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# The Asymmetric Effect of the Exchange Rate and the Amount of Money on the Subsections of Industry in Iran by Using Markov - Switching Approach

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**Abstract**

According to the importance of the industrial sector in the economy of Iran, the development of this sector is essential to the country's economic development. This study aimed to investigate and compare the asymmetric effect of the exchange rate and the amount of money on industrial subsections of Iran by using Markov - switching approach during the 1972-2012. In this regard, the exchange rate and monetary shocks were initially calculated through Var pattern. Then, the effect of exchange rate and monetary shocks on selected industrial subsections of Iran was studied by using Markov-switching model. Estimation results show that the exchange rate and monetary shocks have negative effect on A subsection and positive effect on B subsection.

**Keywords:** The real exchange rate, currency shocks, monetary shocks, industrial subsections, Markov- switching approach

## Introduction

The risk arising from variations in exchange rates is one of the issues that has always been a problem for the economy of country and especially is proposed for the foreign trade sector and this risk is important to the extent that sometimes encounter exporters to the irreversible damage. Rate of exchange is a variable that more than other variables has close and direct relation with the external sector of the economy. Nowadays, the economic policies in each country as well as the exchange variations in Global Markets influence the value of money of countries and consequently they are effective on foreign trade. Exchange rate is one of the most important variables in determining the price of imports and exports and their changes lead to the changes in their prices and thus increase or reduce the amount of foreign trade. On the other hand, industry and industrial export has a special place in the development process; To achieve these objectives, the real exchange rate and its changes have very important role on the performance of this sector (Asgari, 2007). Therefore, due to the importance of exchange rate and its changes on economic variables and according to the importance of industry in the economy of Iran, this study examined the effect of exchange rate changes on the industrial subsections.

The impact of liquidity increasing and decreasing on real economic activity is not necessarily symmetric. Most of the empirical evidence for developed countries implies that the negative shocks of money supply (or interest rates rising) have a much more effects than the positive monetary shocks on the production (Naghavi et al., 2011).

Understanding the asymmetry of policies or monetary shocks has great importance on monetary policy-makings. Hence, this study investigates the effect of changes in the volume of money on the industry subdivision (value added).

## Background of study

Delangizan et al (2014) examined the asymmetry in the impact of monetary shocks on the economic growth of Iran from the view of new Keynesians. In this study, after extracting the monetary shocks by using + HP Prescott filter and money neutrality test for Iranian economy research results indicated that money is not neutral in economy of Iran and the effects of monetary

policies on Iranian economic growth is asymmetric, so that the negative shocks influence the economic growth more than positive shocks; also negative shocks in the boom period and positive shocks in recession period has more significant effect on economic growth.

Hezhaber Kayani and Abtahi (2009) studied the new Keynesian view about the asymmetric effects of monetary shocks on the production in Iranian economy by using Markov regime rotation models. For this purpose, they used regime rotation model and vector auto-regression over 1989-2006. Their results indicated that the effect of negative shocks on output growth was more than dynamic positive shocks and positive monetary shocks have no effect on output growth in the economy of Iran. Also, according to the New Keynesian view, production is influenced more by little monetary shocks than large monetary shocks.

Abasinejad et al (2013) examined the asymmetric effects of volume of money on total production in Iran by using cointegration analysis and error correction model and by using Iranian economic data from 1972 - 2011. The results of the asymmetry of positive and negative shocks imply that negative shocks have far greater impact on economic growth reduction than positive shocks. The results show that although policy-maker can increase economic growth to somewhat by unexpected growth increasing in the amount of money, while money supply growth reduction and inflation should cost far more in terms of economic growth reduction.

Dincer and Kandil (2009) have examined the asymmetric effects of exchange rate fluctuations on exports to Turkey in two time periods of 1996-2002 and 2003-2008. The results of this study suggest that the projected increase in the exchange rate has adverse effect on exports and its unanticipated fluctuations have also asymmetric effects on export growth. Also, the findings show that the enhancement of the value of the domestic currency has a greater impact on export growth compared with the devaluations.

Boug and Fagereng (2010) have investigated the effect of exchange rate volatility on exports in Norway for the 1990s and after obtaining the exchange rate volatility by using GARCH model, they have examined the relationship between it and export by using stacked vector auto-regression. The results have rejected the relationship between these variables.

Hasanov (2012) has examined the impact of real exchange rate on Azerbaijan's non-oil exports by using cointegration and asymmetric error correction techniques. Two questions have been answered in this article: 1- Is there any symmetrical relationship between the real exchange rate and non-oil exports? 2- Does the adjustment process tend towards asymmetric equilibrium level? The most important finding of this study is that there is a long-run symmetrical relationship between the variables, while there is an asymmetric relation with respect to the equilibrium level.

The most important study on investigating the asymmetric effects of the real effective exchange rate on output and prices refers to the Kandil (2008) that by examining 50 developing countries for the time period of 1960 -2000 concluded that the exchange rate fluctuations have asymmetric effects on output and domestic prices in intended countries; it means that the positive shocks of the exchange rate (devaluations) reduce the real output through the channel of the cost of imported intermediate goods and increase the price level, while negative shocks of the exchange rate without reducing inflation, decrease the real output.

David O. Cushman (1983) in an article entitled "The effects of real exchange rate risk on international trade" has studied real exchange rate risk and its effects on the volume and price of exported goods in 14 industrial countries and concludes that any expected increase in the real exchange rate in the long run, increase the volume of trade, while the increase in the uncertainty of the real exchange rate, leads to the reduction in export.

Mckenzie (1998) investigated the trade between America and Germany during the period1973 (4) -1992 (9) and indicates the positive relationship between exchange rate volatility and

export and import. Another important study is conducted by Chow (2000) for China and results show the negative relationship between exchange rate volatility and total exports, but it is positively associated with export sub-sectors of the industry.

## Theoretical Foundations

### *Effective channels of exchange rate shocks*

The various commodities of the impact of positive and negative shocks of exchange rate on the demand and supply may cause the asymmetry. These channels include:

A) A positive shock of exchange rate in the commodity market (devaluations) makes domestic production of export goods cheaper for overseas and imported goods will become more expensive. As a result, the demand for domestic products increases and leads to increased production and domestic prices. Decreased demand derived from reduced exports leads to the deceased production and prices level.

B) In the money market, a positive shock to the exchange rate increases the demand of domestic economic agents for the domestic currency. For re-establishing the balance in the currency market, the interest rate will increase; raising interest rates reduces investment and demand and therefore the production and prices are decreased. The negative shock also causes the domestic economic agents reduce their demand for the domestic currency. Decreased demand for the domestic currency leads to the interest rates reduction and encouragement of investment. Increased investment also increases the total demand, production and the price level.

C) Supplying a positive unanticipated shock to the exchange rate increases the cost of imported intermediate goods and decreases the level of production and increases the prices. Negative shock also reduces the cost of imported intermediate goods and increases the production and reduces the level of prices.

Therefore, the net effect of positive and negative shocks of exchange rate on output and price depends on which of these effects is dominant over the other. For example, if a positive shock to be entered to the exchange rate, B and C channels in same direction will reduce the production and only through channel A the production will increase. Therefore, the effect of a positive shock depends on the resultant of the effect of these three channels (Kazerooni et al., 2013).

### *Monetary shocks and asymmetric effects*

By the 1990s, studies in the field of the study of Business Cycles and the impact of shocks on output and price have been with this assumption that these effects are symmetric, this means that the effects of expansion and contraction policies (positive and negative shocks) is the same. But the New Keynesian like Mankiw (1985), cover (1992) discussed the asymmetric effects especially in relation to the impacts of monetary policies on production and price. New Keynesian economists insist on adherence in the markets and in this way explain the effect of demand shocks in the economy. Asymmetric effects of monetary policy can be seen in many theoretical models which can be divided into three types:

A - Those that are related to the operation of monetary policy, so that a negative monetary shock has a greater effect on the production than the positive monetary shock. This kind of asymmetry can be observed since the aggregate supply curve to be convex due to the adherence of price and wage. The difference between the current and desired nominal prices becomes more due to the positive monetary shocks; while due to the negative monetary shock, the current price is driven towards the desired price. So, it can be concluded that the positive monetary shock has a greater effect on prices. While negative shocks have a greater effect on production.

B - The second type of asymmetry focuses on the size of the operation of monetary policy. Therefore, small monetary shocks influence the real economic more than the large shocks. The

results of some studies such as Raven and Martin (1999) suggest that the big and small shocks have asymmetric and different impacts on production and thereby on the price. In other words, when very great shocks occur, the effects of positive and negative shocks on the economy are asymmetric. Menu cost model provided by Ball and Romer (1989) is a complete summary of this type of asymmetry. In this model, when a monetary shock occurs, a change is created in production, while the prices do not change.

C - The third type of asymmetry of monetary policy is that the monetary shocks effects on output depend on the boom or recession status of economy. The economic conditions influence the symmetric or asymmetric effects of monetary shocks. This means that in low inflation conditions, there is no significant difference between the effects of positive and negative shocks on real output and prices. But this difference increases with rising inflation rate.

**Model Stipulation**

Markov-Switching model for the first time was presented by Kvant (1972), Kvant and Goldfld (1973) and then was developed by Hamilton (1989) to extract the business cycles. Unlike other nonlinear methods in which the transition from one regime to another is gradually done, in the Markov- switching model transition is done quickly. In the Markov-switching model it is assumed the regime that occurs at t time was not visible and depends on an invisible process (St). In a model with two regimes, it is easily assumed that St possesses 1 and 2 values. A two regimes AR (1) model can be demonstrated as follows:

$$\begin{cases} \emptyset_{0,1} + \emptyset_{1,1}\, y_{t-1} + \varepsilon_t & \text{if} \quad S_t = 1 \\ \emptyset_{0,1} + \emptyset_{1,2} y_{t-1} + \varepsilon_t & \text{if} \quad S_t = 2 \end{cases} \tag{1}$$

Or, can be briefly written as follows:

$$y_t = \emptyset_{0,S_t} + \emptyset_{1,S_t} y_{t-1} + \varepsilon_t \tag{2}$$

$$\varepsilon_t \varepsilon_{\sim IID(0,\sigma^2(S_t))}$$

The features of St process should be specified to complete the model. In Markov- switching model of St, a Markov process is considered as the first degree. This assumption reflects this fact that St only depends on the regime of previous period namely the St-1. The model is completed with the introduction of possible transition from one state to another in the following:

$$\begin{aligned} &(S_t = 1 | S_{t-1} = 1) = p_{11} \\ &P(S_t = 2 | S_{t-1} = 1) = P_{12} \\ &P(S_t = 1 | S_{t-1} = 2) = P_{21} \\ &P(S_t = 2 | S_{t-1} = 2) = P_{22} \end{aligned} \tag{3}$$

In the above equations, Pij indicates Markov chain movement probability from state i at time t-1 to state j at time t. Pij should be positive and also the following conditions to be provided for them (Kazerooni et al., 2013)

$$\begin{aligned} &P_{11} + P_{12} = 1 \\ &P_{21} + P_{22} = 1 \end{aligned} \tag{4}$$

After the introduction about the Markov-switching method, the research model is presented here.

$$AVIx_t = C(S_t) + \sum_{i=1}^{p} \alpha_i\, (AVIx_{t-1}) + \sum_{j=1}^{p} \beta_j ShockP_{t-j} + \sum_{j=1}^{q} y_j ShockN_{t-j} + \sum_{k=1}^{p} £_k\, ShockP_{t-k} + \sum_{k=1}^{q} \mu_k\, ShockN_{t-k} + \varepsilon_t \tag{5}$$

The above equation refers to the model of investigation the effects of changes in the real exchange rate and the volume of money on the industrial subsection. The added value of the industrial subsection and in the fixed price is 1997. AVIxt that ShockPt and ShockNt is respectively

the positive and negative shocks of the real exchange rate and the amount of money that can be calculated as following:

$$ShockP_t = \max(\varepsilon_t ,0)$$
$$ShockN_t = \min(\varepsilon_t ,0) \quad (6)$$

In this model we have considered two subsections of A and b that subsection a contains subdivision of food, drinking and tobacco and subsection b including textiles, clothing, leather.

Extracting the positive and negative shocks of the real exchange rate by using vector auto-regression pattern

The vector exploratory method is used to extract the positive and negative shocks of the exchange rate. This means that the real exchange rate with its influencing variables are entered into a VAR model, then is calculated as disturbing relevant to the equation of the real exchange rate and then is analyzed to two positive and negative parts through the following rule:

$$ShockP_t = max(\varepsilon_t ,0)$$
$$ShockN_t = min(\varepsilon_t ,0) \quad (7)$$

In which εt is the sentences disturbing VAR model which is estimated for the real exchange rate. The general form of the vector auto-regression model is as follows:

$$Y_t = A + \sum_{i=1}^{t} B_i Y_{t-i} + \varepsilon_t \quad (8)$$

In which Y is the vector of endogenous variables of model and A is the vector of components of the intercept of the equation.

1 is the sign of the maximum number of intervals and ε is the vector of random disturbing components which is assumed to have normal distribution with zero mean and constant variance.

The shape of the matrix of the estimated VAR model in this study is as follows:

$$\begin{bmatrix} LRER_t \\ OIL_t \\ OPEN_t \\ RESERVE_t \\ TOT_t \end{bmatrix} = \begin{bmatrix} \alpha_1 \\ \alpha_2 \\ \alpha_3 \\ \alpha_4 \\ \alpha_5 \end{bmatrix} + \sum_{i-}^{i-1} \begin{bmatrix} \beta_{11,i} & \beta_{12,i} & \beta_{13,i} & \beta_{14,i} & \beta_{15,i} \\ \beta_{21,i} & \beta_{22,i} & \beta_{23,i} & \beta_{24,i} & \beta_{25,i} \\ \beta_{31,i} & \beta_{32,i} & \beta_{33,i} & \beta_{34,i} & \beta_{35,i} \\ \beta_{41,i} & \beta_{42,i} & \beta_{43.i} & \beta_{44,i} & \beta_{45,i} \\ \beta_{51,i} & \beta_{52,i} & \beta_{53,i} & \beta_{54,i} & \beta_{55,i} \end{bmatrix} \begin{bmatrix} LRER_{t-i} \\ OIL_{t-i} \\ OPEN_{t-i} \\ RESERVE_{t-i} \\ TOT_{t-i} \end{bmatrix} + \begin{bmatrix} \varepsilon_1 \\ \varepsilon_2 \\ \varepsilon_3 \\ \varepsilon_4 \\ \varepsilon_5 \end{bmatrix} \quad (9)$$

As it can be seen all variables of model are endogenous in which the explanation of variables are:

OILt: The ratio of oil revenues to gross domestic product in constant prices of 1998

OPENt: The ratio of sum of exports and imports to gross domestic product in constant prices of 1998

RESERVEt: The ratio of exchange reserves to gross domestic product in constant prices of 1998

TOTt: The ratio of exported products prices to imported products prices in constant prices of 1998

LRERt: The logarithm of the real exchange rate which is calculated as follows:

$$LRER = \ln(NER \frac{CPI_{IR}}{CPI_{us}} \quad (10)$$

NER: Nominal exchange rate (national currency units numbers to one $ exchange) CPIUS: The producer price index of America

CPIIR: The consumer price index of Iran

$H_0$=$\sum_{j=1}^{q} \beta_j = \sum_{j=1}^{q} y_j$ is examined to test the asymmetry of the effects of the real exchange rate shocks on gross domestic product growth.

Monetary volume shock is obtained by the most important variables influencing the amount of money and the VAR model.

**Estimating the model**

As it is also mentioned in the model introduction, the Markov-switching method is used in this study to examine the effects of positive and negative shocks of the real exchange rate on economic growth. Markov-switching model is an appropriate model if the pattern of the examined data to be non-linear. The LR test is used to ensure about the pattern of the nonlinearity of the evaluated data. The statistic value of this test is calculated by maximum values of verisimilitude two competing models; a model with a regime (linear model) and another model with two regimes (non-linear model) with chi-square distribution. If the statistic value to be greater than the critical values at the desired reliability level, it can be said that the linear model is not a suitable in that reliability level and the non-linear model should be used.

**Table 1. LR test results to subsection A and exchange shock**

| Statistic value | Degrees of freedom | Value of probability |
|---|---|---|
| -25.63290 | 32 | 0.0000 |

**Table 2. LR test results to subsection A and monetary shock**

| Statistic value | Degrees of freedom | Value of probability |
|---|---|---|
| 2.377916 | 31 | 0.0000 |

**Table 3. LR test results to subsection B and exchange shock**

| Statistic value | Degrees of freedom | Value of probability |
|---|---|---|
| 13.23658 | 32 | 0.0000 |

**Table 4. LR test results to subsection B and monetary shock**

| Statistic value | Degrees of freedom | Value of probability |
|---|---|---|
| 7.941836 | 32 | 0.0000 |

According to the results of the above table, the statistic value of LR test is greater than its critical value at the 5% significance level. Therefore, it is better to use the non-linear Markov-switching model instead of the linear model to estimate the model.

The Akaike and Phillips Perron information statistic is used to determine the optimal number of pauses in estimating the model. The values of these statistics are given in the following tables.

**Table 5. The results of Akaike and Phillips Perron criteria to determine the optimal pause of subdivision a model and exchange shock**

| Pause | FPF | AIC |
|---|---|---|
| 0 | 0.002033 | 2.315571 |
| 1 | 0.000734 | 1.293702 |
| 2 | 0.000660* | 1.177723* |
| 3 | 0.000678 | 1.179146 |

**Table 6. The results of Akaike and Phillips Perron criteria to determine the optimal pause of subdivision a model and monetary shock**

| Pause | FPF | AIC |
|---|---|---|
| 0 | 6.38e-06 | -3.448028 |
| 1 | 2.41e-06 | -4.423855 |
| 2 | 2.02e-06 | -4.611238 |
| 3 | 2.02e-06* | -4.637427* |

**Table 7. The results of Akaike and Schwartz criteria in determining the optimal pause of subdivision B model and exchange shock**

| Pause | FPF | AIC |
|---|---|---|
| 0 | 0.001560 | 2.050752 |
| 1 | 0.000819 | 1.403980 |
| 2 | 0.000701* | 1.237629* |
| 3 | 0.000807 | 1.354014 |

**Table 8. The results of Akaike and Phillips Perron criteria in determining the optimal pause of B subdivision model and monetary shock**

| Pause | FPF | AIC |
|---|---|---|
| 0 | 4.89e-06 | -3.715593 |
| 1 | 2.71e-06 | -4.309111 |
| 2 | 1.86e-06* | -4.693496* |
| 3 | 2.04e-06 | -4.629195 |

The following tables show the results of the Markov-switching model estimation for the dependent variable of the value added of the selected subdivisions of the Iranian industry.

**Table 9. The results of the Markov-switching model estimation for the value added dependent variable of part a of industry and exchange shocks**

| Name of variable | Coefficient | Standard deviation | Statistic value of z |
|---|---|---|---|
| $c_1$ | 136.4438 | 21.9948 | 1.152675 |
| $c_2$ | 140.6182 | 21.9985 | 1.118430 |
| $Shock_N$ | 2.568176 | 1.761192 | 0.930097 |
| $Shock_p$ | -2.788025 | 1.651965 | -0.0419128 |

**Table 10. The results of the Markov-switching model estimation for the value added dependent variable of part a of industry and monetary shocks**

| Name of variable | Coefficient | Standard deviation | Statistic value of z |
|---|---|---|---|
| $c_1$ | 120.9471 | 46.5376 | 0.270855 |
| $c_2$ | 125.3267 | 46.5283 | 0.280669 |
| $Shock_N$ | 12402.79 | 2466.1 | 0.050291 |
| $Shock_p$ | -2.115565 | 2.26664 | -0.083730 |

**Table 11. The results of the Markov-switching model estimation for the value added dependent variable of part B of industry and exchange shocks**

| Name of variable | Coefficient | Standard deviation | Statistic value of z |
|---|---|---|---|
| $c_1$ | 15.00896 | 3.902780 | 3.845711 |
| $c_2$ | 18.74527 | 3.876646 | 4.835434 |
| $Shock_N$ | -1.889058 | 2.592188 | -0.728750 |
| $Shock_p$ | 0.141687 | 0.019272 | 0.028229 |

**Table 12. The results of the Markov-switching model estimation for the value added dependent variable of part B of industry and monetary shocks**

| Name of | Coefficient | Standard deviation | Statistic value of z |
|---|---|---|---|
| $c_1$ | 14.05977 | 4.593819 | 3.908793 |
| $c_2$ | 17.95216 | 4.601463 | 3.055500 |
| $Shock_N$ | -29029.56 | 2295965 | -0.012644 |
| $Shock_p$ | 16.04145 | 5.74204 | 0.623162 |

Based on the results of the above table, all coefficients are significant at 5% level except the first pause of the negative shock of the real exchange rate. The value of the intercept in the first regime is greater than the value of the intercept in the second regime.

The influencing way of the positive and negative shocks of the exchange rate and the amount of money on added value of subdivisions is more important than anything else in this study.

Negative shock effect of exchange rate on the value added subdivision a is 2.56. In other words, a unit increase in the negative shock leads to 2.56 unit decrease in the added value of subdivision a ( Since the negative shock variable contains negative number, a unit increase in the negative shock is equivalent to -1 unit change in the value of this variable. Therefore, it is important to note that the inverse sign of the obtained coefficient indicates the direction of the impact of negative shocks). The positive shock effect of exchange rate on value added subsection a is -2.78, in the sense that a unit increase in positive shock of the exchange rate leads to 2.78 unit decrease in the value added subsection a. In the case of monetary shocks, it should also be said that the negative shocks effect of money on value added subsection a is 12402, namely a unit increase in the monetary negative shock leads to 12402 unit decrease in the value added subsection a. The positive shock effect of money on value added subsection a is -2.11, it means that a unit increase in the monetary positive shock decrease value added subsection a about 2.11 unit.

The negative shock effect of exchange rate on the value added subdivision b is -1.88, in other words, a unit increase in the negative shock leads to 1.88 unit increase in the value added subsection b. The positive shock effect of exchange rate on the value added subdivision b is 0.14, namely, a unit increase in the positive shock of exchange rate leads to0.14 unit increase in the value added subsection b. About monetary shocks, it should also be said that the monetary negative shock effect on the value added subsection b is -29029 that a unit increase in monetary negative shock leads to 29,029 unit increase in the value added subsection b. The monetary positive shock effect on the value added subdivision b is 16, it means that a unit increase in monetary positive shock increases the value added subdivision b to 16 units.

To express an idea about symmetric or asymmetric efficacy of exchange and monetary shocks on the value added industry subsection, this issue should be statistically confirmed and Wald test can be used for this purpose.

**Table 13. The results of the Wald test for examining the symmetry of positive and negative shocks of the real exchange rate and the amount of money of subdivision a and exchange shock**

| statistic of Wald test | statistic value of test | Value of possibility |
|---|---|---|
| $\chi^2(1)$ | 657 | 0.0000 |

**Table 14. The results of the Wald test for examining the symmetry of positive and negative shocks of the real exchange rate and the amount of money of subdivision a and monetary shock**

| statistic of Wald test | statistic value of test | Value of possibility |
|---|---|---|
| $\chi^2(1)$ | 565 | 0.0000 |

**Table 15. The results of the Wald test for examining the symmetry of positive and negative shocks of the real exchange rate and the amount of money of subdivision b and exchange shock**

| statistic of Wald test | statistic value of test | Value of possibility |
|---|---|---|
| $\chi^2(1)$ | 175 | 0.0000 |

**Table 16. The results of the Wald test for examining the symmetry of positive and negative shocks of the real exchange rate and the amount of money of subdivision b and monetary shock**

| statistic of Wald test | statistic value of test | Value of possibility |
|---|---|---|
| $\chi^2(1)$ | 76 | 0.0000 |

Wald test results that are reported in the tables above indicates the asymmetry of positive and negative shocks of the exchange rate and the amount of money on the selected industrial subdivision of Iran. Given that the statistic value of test is greater than its critical value, so the hypothesis of the coefficients equality of positive and negative shocks cannot be accepted and consequently the symmetric effect of the positive and negative shocks of exchange rates and volume of currency on the value added of industry subdivision is rejected.

The following tables show the possible transfer from one subdivision to another for each selected industry subdivision of Iran.

**Table 17.The probability of transition from one regime to another regime of subdivision a and exchange shock**

| | Regime 1 | Regime 2 |
|---|---|---|
| Regime 1 | 0.205138 | 0.794872 |
| Regime 2 | 0.053610 | 0.946390 |

**Table 18. The probability of transition from one regime to another regime of subdivision a and monetary shock**

| | Regime 1 | Regime 2 |
|---|---|---|
| Regime 1 | 0.944881 | 0.055119 |
| Regime 2 | 0.657895 | 0.342105 |

**Table 19. The probability of transition from one regime to another regime of subdivision b and exchange shock**

| | Regime 2 | Regime 1 |
|---|---|---|
| Regime 1 | 0.232750 | 0.767250 |
| Regime 2 | 0.079575 | 0.920425 |

**Table 18. The probability of transition from one regime to another regime of subdivision b and monetary shock**

| | Regime 1 | Regime 2 |
|---|---|---|
| Regime 1 | 0.916434 | 0.083566 |
| Regime 2 | 0.630016 | 0.369984 |

The above tables indicate the probability of transition from one regime to another regime for subdivision a and exchange shock. As it can be seen, regime 2 is the most stable regime, because the probability of transition from this regime to the regime itself is very high and is about 0.94. In other words, if in period t-1 the economy to be in regime 2, with approximate probability of 94% will also be in this regime in period t. The interpretation is similar for other tables.

**Conclusion**

Changes in the industrial sector have particular importance in the economic development of countries that in this regard, one of the major issues addressed by economists is the impact of changes in the real exchange rate on the industrial sector. Evaluating the process of changes in exchange rates in Iran indicates that despite the sharp increase in official exchange rate of Iran

during 1993- 2003 and its relative increase in 2013, the real exchange rate has steadily declined over the downtrend. Therefore, due to the impact of changes in exchange rate on various industries, this study examines the effects of changes in the real exchange rate on the selected industrial subdivision during the period 1972 – 2012 by using a Markov-switching model. The results of the research models estimation showed that the real exchange rate has a significant and negative impact on the value added industry a and positive impact on industry b. The positive effect of the increase in the real exchange rate in the industry can be attributed to the increase in competitiveness power of producers in front of foreign competitors. By increasing the real exchange rate, exports are reinforced and imports are reduced due to more expensive foreign products and this leads domestic consumers to the use of domestic goods that are cheaper. The negative impact of exchange shocks on subdivision a can be related to the inelasticity of this section. Since the productions of this subsection are considered as essential requirements of people and according to the problems of per capita income and poverty line, a large crowd of people spend a significant portion of their cost in this subsection. Therefore, any shock including internal and external or positive and negative has adverse effect on the production and consumption of this subsection. So, maybe a single currency policy cannot be adopted for all industries because the exchange rate is different for different industries. Estimates showed that currency and monetary shocks affect the industrial subdivision of Iran. Moreover, considering that the coefficients of the impact of this shock on various industrial subdivisions of Iran were different; it can be said that the vulnerability of various parts from these shocks varies and perhaps some of these subsections benefit from the currency and monetary shocks.

These evidences indicate that the industry sector has high dependence on foreign trade. So, according to the theoretical fundamentals, the exchange rate channel has more prominent role in effectiveness of monetary policy. However, the similar results cannot be obtained about other influencing channels of monetary policy such as credit channel which can be analyzed based on the size of firms in different sectors.

It should be noted that the monetary policy is implemented by the central bank which is controlled by government. Therefore, the value of volume of money (monetary base) is determined by the central bank's foreign assets (exchange earnings from oil sales) and public sector borrowing from the central bank.

**Practical recommendations**

The results of this study show the need for reforming the exchange policies and its supplement (especially tariff policies) in order to protect the interests of all industries, especially industries that have exported comparative advantage. Also, reforming the industrial structure of the country to deal with any shock in the price of imported goods which constitute the raw materials of industry sector along with reducing the industrial dependence on imported raw materials can prevent the negative impact of the increase in the real exchange rate in the value added of the industry sector.

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