in import equations, in next stage, that relation should be employed in VAR model to give the vector error correction model.

Fourth Stage

Vector Error Correction Model: As explained above, by performing the co-integration test and certainty of existence of a long term relation among research variables, in the following step, a long-term relation was employed in VAR model and consequently, the vector error correction model was obtained. Table (5) lists the results obtained from assessing long-term relations among existing variables in imports equation.

LIMP=-149/40-0/221 (4/38)
*LREXCH+0/32 (4/05)
*LGDP-0/0012UNCERT (4/49)

The adjustment coefficient for VEC was obtained as -004.0. This coefficient shows the coefficient of moving speed towards long-term balance and indicates that in each period, an amount equal to this coefficient is deducted from the error and we will move towards long-term balance.

The coefficient related to width from origin with respect to "t" statistic of it is significant in 95% probability range and indicates that one unit increase in factors that affect imports; though it is not considered in the assessed model, has decreased imports equal to 4.149 percent.

In addition, with respect to the statistic "t" obtained for production variable coefficient, the mentioned coefficient in statistics term is significant in 95% probability level and indicates that each one per cent increase in GDP increased 32.0 percent import volume during the mentioned period; and this result has been confirmed by results of empirical studies on positive effects of income on imports.

The coefficients of real exchange rate, with respect to statistic "t" of it, is significant in 95% probability level and with respect to the coefficient obtained, each one percent increase in real exchange rate led to 0.22 percent deduction in volume of imports during considered period.

The real exchange rate uncertainty coefficient is significant in 95% probability level with respect to static "t" and this indicates that one unit increase in exchange rate uncertainty deducted 0012.0 percent reduction in import volume.

CONCLUSION

Foreign exchange rate uncertainty has negative impacts on imports. In fact, as the uncertainty in exchange rate becomes more intensified, importation will become lower. The reason is that in developing countries, market is not sufficiently transparent and therefore, importers in macro level withdraw from taking risks and in facing with uncertainty in exchange rate, they decrease their import. Real exchange rate has negative impact on imports. In fact, as real exchange rate increases, the size of imports decreases; by increase in real exchange rate, foreign made goods become more expensive for local consumers and

the import demands reduce. GDP has positive impacts on imports. In fact, as the GDP grows, the importation volume increases accordingly; for, by increase in GDP, both income and purchase power of local consumer increase and this increase leads to growth in import demands for our country.

Another optimized approach is that, after concluding the contract, to the time of realization and execution, the importer may receive its needed money based on the current rate as agreed, for delivering a specific amount of foreign exchange in future and cover itself against undesirable changes and displacements of foreign exchange rate. The importer may invest an amount more than the value of contract in the financial markets of countries with more transparent status and in industries with more specific output situation. By this solution, the importer will be able to gain some profit from difference in interest rates inside and outside the country and perform the so-called speculation in a foreign exchange. The last suggestion addresses researchers in econometrics to develop suitable methods for extracting optimized functions of econometrics as much as possible in order to recognize the uncertainty in foreign exchange rate and its harmful impacts on macroeconomics variables, particularly imports, in scientific term. This might enable the officials to take actions for adjusting the harmful effects of exchange rate risk.

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