Causal Relation between Money Stock and Exchange Rate under the Fixed and Floating Regimes

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Abstract

Mundell-Fleming model of open economy macroeconomics states that the direction of the causal relationship between money supply and exchange rate is dependent on the exchange rate regime. In fact, in the fixed exchange rate regime, there is a bidirectional causal relationship between these two variables, while floating regime is characterized with the unidirectional causal relationship from money supply to exchange rate. This paper investigates this problem regarding Iranian exchange rate regimes using quarterly time series data for the relevant variables. This relationship has been investigated during three periods (1974:1-1992:4, 1993:1-2001:4, 2002:1-2008:4). Toda-Yamamoto causality test results show that in the fixed regime, or first period, there is bidirectional causality between money stock and market exchange rate (RIAL/DOLLAR) in Iran. In the second period, when no fixed exchange rate policies have been followed regarding the exchange rate regime, the results represent no significant relationship between the variables. Also, in the floating regime, or third period, there is bidirectional causality between the variables.

Keywords: Exchange Rate, Money stock, Fixed Exchange Rate Regime, Floating Exchange Rate Regime, Causal Relation

1. Introduction

This paper has investigated the causal relationship between money stock and exchange rate under fixed and floating regimes. This issue should be examined due to the problems and challenges regarding exchange rate decision making and policy making that Iranian economy is
facing. The research in this area is required due to the problems of liquidity and monetary policies as well as the challenges decision-makers and economic policymakers are facing in determining the appropriate exchange rate and exchange rate regime according to Iran economic conditions. During the recent years, adjustment of the real exchange rate and its relationship with a known exchange rate regime consistent with the economic conditions of Iran is among the problems Iranian economy is facing. Today, due to changes in the exchange rate regimes, the variable of exchange rate is presented as a key factor in economic policymaking more than before. According to the features of exchange rate regimes of Iran, this relationship has been investigated during three periods. In the first period (1974-1992), fixed exchange rate regime has been dominated on the exchange rate system. In the second period (1993-2001), the country does not have a fixed exchange rate regime and has been associated with changes in exchange rate regimes. At the beginning of this period, floating exchange rate regime was implemented in the form of managed float. But, after a while, due to debt crisis, exchange rate regime actually moved towards fixed exchange rate regime and announcement of two different exchange rates for the national currency; which continued until the end of period (Ministry of Economy and Finance, 2004). In the third period (2002-2008), floating exchange rate regime dominates the exchange rate regime of Iran in the form of managed float.

Monetary model of exchange rate determination includes a great deal of literature in the experimental studies. Today, the impact of monetary variables on the exchange rate has been more emphasized. The main root of the monetary approach to the exchange rate dates back to the time of floating exchange regime's inception, i.e. 1970s and is related to studies of Frenkel (1976) and Bilson (1978). A review of recent studies, including the studies of (Barnett, 2005), (Honing, 2005), (Bauer & Herz, 2007), (Nandwa & Ramesh, 2007) and (Ketenci & Uz, 2008), which have investigated the monetary approach to the exchange rate, suggests that the monetary approach to the exchange rate, or in other words, the impact of monetary variables on the exchange rate has been seriously emphasized. Through a study, (Mark & Sul, 2001) showed that there is a long-term relationship between the monetary variables and exchange rates and monetary variables predict the exchange rate. (Papadopoulos & Papanikos, 2002) examined the relationship between output, money, price, trade balance and exchange rate under fixed and floating exchange rate regimes, and showed that the effect of money on the flexible exchange rate regime is greater. (Maitra, 2009) showed that money supply plays an important role in the exchange rates (rupee/dollar). (Maitra & Mukhopadhyay, 2009) showed that in the Basket peg regime, there is bidirectional causality between exchange rate and money supply. (Maitra & Mukhopadhyay, 2009) and (Maitr, 2010) showed that there is a causal relationship between money supply and exchange rate in the free unidirectional floating exchange rate regime in terms of money supply to exchange rate.

2. Theoretical background

Generally, a part of the literature on the exchange rate regime features is focused on determination and recognition of exchange rate features, in which the articles of Mar. Fleming (1962) and Robert Mandel (1963) play a central role. Mandel and Fleming showed that in case
of high capital mobility, the results of economic stabilization policy implementation under fixed and floating exchange rate regimes would be quite different.

Mundell-Fleming model of open economy macroeconomics states that the nature and direction of the causal relationship between money supply and exchange rate is dependent on the exchange rate regime.

According to the Mundell-Fleming Model, an open economy with high capital mobility is described through the following equations:

\[ IS: \quad Y = C(Y-T) + I(r) + G + NX(e) \]  \( (1) \)

\[ LM: \quad \frac{M}{P} = L(r, Y) \quad L_r < 0, \quad L_Y > 0 \]  \( (2) \)

\[ r = r^* \]  \( (3) \)

Equation (1) represents goods market equilibrium and the equation (2) represents money market equilibrium. Equation (3) also suggests that international capital flows are fast enough to hold domestic interest rate \( r \) equal to the foreign interest rate \( r^* \) (Romer, 1996).

In this system, \( T, G \) (fiscal policy instrument) and \( M \) (monetary policy instrument) are exogenous variables. Also, due to the assumption of the Keynesian system, Foreign interest \( r^* \) rate and the price level \( p \) are fixed.

Exchange rate may be defined as two ways direct or indirect. In fact, Exchange rate may be defined as the number of foreign currency units per unit of domestic currency (Direct definition of exchange rate). In this case \( \frac{dm_r}{dm_t} < 0 \) represents decrease in the exchange rate following increase in the money supply. Also, Exchange rate may be defined as the number of domestic currency units per unit of foreign currency (Indirect definition of exchange rate). In this case \( \frac{dm_r}{dm_t} > 0 \) implies increase in the exchange rate following an increase in the money supply.

Exchange rate is calculated by the indirect method in Iran. Therefore, in this paper we use analyzes that are related to the indirect method.

According to equation (2) LM curve in space \( (Y, e) \) is vertical; because the exchange rate has not been entered in LM equation. The intersection point of the two curves LM and IS i.e. \( (Y, e) \) shows the equilibrium in both goods and money markets.

Suppose the central bank increases the money supply, which causes the LM curve to shift to the right. Consequently, the income level and exchange rate will increase. Since in the fixed exchange rate regime, the central bank will avoid the exchange rate changes, in these circumstances, it has to sell exchange rate. Through selling exchange rate and, in return, receiving domestic currency from the central bank, domestic money supply decreases. Thus, LM will gradually move to the left and the LM transfer will continue until the exchange rate return to its original level. Hence, monetary policy has no function in the fixed exchange...
rate regime, or it is not possible to run an independent monetary policy, which means that the central bank cannot change money supply in the fixed exchange rates regime, because money supply will be again reduced in the reverse direction (Rahmani, 2001).

Thus, in the fixed exchange rate regime, there is bidirectional causality between money supply and exchange rate (Maitra & Mukhopadhyay, 2009).

Again, suppose that the central bank increases the money supply. Therefore, LM curve shifts to the right. Thus, income level and exchange rate will increase. Since in the floating exchange rate regime, the central bank does not intervene in determining the exchange rate and the exchange rate is determined by market forces, there is a possibility of running an independent monetary policy in this regime. It means that money supply does not decrease again after the increase of the amount of money by the central bank (Rahmani, 2001).

Thus, in the floating exchange rate regime, there is unidirectional causality from money supply to exchange rate (Maitra & Mukhopadhyay, 2009).

3. Methodology and empirical results

In this research, hypotheses of existence of bidirectional causal relationship in the fixed exchange rate regime and unidirectional causal relationship in the floating exchange rate regime will be tested. The data used in this study are money stock for Iran and market exchange rate (RIALS/DOLLARS). The data has been seasonally collected from time-series data of the Central Bank of the Islamic Republic of Iran and has been analyzed. In this study, the variable of LE represents the natural logarithm of the exchange rate and LM represents the natural logarithm of the money stock.

To examine the casual relationships between variables in each period, Toda-Yamamoto causality method has been used. Toda-Yamamoto method makes it unnecessary for us to know them-co-integration characteristics of system and only knowing about VAR (Vector Autoregressive) rating and the maximum similarity degree of variables suffices to conduct this test (Zapata & Rambaldi, 1997). Since the degree of reliability of variables is required to conduct Toda-Yamamoto test, the reliability of variables was evaluated first. The results of HEGY and ADF unit root tests showed that the variables are I(0) in the first period and I(1) in the second and third periods.

Toda-Yamamoto causality Test:

To investigate the causality relationship between variables through Toda and Yamamoto method, the model used for Toda and Yamamoto test, including variables LE and LM were used with equations of the form (7) and (8) with \( p+d\) max lags:

\[
LE_t = \alpha_0 + \sum_{i=1}^{p+d \text{ max}} \alpha_{1i} LE_{t-i} + \sum_{i=1}^{p+d \text{ max}} \alpha_{2i} LM_{t-i} + \epsilon_t (7)
\]
\[ LM_t = a_0 + \sum_{i=1}^{p+d_{\text{max}}} a_{1i} LM_{t-i} + \sum_{i=1}^{p+d_{\text{max}}} a_{2i} LE_{t-i} + \varepsilon_t \] (8)

Here, \( d_{\text{max}} \) is the very maximum degree of co-integration of the variables used in the model and \( p \) is the order of the Vector Autoregressive Model.

In Toda and Yamamoto causality test (1995), the null hypothesis is based on lack of causality relationship which is identified by Wald test and its probability. For example, if the obtained probability is less than 5%, the null hypothesis will be rejected with more than 95% and causality will be approved.

Toda and Yamamoto causality test results are presented in table (1):

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Toda-Yamamoto Causality (Modified WALD) Test Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>direction of the causal relations</td>
<td>( \chi^2 )</td>
</tr>
<tr>
<td>LM → LE</td>
<td>29.04976</td>
</tr>
<tr>
<td>LE → LM</td>
<td>12.27303</td>
</tr>
<tr>
<td>direction of the causal relations</td>
<td>( \chi^2 )</td>
</tr>
<tr>
<td>LM → LE</td>
<td>2.003137</td>
</tr>
<tr>
<td>LE → LM</td>
<td>5.479293</td>
</tr>
<tr>
<td>direction of the causal relations</td>
<td>( \chi^2 )</td>
</tr>
<tr>
<td>LM → LE</td>
<td>18.16199</td>
</tr>
<tr>
<td>LE → LM</td>
<td>22.86302</td>
</tr>
</tbody>
</table>

First period (1974:1-1992:4): To examine the causal relationship from money stock to exchange rate, the probability is less than 0.05 and the null hypothesis suggesting the lack of causality between variables will be rejected. Also, to examine the causal relationship from exchange rate to money stock, the probability is less than 0.05. Thus, the null hypothesis suggesting the lack of causality between variables will be rejected. Thereby, in this period, there is bidirectional causality between variables of money stock to exchange rate.

Second period (1993:1-2001:4): Considering that in the examination of the direction of the causal relationship from both sides, the probability is greater than 0.05 and the null hypothesis suggesting the lack of causality will be approved. Thus, there is no causal relationship between variables of money supply and exchange rate in this period.
Third period (2002:1-2008:4): In order to investigate the causal relationship from money stock to exchange rate, the probability is lower than 0.05 and the null hypothesis suggesting the lack of causality between variables will be rejected. Also, to examine the causal relationship from exchange rate to money stock; the probability is less than 0.05. Thus, the null hypothesis suggesting the lack of causality between variables will be rejected. Thereupon, in this period, there is bidirectional causality between variables of money stock to exchange rate.

4. Conclusion

The results of Toda-Yamamoto causality test indicate that in the first period when the exchange rate regime is fixed, there is bidirectional causality between money stock and exchange rate (RIAL/DOLLAR) in Iran. In the Second period when no fixed exchange rate policies has been followed regarding the exchange rate regime and no similar exchange rate regime has dominated the whole period, the results represent no significant relationship between these two variables. Also, in the third period when the exchange rate regime is floating (in the form of managed float), there is a bidirectional relationship between the variables.

In other words, in the period when fixed exchange rate regime has dominated the whole period, the study results show bidirectional causal relationship between money stock and exchange rate; these results are consistent with suggestion of Mundell-Fleming about the relationship between money stock and exchange rate under the fixed and floating exchange rate regimes. In fact, the increase in money supply will lead to a depreciation of the domestic currency and the exchange rate increases. Since, the central bank is prevented from changing the exchange rate, in the fixed exchange rate system; so, in these Conditions, The central bank is forced to sell foreign exchange. With selling foreign exchange and against receiving domestic currency by the central bank, Domestic money supply falls. Hence, in system of fixed exchange rates, monetary policy does not so efficient.

In addition, in a period when a managed floating exchange rate regime has dominated the whole period, the study results indicate the bidirectional causal relationship from money stock to exchange rate. According to, Mundell-Fleming proposition, in floating exchange rate regime, there is a unidirectional causal relationship between these two variables, from money supply to exchange rate. In fact, in free floating exchange rate regime, Exchange rate is determined by market forces and the central bank does not intervene in the market. While, floating exchange rate regime, in Iran, has been implemented in the form of managed float. In this regime, supply and demand forces of market are the main factor in determining the exchange rate and the Central banks can sometimes alter the exchange rate. However, Market forces are not the main factor in determining the exchange rate in Iran and determining exchange rate (RIAL/DOLLAR), is greatly under the control of monetary authorities. So, interference in the market will also change money stock.
The central bank can use from buy and sell other assets of the central bank (e.g., bonds) in reverse foreign exchange buying and selling For neutralizing the effects of the intervention in the foreign exchange market on the money stock.

References


