Investigation of the Factors Affecting Real Exchange Rate in Iran

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This paper intends to investigate the factors affecting the real exchange rate in Iran in the period of 1978-2008. In this part, the econometric methodology and vector autoregressive model that is known as VAR is used to investigate the effect of proper variables on the real exchange rate. The results of Johansson-Jousilious test confirmed co-integration between variables, and thus long-run equilibrium relationship was confirmed among proper variables. Overall, the impulse and response functions showed that the shocking of variables, oil price and volume of money flows, has a positive impact on the real exchange rate and put it above its permanent level in the whole period of study. The results of variance decomposition showed that the most effects belonged to oil price and then volume of money flow that in fact represents greater relative importance of these variables in comparison with other variables among all model variables.

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1.Introduction

Real exchange rate behavior has been at the centre of policy debates since the breakdown of the Bretton Woods system in the early 1970s. Because exchange rates play a vital role in global trading and portfolio investments, countries with fixed exchange rates need to know what the equilibrium rate is likely to be, and countries with variable exchange rates need to know what levels and variations in real and nominal exchange rates are expected (Haw et al., 2011).

Goldberg and Klein (1997) found that foreign direct investment in some less developed countries is significantly affected by bilateral real exchange rate. Caballero and Corbo (1988) study the conditions under which increases in the degree of uncertainty about the real exchange rate depress exports and find a clear and strong negative effect of real exchange rate uncertainty on export performance in several least developed countries. However, identifying the sources of exchange rate fluctuations is important if exchange rate stabilization is to be achieved. It is useful to be able to measure and distinguish between, relative importance of permanent and transitory shocks on real exchange rate.

Based on many studies, fluctuation in real exchange rate behavior has negative impact on other economic sectors among the exports. Hence, in order to increase the degree of international competitiveness and the export boom, analyzing the behavior of real exchange rate and its determining factors has always allocated a significant part of economic studies. Accordingly, this article intends to investigate determinants of real exchange rate in Iran at the period of 1978-2008.

Historical Time Path of Nominal and Real Exchange rate in Iran

The currency and exchange rate arrangements in Iran are faced with many changes before and after the revolution. This event is characterized by a multi-rate system that was severe with regulations and exchange controls the decade after 1971. The years before the Iranian revolution, dollar exchange rate had stabilized at around 70

rials because of high oil revenues. The year 1973 was accompanied by emerging a floating currency system and collapsing the Bretton Woods system.

Until the spring of 1993, there were three exchange rates - official exchange rate, basic exchange rate, and float and competitive-in banking system and the parallel market exchange outside the banking system. Basic rate was used for oil exports income, imports of necessities and refunding the government debt. Competitive rates used on imports of intermediate and capital goods which were not eligible to use the official rate and the floating exchange rate - that the banks determined it according to the parallel market rate - was applied for the remaining transactions in the banking system. In early 1993, these three official exchange rates were changed to a single rate that had a less value compared to the previous level of official and competitive exchange rate and this was whilst some foreign exchange restrictions were lifted. Central bank of Iran determined the new daily rate according to the parallel market rate. However, the same rate was not used comprehensively because the previous base rate for imports of needed goods was offered to repay certain debts whose date of contracts was before the exchange. This led to large financial losses whose compensation was needed to increase the net domestic assets of the central bank.

Increasing in liquidity by easy tinder financial policies and the expected uncertainty of oil prices in Iran's economy decreased the official exchange rate rapidly after the October 1993 indicating devaluation in the parallel market. In December 1993, authorities dropped the floating exchange rate and had stabilized the official exchange rate at the level of 1,750 rials per dollar; as result, added price of exchange rate in the parallel market increased constantly compared to the official exchange rate. In May 1994, the second official exchange rate was introduced that was used for the non-oil exports, a list of import and the payment of the costs of services. This rate which was called

the export exchange rate was fixed at the level of 2,345 rials per dollar. Main reason of adopting this rate was limiting the demand for imports of unnecessary goods and increasing in exports. After representing the export exchange rate in May 1994, added price of exchange rate in the parallel market was increased constantly in comparison with the official exchange rates that high inflation and expected intensification of trade embargoes of the US against Iran were the main reasons of it. In May 1994, delivery requirements of non-oil exports exchange rate increased by 100% and export rates were devaluated 3,000 rials per dollar. High inflation in Iran in comparison with its trade partners and increasing the dollar value against other major currencies led to a 27% increase in the stabilized official exchange rate the period 1996-1997.

In early June 1997, the third mechanism of exchange was offered in Tehran stock exchange market and a significant amount of imports were transported to this market. Despite the significant devaluation, the value of exchange in this stock market was growing increasingly in comparison with exchange rates in the parallel market.

Authorities recognized the need to reform the currency system and began initial reform measures in the period of 1999-2000. In May 1999, central bank absorbed significant amount of the excess reserves of commercial banks through facilities deposit accounts again and decreased added exchange prices in stock market. This stabilized the exchange market. After May 1999, added value of exchange rate in the parallel market decreased gradually in the stock market and reached from 17 percent to less than 2 percent in February 2000 and the import provided from official export rates led to the stock exchange gradually. At the end of March 2000, export prices were eliminated and exchange rate in the stock exchange set by the market became the most important exchange rate used for all the officially accepted current account transactions. Of course, transactions related to imports of subsidized commodities and debt repayment - that took place with the official rate of 1,750 rials per dollar - was an exception.

So, Tehran stock exchange market had a remarkable stability by doing the suggested reforming measures in the second half of 1999.
In March 2002, all exchange transactions were done in stock market previously moved to an interbank market. The base official rate was removed and the exchange rate became uniformed at level of the stock market in which it was established earlier. In relation to uniformity of the exchange rate in March 2002, authorities undertook the total cost of exchange rate differences –that was as result of the uniformity of exchange rate for the import of some goods.
The exchange subsidies of this import that were paid invisible previously, became evident largely in the budget of year 2002-2003. Part of this is provided by imported supplies through increasing the oil revenues that will be allocated in budget. Besides these obvious subsidies, the government undertook exchange rate differentials in obligations set forth by signing a Letter of credit with public companies to cover eliminated official rate. In the budget of year 2002-2003, using oil reserve fund and financing was predicted by the central bank to cover these commitments.
Authorities intended to remove apparent subsidies in the process of exchange rate uniformity during mid-term gradually and replace the desired transfers. Totally, central bank authorities' approach to exchange rate policy over the past decade indicates their strong tendency is maintaining the fixed official exchange rate. The witness of this claim is the registered official rate in many international transactions up to 1997 particularly. One of the continuing obstacles on the official rate was high inflation and high value of the real official rate in addition to significant price, and high added prices in comparison with the official exchange rates in the parallel market whose supply has been increasing in liquidity in order to finance the public sector.
From mid-1999, when financing significant amount of imports was driven toward the Tehran stock market, exchange rate at the Tehran

stock exchange has been remarkably stable because of the massive central bank intervention and using oil revenues (Celasun, 2003).

Brief Literature Review

A number of studies have found that the level of real exchange rate relative to an equilibrium real exchange rate and its stability, has strong influence on exports and private investment (e.g., Caballero and Corbo, 1989; Serven and Solimano, 1991, Ghura and Grennes, 1993; Rodrik, 1994 and). More seriously, Yotopoulos and Sawada (2005) discover that systematic deviations of nominal exchange rate from their purchasing power parity (PPP) levels may endanger serious instabilities of the international macroeconomic system.

Different studies have been led about factors affecting the real exchange rate of which some are addressed below.

Moore and Pentecost (2006) examined the contributions of real (permanent) and nominal (temporary) shocks on the nominal and real exchange rates of the Indian Rupee against the US dollar in the period since 1993, using the long-run structural VAR technique. The paper results showed that the real exchange rate of the Rupee against the U.S. dollar is non-stationary and that real shocks have permanent effects on the exchange rate, thus making exchange rate management at best futile and possibly harmful to the economy.

Rano (2009) investigated the long-run behavioral equilibrium real exchange rate in Nigeria by using a vector error correction model (ECM). Regression results showed that most of the long-run behaviors of the real exchange rate can be explained in term of trade, index of crude oil volatility, index of monetary policy performance, and government fiscal stance.

Celasun (2003) evaluated exchange rate policy and the basic criteria for the choice of the exchange rate regime in the medium term in the Islamic republic of Iran from 1993 to 2002. The analysis highlights the merits of an intermediate regime which would allow the authorities to smooth out excessive short term exchange rate fluctuations while

letting nominal exchange rate movements facilitate real exchange rate adjustments called for by major oil price shocks.

Luqman Khan and Sulaiman and Alamgir (2010) investigated the sources of real exchange rate fluctuations in Pakistan, and used Structural VAR model to study the relative importance of different types of macroeconomic shocks on fluctuations in real exchange rate. The structural decomposition showed that more than 60 percent of the variance in forecasting the real exchange rate at a horizon of 4 quarters is due to nominal shocks.

Inoue and Hamori (2009) empirically analyzed the sources of the exchange rate fluctuations in India by applying the Structural VAR model. The VAR System consisted of three variables, the nominal exchange rate, the real exchange rate, and the relative output of India and a foreign country. The empirical evidence demonstrated that real shocks are the main drives of the fluctuations in real and nominal exchange rates.

Methodology and Econometric Procedures

In this section we discuss our approaches to estimate the factors affecting the real exchange rate. In our analysis we make use of seven macroeconomic variables and specify the real exchange rate equation as follows:

$$LRE = \beta_0 + \beta_1 LBD + \beta_2 LM + \beta_3 LMR + \beta_4 LNFA + \beta_5 LY + \beta_6 LOP + \varepsilon_0 \quad (1)$$

Where *LRE* is natural logarithm of real exchange rate; *LBD* is natural logarithm of budget deficit; *LM* is natural logarithm of volume of money flows; *LMR* is natural logarithm of import restriction; *LNFA* is natural logarithm of net foreign assets; *LY* natural logarithm of gross domestic product; *LOP* is natural logarithm of oil prices; β_0 and ε_0 are a constant and a normally distributed error term, respectively. This equation says that real exchange rate equation depends on budget deficit, volume of money flows, import restriction, net foreign assets, gross domestic product (GDP), and oil prices.

This study uses annual data for the period of 1978 to 2008. The data are obtained from the central bank of Iran, World Development Indicators (WDI) published by the World Bank and the International Financial Statistics (IFS) published by the International Monetary Fund (IMF).The variables are constructed as follows:
The real exchange rate (RE) is defined as follows:

$$RE_t = (ER_t * CPI_F / CPI_{IR}) \quad (2)$$

Where CPI_F is consumer price index in the U.S. and CPI_{IR} is consumer price index in Iran and ER_t is exchange rate in open market.
Import restriction is defined as follows:

$$MR = (TIM / IM) \quad (3)$$

Where *TIM* is tax on import and *IM* is total import.
To investigate the response of macroeconomic variables to positive and negative innovations in real exchange rate, we use an unrestricted vector autoregressive model (VAR). The Vector Autoregression (VAR) model is one of the most flexible and easy to use models for the analysis of multivariate time series. It is a natural extension of the univariate autoregressive model to dynamic multivariate time series. The VAR model has proven to be especially useful for describing the dynamic behavior of economic and financial time series and for forecasting. It often provides superior forecasts to those from univariate time series models and elaborate theory-based simultaneous equations models. Forecasting from VAR models are quite flexible because they can be made conditional on the potential future paths of specified variables in the model.
In addition to data description and forecasting, the VAR model is also used for structural inference and policy analysis. In structural analysis, certain assumptions about the causal structure of the data under investigation are imposed, and the resulting causal impacts of unexpected shocks or innovations to specified variables on the variables in the model are summarized. These causal impacts are

usually summarized with Impulse Response Functions (IRF) and Forecast Error Variance Decompositions (VDC).

Our unrestricted vector autoregressive model in reduced form of order p is presented in equation (4):

$$y_t = c + \sum_{i=1}^{p} A_i y_{t-i} + \varepsilon_t \quad (4)$$

Where $c = (c_1,\ldots, c_7)'$ is the (7×1) intercept vector of the VAR, A_i is the i^{th} (7×7) matrix of autoregressive coefficients for i = 1, 2,…, p, and $\varepsilon_t = (\varepsilon_{1,t},\ldots, \varepsilon_{7,t})'$ is the (7×1) generalization of a white noise process.

The vector autoregressive model is estimated in levels of the variables in natural logarithms. As described in the data section, we use seven endogenous macroeconomic variables in our system: *LRE*, *LBD*, *LMR*, *LM*, *LNFA*, *LOP*, *LY*. The form of unrestricted VAR system in this study is thus given by

$$\begin{bmatrix} LRE \\ LBD \\ LMR \\ LM \\ LNFA \\ LOP \\ LY \end{bmatrix} = \begin{bmatrix} c_1 \\ c_2 \\ c_3 \\ c_4 \\ c_5 \\ c_6 \\ c_7 \end{bmatrix} + A(L) \begin{bmatrix} LRE_{t-1} \\ LBD_{t-1} \\ LMR_{t-1} \\ LM_{t-1} \\ LNFA_{t-1} \\ LOP_{t-1} \\ LY_{t-1} \end{bmatrix} + \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \\ \varepsilon_{3t} \\ \varepsilon_{4t} \\ \varepsilon_{5t} \\ \varepsilon_{6t} \\ \varepsilon_{7t} \end{bmatrix} \quad (5)$$

Where A(L) is the lag polynomial operators, the error vectors are assumed to be mean zero, contemporaneously correlated, but not auto-correlated.

The unrestricted VAR system can be transformed into a moving average representation in order to analyze the system's response to a shock on real oil prices, which is:

$$y_t = \mu + \sum_{i=0}^{\infty} \Psi_i \varepsilon_{t-i} \quad (6)$$

With Ψ_0 is the identity matrix and μ is the mean of process:

$$\mu = (I_p - \sum_{i=0}^{\infty} A_i)^{-1} c. \quad (7)$$

The application of moving average representation is to obtain the forecast error variance decomposition (VDC) and the impulse response functions (IRF).

Results and Discussion

In order to properly specify the VAR, test for unit roots and co-integration are conducted. There have been at least two exogenous shifts in variables during 1978 to 2008, which would significantly affect the analysis. In the presence of such shifts Philips-Peron test is an appropriate check on the ADF (Philips, 1991). We first check the unit roots using Augmented Dickey-Fuller (ADF) and Philips-Peron (PP) tests. Table (1) provides the results of unit root tests on the data. Augmented Dickey-Fuller (ADF) and Philips-Peron (PP) tests are evaluated. Both the ADF and PP tests indicate that the null hypothesis of a unit root cannot be rejected for the levels of all variables, while the first differences are confirmed to be the stationary. Thus, all variables are found to be I(1) series.

Table 1

Results of (ADF) and (PP) unit root tests on variables of model

	ADF test		*PP test*	
Variables	*Level*	*First difference*	*Level*	*First difference*
LRE	-2.46	-3.43**	-2.59	-3.66**
LBD	-2.38	-5.85***	-1.78	-6.42***
LY	-1.89	-2.66*	-2.07	-2.72*
LM	-2.03	-2.75*	-2.23	-3.36**
LNFA	-2.08	-3.45**	-2.53	-3.22**
LMR	-2.58	-6.11***	-1.96	-2.85**
LOP	-1.86	-3.97***	-2.27	-5.6***

Note:*, ** and *** denotes 10%, 5% and 1% significance levels, respectively.
Source: Research findings

In empirical analysis, using the Akaike Information Criterion (AIC) and Schwartz Bayesian Information Criterion (SBC) to choose the optimal lag length of VAR, we find that the VAR(1) model is the most appropriate for the system. Then, we checked whether the variables

are co-integrated, utilizing a maximum likelihood procedure developed by Johansson and Jousilious (Johansson and Jousilious, 1990). If the variables were co-integrated, it shows that long-run equilibrium relationship is confirmed between proper variables. Table (2) presents co-integration test results based on Johansson's procedure. Test results indicate that there are 4 evidences of co-integration among variables. Therefore, long-run equilibrium relationship is confirmed between proper variables.

Table 2

Results of the Johansson test to specify long-run equilibrium relationship between proper variables

Trace Statistic Test	*Null*	*Alt.*	*Eigen value*	*Trace Statistics*	*0.05 Critical Value*
	r =0	r =1	0.961	226.07***	125.61
	r≤1	r =2	0.903	144.84***	95.75
	r≤2	r =3	0.767	86.54***	69.82
	r≤3	r =4	0.589	50.18**	47.86
	r≤4	r =5	0.469	27.92	29.79
	r≤5	r =6	0.347	12.06	15.49
	r≤6	r =7	0.054	1.39	3.84
Maximum Eigen value	*Null*	*Alt.*	*Eigen value*	*Max-Eigen Statistics*	*0.05 Critical Value*
	r =0	r =1	0.961	81.75***	46.23
	r≤1	r =2	0.903	58.35***	40.08
	r≤2	r =3	0.766	36.37**	33.88
	r≤3	r =4	0.589	22.24	27.58
	r≤4	r =5	0.469	15.85	21.13
	r≤5	r =6	0.347	10.66	14.26
	r≤6	r =7	0.054	1.39	3.84

The Johansson tests with linear deterministic trend
*, ** and *** denotes 10%, 5% and 1% significance levels, respectively.
Source: Research findings

After specifying the VAR properly, the restrictions are imposed and the shocks are identified. The dynamic effects of all types of shocks

can be analyzed by variance decompositions and impulse response functions. To shed light on the sources of each variable, we calculate the forecast error variance decomposition. Variance decomposition is a convenient measure of the relative importance of such shocks with respect to the overall system. Table (3) reports the variance decomposition for the real exchange rate in logarithmic first differences at selected horizon.

Table 3

Results of variance decomposition of the real exchange rate in the period of 1978-2008

Period	*S.E*	*LRE*	*LBD*	*LM*	*LMR*	*LNFA*	*LOP*	*LY*
1	0.084	100.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.12	84.053	0.012	2.45	2.21	2.27	7.94	1.05
3	0.151	68.65	0.21	7.6	1.84	2.57	18.22	0.87
4	0.176	58.74	0.18	11.86	1.35	2.33	24.82	0.67
5	0.194	52.98	0.16	14.47	1.34	2.04	28.11	0.87
6	0.205	49.85	0.22	15.63	1.67	1.83	29.4	1.36
7	0.211	48.33	0.35	15.87	2.08	1.73	29.74	1.88
8	0.214	47.75	0.46	15.69	2.38	1.69	29.76	2.23
9	0.215	47.61	0.54	15.54	2.51	1.68	29.71	2.38
10	0.216	47.53	0.56	15.69	2.51	1.67	29.61	2.39

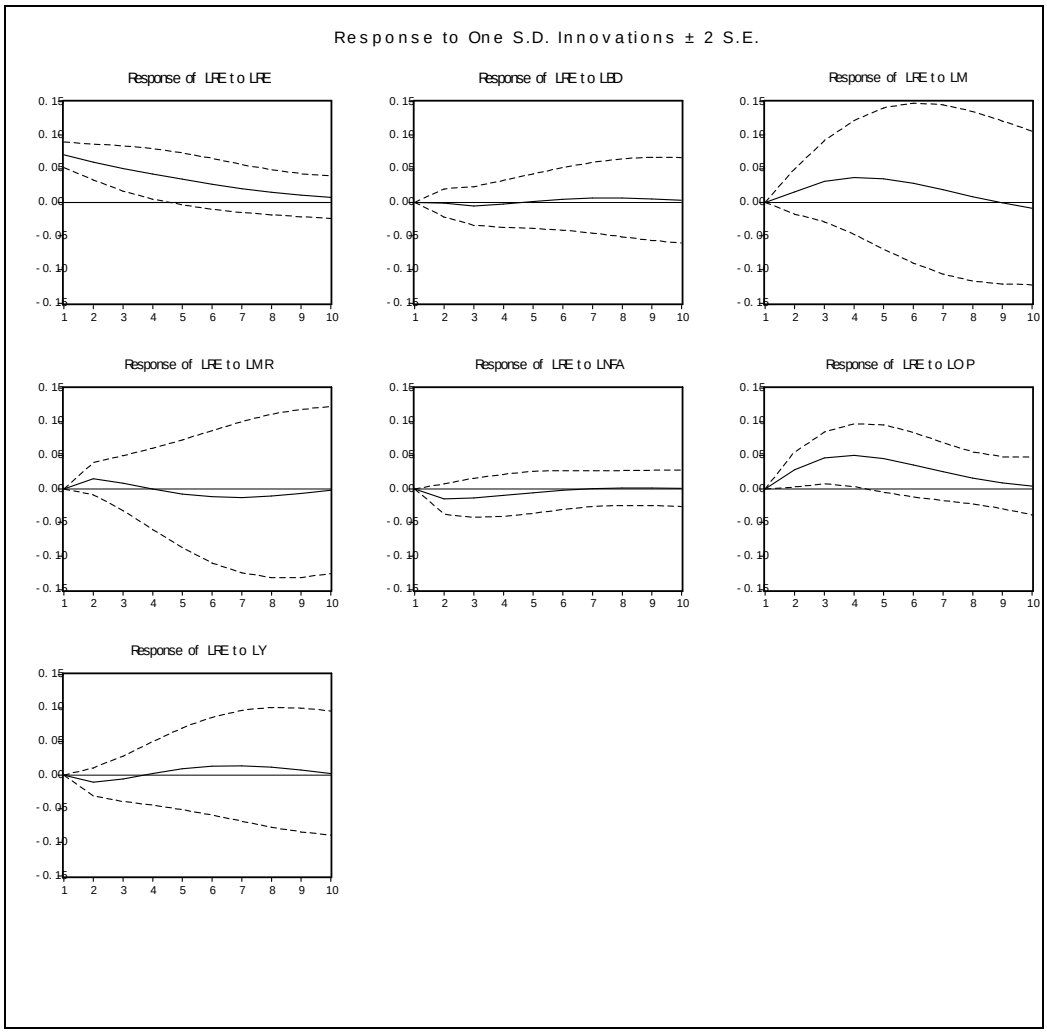
Cholesky Ordering: LRE LBD LM LMR LNFA LOP LY
Source: Research findings

Variance decomposition in the real exchange rate suggests that oil prices shocks explain most of the movement in the real exchange rate. Oil prices shocks, which are the most important factor, account for more than 29% of the real exchange rate variation. Volume of money flows, meanwhile, explains about 15.7% of the forecast error variance. Import restriction shocks account for about 2.5% of the real exchange rate movements. Gross domestic product, net foreign assets, and budget deficit shocks account for about 2.4%, 1.7% and 0.5% of the

real exchange rate variation respectively. To summarize, oil prices shocks account for most of the forecast error variance of the movement in the real exchange rate.

While the variance decomposition measures the relativity of the different types of shocks to real exchange rate, the effects of one-time shocks are measured by the impulse response functions and it is useful in assessing the signs and magnitude of response to different shocks. Figure (1) displays the impulse response function for the real exchange rates in respect to variables of model.

Figure 1: Response of the real exchange rate due to imposed shocks from the other variables in Iran in the period of 1978-2008



Source: Research findings

Figure (1) shows response of the real exchange rate due to imposed shocks from the other variables. According to this chart, the variable real exchange rate has had a decreasing trend until the fourth period in response to shocks of budget deficit. This impact was fixed from the fourth to fifth period and has increased the real exchange rate until the end of the period. These results show that volume of money flow has

positive impact in the short-run and negative impact in the long-run on real exchange rate respectively. These impacts have reduced over time and tend to zero at the end of period. This result show that the imposed shocks on the real exchange rate does not disappear in the short term and it takes at least ten years for the real exchange rate to reach its equilibrium level. Import restriction has positive impact in the short-run and negative impact in the long-run on real exchange rate and finally reaches its constant level at the end of the period. Response of real exchange rate to the shocks of the variable of foreign assets decreases to the third period. From this period until the fifth there has been an increasing trend and after the fifth there has been a constant and uniformed process. The shocks of oil prices almost has had the same impact as volume of money flow which has positive impact on real exchange rate in the short-run and negative impact in the long-run. GDP has had negative effect on real exchange rate. in the short-run But it has increased real exchange rate in the long-run and the effect of this shock will disappear after about ten years.
Long-run relationship between variables was estimated and presented in the form of normalized co-integration coefficients as following:

Table 4

Results of Johansson co-integration test of real exchange rate

Variable	*Coefficient*	*Standard Error*	*t Statistic*
LRE	1	-	-
C	7.9	-	-
LBD	0.0017	0.0003	5.6
LM	0.94	0.091	10.3
LMR	-0.603	0.091	-6.62
LNFA	-0.61	0.05	-12.2
LY	-0.91	0.173	-5.26
LOP	0.701	0.072	9.73

Source: Research findings

The results of table (4) show that there is a positive relationship among budget deficit, volume of money flow, oil prices and the real

exchange rate but a negative relationship among import restriction, net foreign assets, GDP and the real exchange rate. According to the other research, the positive relationship among budget deficit, volume of money flow and the real exchange rate and the negative relationship among import restriction, net foreign assets and GDP and the real exchange rate is consistent with theoretical principles. But the positive relationship between oil prices and the real exchange rate is inconsistent with theoretical principles. The positive impact of this variable on the real exchange rate justifies that increasing in oil prices have a positive impact on oil revenues - that is the main source of government income- and will increase national income. Economic experience of Iran shows that the most revenue from oil sales causes to increase liquidity, inflation and the devaluation of domestic currency and thereby increases the real exchange rate.

Conclusion

This paper analyzed the factors affecting the real exchange rate in Iran in the period of 1978-2008. The analysis applied the VAR model. The results of Johansson-Jousilious test confirmed convergence between variables and thus long-run equilibrium relationship was confirmed among proper variables. Overall, the impulse and response functions showed that the shocking of the variables- oil price and volume of money flows-has a positive impact on the real exchange rate and puts it above its permanent level in the whole period of study. The results of variance decomposition show that the most effect belongs to oil price and then volume of money flows that in fact represents greater relative importance of these variables in comparison with the other variables of model.

According to the results of research, this paper suggests that the central bank can decrease the real exchange rate fluctuations more than volume of money flow and inflation by decreasing monetary policies and increasing fiscal policies when oil revenues increase as a

result of increasing in oil prices. Attention to the amount of revenues and Reduce unnecessary costs is necessary to reduce or prevent constant budget deficits. The government can decrease the real exchange rate by adopting taxes on import of unnecessary goods. Consequently, this will lead to increase in domestic production and gross domestic product.

Reference

Caballero, J., and V. Corbo. 1988. Real Exchange Rate Uncertainty and Exports: Multi-Country Empirical Evidence. Department of Economics, Columbia University, Working Paper 414.

Caballero, R., and V. Corbo. 1989. How Does Uncertainty about the Real Exchange Rate Affects Exports?. Policy Research Working Paper Series No. 221 (Washington: World Bank).

Celasun, O. 2003. Exchange rate regime consideration in an oil economy: The case of the Islamic Republic of Iran. IMF Working Paper, WP/03/26.

Ghura, D., and T.J. Greenes, 1993. The Rea Exchange Rate and Macroeconomic Performance in Sub-Saharan Africa. Journal of Development Economics, 42: 155–174.

Goldberg, S., and W. Michael. 1997. Foreign Direct Investment, Trade and Real Exchange Rate Linkages in Southeast Asia and Latin America. National Bureau of Economic Research, Working Paper 6344.

Haw, C.T., C.L. Lee. and C.H. Wooi. 2011. Japan-U.S. real exchange rate behavior: Evidence from linear and non-lineare endogenous break tests. Asian Academy of Management Journal of Accounting and Finance, 7(1): 95-109.

Inoue, T., and S. Hamori 2009. What explains real and nominal exchange rate fluctuations?: Evidence from SVAR analysis for India. Economics Bulletin, 29(4): 2803-2815.

Johansson, S., and K. Jousilious. 1990. Maximum likelihood estimation and inference on co-integration with the application to the demand for money. Oxford Bulletin of Economics and Statistics, 52: 169-210.
Luqmankhan, M., M.D. Sulaiman. and Alamgir. 2010. The sources of real exchange rate fluctuations in Pakistan. European Journal of Social Sciences, 14(1): 34-43.
Moore, T., and E. J. Pentecost. 2006. The sources of real exchange rate fluctuations in India. Department of Economics, Delhi School of Economics. Journal of Indian Economic Review, 41(1): 9-23.
Philips, P.C.B. 1991. Optimal inference in co-integrated systems. Econometrica, March 1991, 283-306.
Rano, S.U. 2009. Real exchange rate misalignment: an application of behavioral equilibrium exchange rate (BEER) to Nigeria. Available at Social Science Research Network (SSRN): https://ssrn.com/abstract=1333642.
Rodrik, D. 1994. King Kong Meets Godzilla: The World Bank and the East Asian Miracle, in Albert Fishlow, Catherine Gwin, Stephan Haggard, Dani Rodrik and Robert Wade, eds., Miracle or Design? Lessons from East Asian Experience, Washington, DC, Overseas Development Council, 15–53.
Yotopoulos, A. P., and Y. Sawada. 2005. Exchange Rate Misalignment: A New Test of