

Exchange Rate Policy of Iran

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Abstract

The exchange rate regime in Iran is practically fixed. The Central Bank of Iran (CBI) has committed itself to trying to bring about a particular exchange rate regime to meet two important targets: 1. Sustaining competitiveness of the economy, 2. Acquiring the share of foreign reserves in monetary base in a predetermined level. Since 2001 the share of foreign reserves in monetary base has increased, which suggests that the sensitivity of CBI toward its second target should have also increased. This study tries to test whether this hypothesis is statistically significant. A Markov Switching model is used to test this hypothesis. The results show that from 2001 the sensitivity of CBI toward its second target has increased significantly, while its sensitivity toward the first target has decreased.

Keywords: exchange rate, foreign reserves, competitiveness, Markov switching.

JEL Classification: E52, E58, E61, E63

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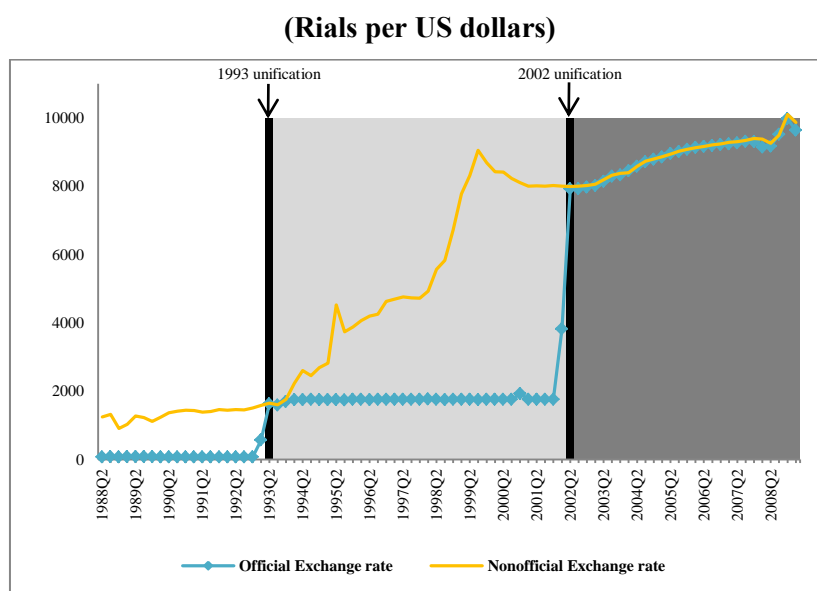
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1. Introduction

For three decades from 1970 s to 1990's, the exchange rate regime of the Islamic Republic of Iran was based on a multi-layered system, where there was more than one official exchange rate. Over the years, economy of Iran has experienced many forms of foreign exchange rate regulations, which caused an emergence of a black market beside the official market.

In both pre- and post-revolution periods, the Central Bank of Iran implemented a fixed exchange rate regime, albeit with periodic devaluations. Prior to the Islamic Revolution in 1979, the official exchange rate between the Rial and the US dollar was approximately 70 Rials per-dollar (Kamalian, et al, 2009).

Figure (1) Official and Nonofficial Exchange Rates



The white area is pre 1993 unification period; the light gray area is post 1993 unification and pre 2002 unification period and the dark gray area is post 2002 unification period which reduced the number of exchange rates to one unique exchange rate.

In early years of the Islamic Republic, multiple exchange rates regime, conventionally, had some appeal for the economy of Iran. With this system the official exchange rates varied in response to different economic conditions. Conversely, studies showed that parallel exchange rates were more likely to be adopted when economic performance was poor. Hence, the Central Bank of Iran (CBI) made attempts to reduce the number of exchange rate in the 1990 s. Successively, in 1991, the number of official exchange rates was reduced from seven to three.

Later, in March 1993, the three official rates were unified and the official rate was linked to the parallel exchange rate (Figure 1). While the premium on the parallel exchange market was virtually eliminated in the period immediately following unification, the negative feedback mechanism linking economic performance and parallel exchange markets was revealed. The continued provision of foreign exchange for essential imports, and repayments of foreign debt at a more appreciated exchange rate paired with a steep decline in international oil prices, negatively affected the fiscal position. This led to the separation of the official and the parallel exchange rates, and, in May 1994, the authorities reverted to a dual exchange rate system by establishing a more depreciated export rate in addition to the official rate (Sundararajan et al., 1999, P.4).

After the introduction of export rate in 1994, the premium exchange rate of the parallel market over the official rates increased steadily. Consequently, to fill this gap, the export rate was depreciated to 3,000 Rials per U.S dollar. In early July 1997, a new exchange rate was introduced through the Tehran Stock Exchange (TSE), however, unlike earlier practice, to fill the new gap; this new exchange rate was appreciated relative to those of parallel market.

In the next years, CBI depreciated the TSE rate significantly so the gap between this rate and parallel market rate decreased considerably.

Then in 2000, imports that were financed at the official export rate were gradually shifted to TSE rate.

Finally, on March 2002 exchange rate unification took place. Since then CBI has been using a managed floating exchange rate regime. The unified exchange rate has increased gradually from 8,193 Rials per U.S dollar in 2003 to around 1,000 Rials per dollar in early 2011.

Over the past decades, CBI has tried to manage the fluctuation of nominal exchange rate to protect the competitiveness of the economy. This has been done through monitoring the difference between domestic and foreign inflation. When domestic inflation is higher than foreign inflation, CBI tries to depreciate the Rial. Rial depreciation is the loss of value of Rial with respect to a foreign currency, and it is used for the unofficial increase of the exchange rate due to market forces. Also, CBI responds to its foreign reserves fluctuations and keeps the ratio of foreign reserves to monetary base relatively stable by controlling the nominal exchange rate. When the foreign reserves of CBI increases (mostly through higher oil income), the monetary base starts to rise and CBI starts to appreciate Rial to decrease the value of foreign reserves in Rial, and keep the ratio of foreign reserves to monetary base relatively constant. However, since exchange rate unification in 2002, the sensitivity of CBI towards these two goals for managing the nominal exchange rate has been changed considerably. Thus, in this paper we first try to introduce and estimate an exchange rate policy rule which stipulates how much the Central Bank of Iran would change the nominal exchange rate in response to factors affecting its behavior in foreign exchange market. Then, we test if CBI's sensitivity towards its targets has changed during the time.

The paper is organized as follows; the next section reviews the literature examining the exchange rate regime adopted in Iran. In addition, the section reviews some empirical studies conducted on the determinants of the real exchange rate in Iran. Section 3 discusses the historical data of Iran and section 4 introduces a model, which seems to

best explain the exchange rate regime in Iran and section 5 presents some concluding remarks.

2. Literature Review

This section starts with a brief review of the relevant literature evaluating the experience of Iran with various exchange rate arrangements. Then it reviews the literature that focus on determinants of real exchange rate in Iran.

Sundararajan et al., (1999) review developments in the exchange rate system in the Islamic Republic of Iran and the real effective exchange rate (REER). They also study the determinants of the REER concerning the choice of exchange rate regime after unification. Then the paper discusses the way exogenous economic variables and shocks affect the real exchange rate.

Tayebi and Nasr Elahi (2002) introduce total productivity of factors of production, (TPF), the ratio of current expenditures to development expenditures as an index of government fiscal policy, domestic terms of trade, ratio of Central Bank exchange reserves to the base money and an index of import-intensive of investment as the determinants of the Long Run Equilibrium of Real Exchange Rate (LRER) in Iran. Historically, there have been at least five real exchange rates in Iran in the form of; real effective formal exchange rate, real effective parallel exchange rate, real effective export exchange rate, real effective receivable exchange rate and real effective payment exchange rate. The study explains that the effects of each of these differ when using different types of real exchange rate.

Celasun (2003) reviews the evolution of exchange rate policy in Iran from 1993 to 2002 and argues the basic criteria for the choice of the exchange rate regime in a medium term. Then he references to the advantages of an intermediate regime which would allow the authorities

to smooth out excessive short term exchange rate fluctuations while letting nominal exchange rate move in response to oil price shocks.

Valadkhani (2004) examines the short-run and long-run determinants of the black market exchange rate using the co-integration techniques for the annual time series data from 1960 to 2002. This paper verifies that black market exchange rate is co-integrated with the relative consumer price indices in Iran and the U.S. real GDP and the relative import prices. In the short-run only a rise in relative prices and a meager growth in real GDP have been responsible for the depreciation of Iran currency.

Mehrara (2005) examines the determinants of equilibrium real exchange rate in Iran for the period 1959-2002. The paper introduces productivity growth in supply side and fiscal policies, monetary policies, tariff index and the ratio of import and non-oil export difference to GDP (resource balances) in demand side as the determinants of real equilibrium exchange rate. It finds that resource balances as leading variable have the greatest contribution in nominal and real exchange rate fluctuations. Also, policy makers have been conservative in varying exchange rate. They have applied other instruments like trade restrictions to restore equilibrium in the economy.

There are some other papers that study the evolution of exchange rate system or discuss the determinants of real exchange rate in Iran. However, inspection of exchange rate policy rules by which the Central Bank of Iran determines and modifies the nominal exchange rate is absent in the literature. In other words, in this paper we try to introduce factors that can influence the CBI in specifying the exchange rate rules.

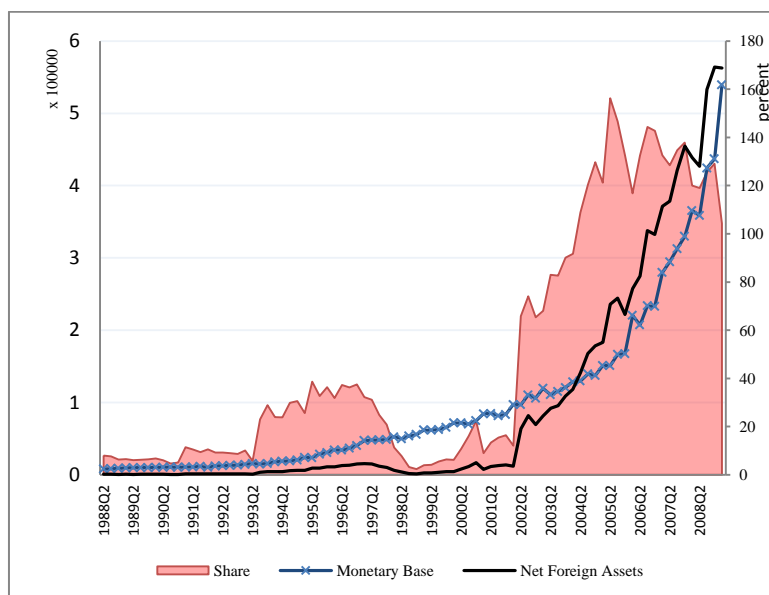
3. Data Analysis

Here, we first conduct a historical and statistical review of how exchange rate and oil price affect NFA¹ and monetary base in Iran. Then we introduce a model, which can best explain the policy rule by which CBI

1- Net Foreign Assets.

tries to intervene in exchange rate determination. We use a sample of seasonal data (official and nonofficial) on exchange rate, oil price, monetary base and NFA, from 1988:2 to 2009:1¹ to review the history of exchange rate system in Iran.

Figure (2) Monetary Base, NFA and the Share of NFA in monetary base



Note: The right axis measures the share of NFA to monetary base (shaded area) and the left axis measures NFA and monetary base in Rial.

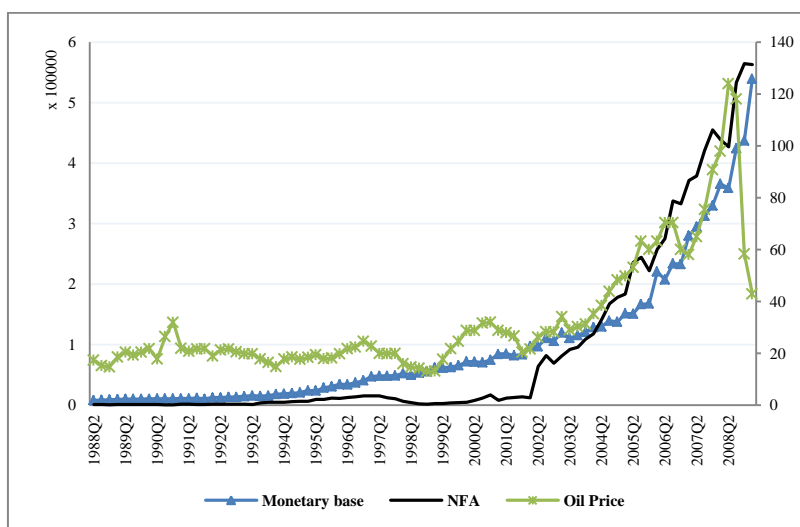
According to Figure 2, since 2002, when depreciation took place (March 2002 exchange rate unification), the Rial value of NFA switched up, which made it the largest portion of monetary base. Since then, the share of NFA in monetary base has been over 60 percent and even in recent years it has increased up to over 100 percent. Thus, changing exchange rate does have a great effect on Rial value of NFA, since most of NFA is in foreign currencies, which are exchanged with domestic

1- The Iranian Calendar is transformed to the Gregorian by considering the first quarter of Iranian calendar as the second quarter of Gregorian calendar. For example our sample data starts from 1367:1, according to Iranian calendar and we consider it approximately as 1988:2. This procedure is considered to all dates and data.

currency by government in central bank. These foreign currencies inflow into domestic economy through oil revenues and government has no choice but to exchange them with Rial in CBI, which yields to higher monetary base.

Figures 3 and 4 show how NFA and monetary base are linked to oil price and exchange rate. According to Figure 3, during 1988 to 2001, when oil price did not face a great increase and had a stable trend, NFA and monetary base did not rise much and had a smooth trend, which was due to appropriate monetary and fiscal policies. But from 2002, when oil price has started to rise, NFA and monetary base has jumped too. As mentioned before, the reason is that higher oil price is equivalent to more oil revenues and greater government income. To be able to spend this higher income in home economy, government has to exchange foreign currencies (mostly Dollars and Euros) with Rial. Since there is not enough demand for these currencies by private sector, CBI has no choice but to buy them all. Buying these currencies by CBI will result in higher NFA and monetary base. Figure 3 clearly shows that in periods with high oil price, NFA and monetary base has risen.

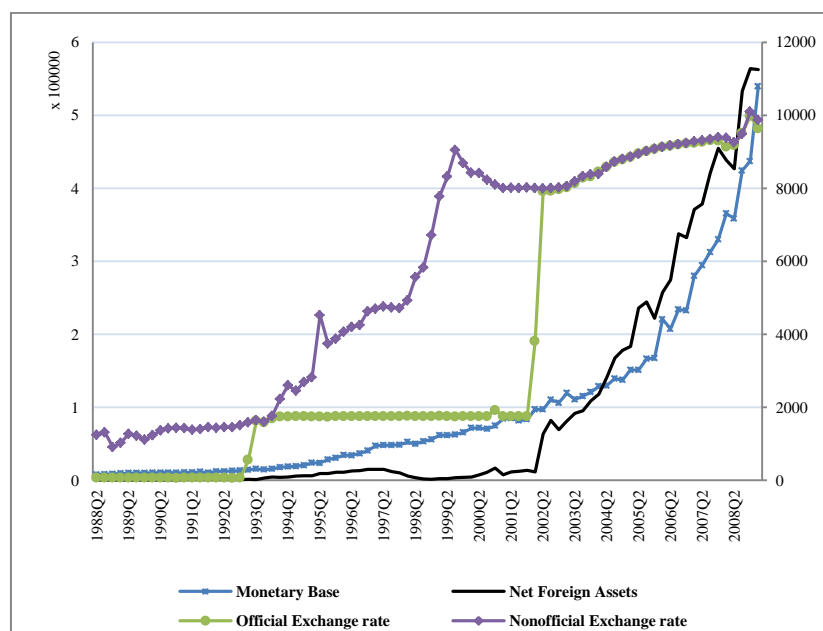
Figure (3) Monetary Base, NFA and Oil Price



Note: The right axis is oil price (barrels in US Dollars) and the left axis is NFA and monetary base in Rial.

Figure 4 shows how NFA and monetary base are related to exchange rate. As said before, CBI buys foreign currencies from government. Before exchange rate unifications these currencies were exchanged with Rial in an official exchange rate, but after unification which reduced all types of exchange rates to one, the value of NFA were modified. The Rial value of NFA rose as soon as the unification took place (on March 2002). Later on, Rial depreciation along with the increase in oil price caused an upward shift of NFA and monetary base.

Figure (4) Monetary Base, NFA and the Exchange Rate depreciation



Note: The right axis is the Exchange Rate (Rials per US Dollar) and the left axis is NFA and monetary base in Rial.

In this paper we want to represent an exchange rate policy rule by which the Central Bank of Iran regulates the exchange rate. CBI tries to reach two targets, to preserve managed floating exchange rate regime. First, CBI attempts to sustain the competitiveness of the economy. This

is done through monitoring the differences between home and foreign inflation. For instance, when home inflation is higher than foreign inflation, CBI tries to depreciate the Rial. Second, CBI tries to acquire the share of foreign reserves in monetary base. When foreign reserves of CBI increases, (mostly through greater oil revenues) the monetary base starts to rise and CBI tries to appreciate Rial to decrease the value of foreign reserves in Rial. This is because foreign reserves constitute greater portion of monetary base in Iran (Figure 2).

4. The Model

The model which best explains this policy rule, is shown as follow:

$$e_t = e_{t-1}^\rho \left\{ \bar{e} \left[\frac{RR_t / M_t}{(RR/M)^*} \right]^{\omega_R} \left[\frac{P_t^f / P_t}{(P^f/P)^*} \right]^{\omega_P} \right\}^{1-\rho} \varepsilon_t^e \quad (1)$$

where, e_t is nominal exchange rate, RR_t is Net Foreign Assets (NFA) in Rial, M_t is monetary base, P_t^f is foreign price index, P_t is home price index, $(\frac{RR}{M})^*$ is the target ratio of NFA to monetary base, $(\frac{P^f}{P})^*$ is the steady state ratio of foreign price to domestic price and ε_t^e is disturbance term which is assumed to have normal distribution.

According to Eq.1, if $\rho = 1$ or $\frac{RR_t}{M_t} = (\frac{RR}{M})^*$ and $\frac{P_t^f}{P_t} = (\frac{P^f}{P})^*$, then

$E(e_t) = E(e_{t-1})$ so the exchange rate regime is fixed, but if $\rho < 1$, then CBI determines the exchange rate in a way to meet its two targets. $E(\bullet)$ stands for expected value. Since in this case CBI wants to get to its targets, it is expected that both ω_R and ω_P to be negative; i.e. once the ratio of net foreign asset to monetary base gets to a higher amount than the target value, the CBI decreases the exchange rate. On the other hand, when home inflation is higher than foreign inflation, CBI increases the exchange rate. The values of ω_R and ω_P show the degree of the

sensitivity of CBI towards its targets. If $\rho = 0$, then CBI determines exchange rate according to NFA and inflations in home and foreign economies, so that the exchange rate regime would be flexible.

To estimate the parameters of the model we use the log-linearized form of Eq.1:

$$e_t = \rho e_{t-1} + (1 - \rho) \left\{ \omega_R \frac{R\bar{R}}{\bar{m}} (rr_t - \dot{m}_t) + \omega_P \frac{\bar{P}^f}{\bar{P}} (p_t^f - p_t) \right\} + \varepsilon_t^e \quad (2)$$

where, x is the deviation of logarithm of variable X from its steady state value and \bar{x} is the steady state value of variable X . We can estimate ρ in Eq.2 but we cannot estimate ω_R and ω_P independently, instead we can estimate $(1 - \rho)\omega_R \frac{R\bar{R}}{\bar{m}}$ and $(1 - \rho)\omega_P \frac{\bar{P}^f}{\bar{P}}$. Once these coefficients are estimated, we can calculate ω_R and ω_P , since we have the estimation of ρ from Eq.2 and the values of $\frac{R\bar{R}}{\bar{m}}$ and $\frac{\bar{P}^f}{\bar{P}}$ from the observed data.

Figure 2 shows the NFA, monetary base and the share of NFA in monetary base. According to Figure 2, the ratio of net NFA to monetary base has increased considerably since 2002. The reason is that the exchange rate unification occurred in 2002 which caused a considerable rise in Rial value of net foreign assets. So in recent years the share of NFA became higher than 1 (2004-2009). As Figure 2 shows, as soon as great depreciation took place in 2002, the Rial value of NFA increased considerably. After this time, high oil price and thereof, high oil revenues, along with slow depreciation increase the share of NFA in monetary base, making NFA the most important determinant of monetary base. As figure 3 shows there is a high correlation between oil price and monetary base. This correlation happens once more when oil revenues pour into the economy. Since the share of Iran in OPEC production is fixed, these revenues come from higher oil price, as the

quantity of oil product is nearly fixed. Then CBI exchanges these currencies into Rial, raising the NFA of CBI. Figure 4 shows the monetary base, NFA and exchange rate. According to this Figure, the exchange rate unification of March, 2002, caused a shift in the Rial value of NFA. This change along with higher oil price raised the NFA. This portion of monetary base has been the most important determinant of monetary base. Since 2002, it seems that via considerably higher share of NFA, the sensitivity of CBI to this part of monetary base has been increased. So, we expect that since 2002, the absolute value of ω_R to be higher while the absolute value of ω_P be lower. So there should be a shift in the sensitivity of CBI with respect to its targets. To test whether this hypothesis is true we first estimate Eq.2 using Ordinary Least Square (OLS) method, and then we estimate the following regime switching equation (MS)¹:

(3)

$$e_t = \rho e_{t-1} + (1-\rho) \left\{ \omega_R^{s_t} \frac{RR}{\bar{m}} (rr_t - \bar{m}_t) + \omega_P^{s_t} \frac{\bar{P}^f}{\bar{P}} (p_t^f - p_t) \right\} + \varepsilon_t^e \quad S_t = 1$$

where s_t is the state of the CBI policy rule and is assumed to follow a two state Markov chain with the following transition probability matrix (Hamilton (1994)):

$$P = \begin{bmatrix} P_{11} & P_{12} \\ P_{21} & P_{22} \end{bmatrix} \quad (4)$$

where

$$p_{ij} = \Pr[s_t = j | s_{t-1} = i], \quad \sum_{j=1}^2 p_{ij} = 1 \quad \text{for all } i \quad (5)$$

The following inequalities apply among the parameters of Eq.3: $|\omega_R^2| > |\omega_R^1|$ and $|\omega_P^1| > |\omega_P^2|$. Hence, state 1 refers to the period before

1- Markov Switching.

2002 and state 2 refers to the period after 2002, when the sensitivity of the CBI regarding NFA was increased.

Table (1) OLS Estimation of the Model

| $(rr_t - \hat{m}_t)$ | $p_t^f - p_t$ | e_{t-1} | e_{t-5} | MA(1) | MA(2) | MA(3) | R^2 |
|----------------------|---------------|-----------|------------|----------|----------|----------|-------|
| -0.01994 | -0.29415 | 0.944699 | -0.23386 | -0.4681 | -0.2454 | -0.2651 | 0.68 |
| (0.00666) | (0.0776) | (0.05332) | (0.039144) | (0.1887) | (0.1235) | (0.1185) | |

(Standard deviations in parenthesis)

We first estimate Eq.2 using Ordinary Least Squares approach and then use this estimation to test the existence of nonlinearity. The OLS estimation of Eq.2 is reported in Table 1. The standard deviations show that all coefficients are significant in %1 level. The estimated values of ω_R and ω_p can be calculated as described before. If we consider the means of $\frac{RR_t}{M_t}$ and $\frac{P_t^f}{P_t}$ as the steady state values, we can compute our main coefficients. The mean of $\frac{RR_t}{M_t}$ in our sample is 0.48564. We also calculate the value of ρ as sum of the coefficients of the lags of e_t . Therefore, the estimated value of ω_R is -0.14199. But the mean of $\frac{P_t^f}{P_t}$ is approximately 1. Therefore, the estimated value of ω_p is simply -1.0173. MA (q) is qth-order moving average process, which is used to remove autocorrelation in residuals.

The BDS test developed by Brock, Dechert and Scheinkman (1987), Hansen (1997) test and LM tests are used to test the nonlinearity in Eq.2. The BDS test is the most popular one for nonlinearity. We apply the BDS test with embedding dimension of 2 to 5 and $\varepsilon = 0.5, 1, 1.5$ and 2 standard deviation for residual of Eq.2. The BDS test statistics are reported in Table 2. The results suggest that we can reject the null hypothesis of linearity in favor of nonlinearity in %1 level.

Table (2) BDS Test Statistics

| Embedding Dimension | | | | |
|---------------------|----------|----------|----------|----------|
| \mathcal{E} | 2 | 3 | 4 | 5 |
| 0.5 | 5.036 | 8.566 | 14.465 | 24.208 |
| | (0.0) | (0.0) | (0.0) | (0.0) |
| 1 | 4.685 | 6.097 | 7.072 | 8.373 |
| | (0.0) | (0.0) | (0.0) | (0.0) |
| 1.5 | 3.131 | 3.613 | 4.334 | 5.118 |
| | (0.0017) | (0.0003) | (0.0) | (0.0) |
| 2 | 2.405 | 2.405 | 2.578 | 3.309 |
| | (0.013) | (0.0162) | (0.0099) | (0.0009) |

(P-values in parenthesis)

The Hansen and LM tests are also applied to test the nonlinearity effects. According to these tests we can also reject the null hypothesis of linearity (see Table 3). Hence, three tests we applied to our model strongly suggest that there exist nonlinearity effects in Eq. 2, therefore we can use Markov switching approach to our model to consider the nonlinear effects.

Table (3) Hansen and LM Tests

| Hansen | LM |
|---------|----------|
| 14.1407 | 7.113 |
| (0.079) | (0.0001) |

(P-values in parenthesis)

From the data of economy of Iran, there seems to be a switch in sensitivity of CBI with respect to its targets. Now, we try to estimate Eq.3, which takes into account this shift. The estimated parameters of Eq.3 are reported in Table 4. The estimation results show that all coefficients are significant in %1 level. So, we can compute our main coefficient, like we did before. Coefficient ρ which can be interpreted as a criterion for exchange rate regime is calculated as sum of coefficients of lags of exchange rate.

Table (4) Estimated Coefficients of Eq. 3

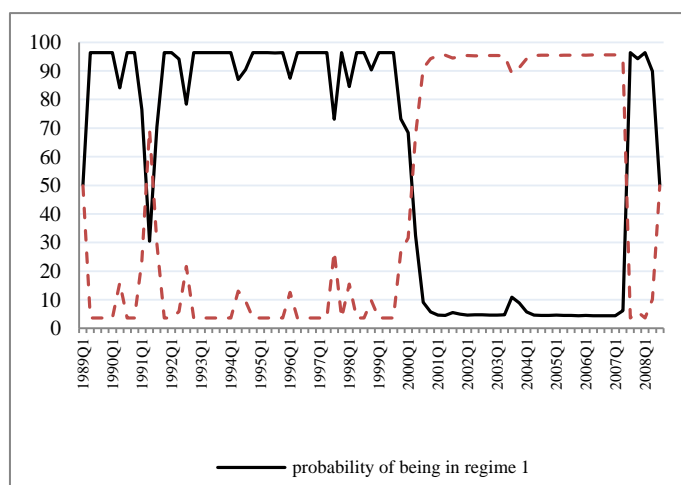
| | $(rr_t - \dot{m}_t)$ | $p_t^f - p_t$ | e_{t-1} | e_{t-5} | p_{11} | p_{22} |
|----------|----------------------|---------------------|--------------------|---------------------|---------------------|---------------------|
| Regime 1 | -0.0044 (0.00037) | -0.0828 (0.0021) | 0.9765 (0.0294) | -0.1439 (0.0047) | 0.9606 (0.00011) | 0.9641 (0.00043) |
| Regime 2 | -0.019 (0.0014) | -0.0687 (0.0149) | 0.9765 (0.0294) | -0.1439 (0.0047) | | |

Note: standard deviations in parenthesis

Hence, $\rho = 0.8167$ which explicitly says that exchange rate regime in Iran is managed floating. This means that CBI tries to keep the exchange rate fixed but somehow it takes into account other targets and slightly modifies the exchange rate. Using this value, the steady state values of $\frac{RR_t}{M_t}$, ω_R^1 and ω_R^2 are -0.0494 and -0.2134 respectively.

Following the same procedure, ω_p^1 and ω_p^2 are -0.4517 and -0.3748 respectively. Therefore, we can conclude that the sensitivity of CBI with respect to NFA has been increased, while that of competitiveness has been decreased.

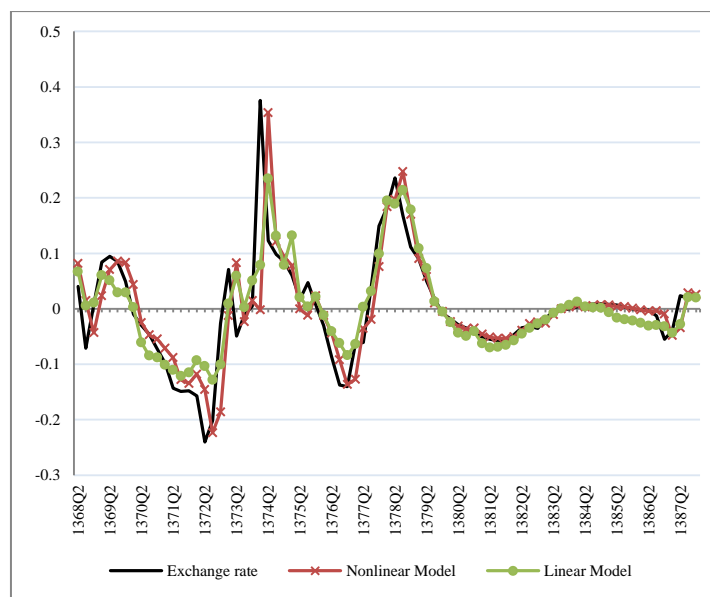
Figure (5) Probabilities of being in regime 1 or 2



The estimated probabilities of regime 1 or regime 2 are also reported in Table 4. The probabilities of about 96 percent for both regimes show that the results we have found are reliable, and there is no ambiguity in whether the model is in regime 1 or regime 2. The plotted graph of P_{11} and P_{22} , i.e. the probability of being in regime 1 and regime 2 respectively (Figure 5), shows that the two regimes are well defined, stable and recurrent which can be used to observe the sensitivity of CBI with respect to its targets.

As Figure 5 shows, up to 2001, the CBI has stressed more on competitiveness and the difference between foreign and home inflations rather than on Rial value of NFA, so that the economy was in regime 1. However, since 2001, which is close to 2002 exchange rate unification, the probability of being in regime 2 is higher than that of being in regime 1. Therefore, since 2001, the CBI becomes more sensitive to Rial value of NFA and less sensitive to the difference between foreign and home inflations.

Figure (6) The Fitness of Linear and Nonlinear Models



To show the advantageous and better fitness of nonlinear model, we plot the projections of linear and nonlinear models and cyclical part of exchange rate (Figure 6). Figure 6 shows the nonlinear model has more fitness than the linear model.

5. Concluding Remarks

Higher oil price in the form of higher oil revenues along with currency depreciation in Iran has resulted in a high NFA in monetary base. This excessive NFA considerably affects the monetary policy in economy of Iran because it is extremely related to external shocks, i.e. oil shocks. Therefore, monitoring the Rial value of NFA has become one of the major targets of CBI. This study examines the CBI exchange rate determination by the differences of home and foreign inflations and the Rial value of NFA. However, by higher oil revenues in recent years the importance of NFA in exchange rate determination has been increased considerably. The MS equation which is used to test this hypothesis confirms that higher NFA share in monetary base has forced CBI to emphasize more on the ratio of NFA to monetary base and less on the difference between home and foreign inflations in exchange rate determination process.

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