How Does the Central Bank of Iran Control the Supply of Money in Circulation?

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Abstract. In this paper, we try to investigate how the money supply has to be controllable by the monetary authorities and how much control does central bank of Iran over money supply? Therefor , the purpose of this paper is to investigate the nature of the money supply process in light of the debate over the concept of exogenous and endogenous money supply to provide a detailed picture of the controllability of Iranian money supply under the reign of the Central Bank from the beginning of its monetary targeting period in 1968 until 2007. Therefore the paper investigated the cointegrating property and stability of the supply of money function in Iran. The paper employed the ARDL approach together with CUSUMand CUSUMSQ tests. The results show that M1 and M2 is cointegrated with net   claims on   the government,   net foreign assets, and rate of profit on bank deposit (interest rate and a major implication of using interest rate elasticity estimates from M2 function is that money is endogenous.

Key words: money supply, monetary policy, money multiplier, central bank, ARDL , financial sector

1. Introduction

'Virtually every monetary economist believes that the CB can control the monetary base and…the broader monetary aggregates as well. Almost all of those who have worked in a CB believe that this view is totally mistaken…' Goodhart (1994).

In discussions about the efficacy of monetary policy instruments, attention is often focused on analyzing the money supply process. Monetarists, in general, argue that   the monetary authorities can exercise effective control over the stock of money; others, especially those who share the new view of monetary theory argue that the determination of the stock of money is part of the economy. In this view, the stock of money is the outgrowth of the behavior of the public, the financial sector (banks), the finance ministry, and the rest of the world as well as of the actions of the central bank.

The strategy of monetary targeting, as pursued by the Central Bank, relies on two basic assumptions. One, the targeted monetary aggregate has to be a stable function of a few indicators (GDP, interest rate, etc.). This condition is commonly referred to as the necessary stability of money demand.Two, the money supply has to be controllable by the monetary authorities. Otherwise unpredicted changes in the growth rate of the money multiplier can jeopardise the usefulness and success of monetary targeting. As far as the first condition is concerned, in recent years several studies confirmed the existence of a stable Iran money demand function with adequate statistical properties. With regard to controllability, far less studies have been presented, however, the Central Bank had documented difficulties in meeting its growth targets for the observed broad aggregate M2. In this study we focus on the problems of controlling the latter during the unstable monetary period of after revolation.

Having determined the most appropriate definition of money and its relation to the price level, monetary authority must understand how its behavior is determined in order, to control it (if possible) in a way consistent with price and other policy objectives. This is a non-trivial undertaking, as a central bank's activities influence but do not directly determine money's behavior. Therefore the purpose of this paper is to

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investigate the nature of the money supply process in light of the debate over the concept of exogenous and endogenous money supply to provide a detailed picture of the controllability of Iranian money supply under the reign of the Central Bank from the beginning of its monetary targeting period in 1968 until 2007.

This paper is organized as follows. Section 2 is a brief literature review. Section 3 discusses the methodology used to test the nature of the relationship and develops a autoregressive distributed lag (ARDL) approach and undertakes a ARDL empirically identify the determinants of factors affecting money supply and to examine the stability of the money and using Iranian monetary data for the period March 1968 to March 2008. Section 4 concludes the paper.

2. Review of Literature

Early theories of money supply developed a mechanistic approach that did not allow for the possibility of ratios being behavioral functions of economic variables(such as the studies by Friedman and Schwartz (1963), and Phillip Cagan (1956)). This stage of the theory's development is evocative of early quantity

$$\Delta \log M_t = \alpha_0 + \sum \alpha_{1i} \Delta \log M_{t-i} + \sum \alpha_{2i} \Delta RF_t + \sum \alpha_{3i} \Delta NFA_t + \sum \alpha_{4i} \Delta \log NGBC_{t-i}$$
$$+ \gamma_1 \log M_{t-1} + \gamma_2 RF_{t-1} + \gamma_3 \log NFA_{t-1} + \gamma_4 \log NGBC_{t-1} \ u_t \qquad (2)$$

theory and Keynesian multiplier analysis. There is now considerable evidence showing that the supply of money can be expressed as a function of a few variables (Miegs(1962), Hendeshoot and De leeuw (1970)). Basically, these functions are two types: Brunner(1961) and Brunner and Meltzer (1963) consider money supply as a function of the monetary base, currency-deposit ratio, and reserve-deposit ratio. They contend that, with the monetary base given, the current rate of interest can have very little effect on the supply of money. In contrast, Teigen(1964), Goldefeld(1966), Smith(1967),Modigliani, Rasche, and Cooper(1970), and Bhattacharya(1974) attach importance to the interest rates.Baghestani and Mott (1997) have argued that the notion of an endogenous money multiplier leads to a better understanding of monetary impacts on the economy.

The theoretical literature has convincingly put forward arguments in favor of money endogeneity. To support this theoretical argument, the empirical literature on the endogeneity of money has vehemently demonstrated that money supply is endogenously determined for various economies. However, all these studies exclusively encompass developed and middle-income economies. Lavoie (2005), Shanmugam et al. (2003), Nell (2001), Vera (2001), and Pollin (1991) have presented a time series analysis to test the money endogeneity hypothesis for the case of Canada, and USA, Malaysia, South Africa, Spain, and US respectively. Marcelin W. Diagne(2010), Chor F. Tang (2009) and Tuck C(2007). Tang also empirically reinvestigate the long-run money demand function and its stability .

3. Methodology

3.1. ARDL approach

Various factors are considered as determinants of the money supply function. The general agreement in the literature a money supply studies is assumed that the money supply function takes the following form:

$$LnM_t = \alpha_0 + \alpha_1 2RP_t + \alpha_2 \log NFA_t + \alpha_3 \log NGBC_t + u_t \qquad (1)$$

Where NGBC is net claims on the government, NFA= net foreign assets, RP is rate of profit on bank deposit (interest rate).In applying the cointegration technique, we need to determine the order of cointegration of each variable. However, as noted in the literature, depending on the power of the unit root tests, different tests yield different results. In view of this problem, Pesaran and Shin (1995) and Perasan et al. (2001) introduce a new method of testing for cointegration. The approach known as the autoregressive distributed lag (ARDL) approach. This method has the advantage of avoiding the classification of variables into I(1) or I(0) and unlike standard cointegration tests, there is no need for unit root pre-testing. However, the ARDL approach is very suitable to our formulation of the demand for money because we may have a stationary variable such as inflation rate along with non-stationary variables such as money or income. The error correction version of ARDL model

pertaining to the variables in Eq. (1) is as follows:

The null of no cointcgration defined by H 0 : γ 1 = γ 2 = γ 3 = γ 4 = 0 is tested against the alternative of H 1 : γ 1 ≠ 0 ,γ 2 ≠ 0 ,γ 3 ≠ 0 ,γ 4 ≠ 0 , by means of familiar F-test.However, the asymptotic distribution of this   F-statistic is non-standard irrespective of whether the variables are I(0) or I(1). Pesaran et al. (2001) have tabulated two sets of that they are all I(0). This provides a band covering all possible classifications of the variables into I(1) and I(0) or even fractionally integrated. If the calculated F-statistic lies above the upper level of the band, the null is rejected, indicating cointegration. If the calculated F-statistic falls below the lower level of the band, the null cannot be rejected, supporting lack of cointegration. If, however, it falls within the band, the result is inconclusive.

3.2. Empirical results

The paper used data from CBI, Central Bank of Iran, over the period 1968–2007 to test the null of no cointegration against the alternative hypothesis. For this section, the Microfit (version 4) statistical software by Pesaran and Pesaran (2003) was used for all the computations of ARDL approach for cointegration (Pesaran et al., 2001) and error correctio model estimates. We employ Akaike's information criterion (AIC) in selecting the lag length on each first differenced variable and Eq. 2 is estimated for M1 and M2 monetary aggregate.. In this stage, considering that monetary aggregates (M1 and M2), net   claims   on   the government,   net foreign assets, and rate of profit on bank deposit (interest rate) are cointegrated, the error correction model Eq. 2 is estimated. The main aim here is to capture the short-run dynamics. Eq. 3, reports the coefficient estimates of all lagged first differenced variables in the ARDL model (short-run coeffecient estimates). Not much interpretation could be attached to the short-run coefficients. All they show the dynamic adjustment of all variable.

The long-run coefficients are reported. These are the coefficients of   γ 1 − γ 4 from the ARDL model. Following the literature, we normalize these long-run elasticites on LM by dividing them by (γ 1). According to results the interest rate elasticity is 10.8323, which is highly significant as reflected by a t-statistic of 2.6150. The after war dumy variable elasticity is 1.7966 and significant supporting our theoretical expectation. The long-run model of the corresponding ARDL(1,1,0,0)for the supply of money can be written as follows:

$$LnM\ t = -8.8109\ + 10.8323\ log\ RPt + -.1262E\text{-}4\ \ NFA\ t+ -.4686E\text{-}4\ \ NGBC\ t \tag{3}$$

Kremer et al. (1992) has shown that the significant lagged error correction term is a more efficient way of establishing cointegration. We use estimates of   γ 1 − γ 4 to form a lagged error correction term,

$$EC\ t - 1 = γ 1 \log M\ t - 1\ \ + γ\ RP\ t - 1\ \ - + γ \log NFA\ t - 1 + γ \log NGBC\ t - 1. \tag{4}$$

After replacing the linear combination of the lagged level of variables in the ARDL model Eq.(4) by ECt-1, we re-estimate the model by imposing the same lag structure selected by the AIC criterion, and look for the significance of ECt-1. A negative and significant coefficient of ECt-1 will be an indication of cointegration. As can be seen from results : the ECt-1 carries an expected negative sign (ecm(-1) = -.03249), which is highly significant, indicating that,M1 and M2, net   claims   on   the government,   net foreign assets, and rate of profit on bank deposit (interest rate) are cointegrated. We also report the Lagrange Multiplier (LM) statistic for serial correlation and Ramsey's RESET test for functional specification, Since our calculated LM statistic is less than the critical value we conclude that the residuals of the estimated ARDL are free from serial correlation. and also, since our calculated RESET statistic is less than its critical value we conclude that the ARDL model is correctly specified.

The existence of a stable and predictable relationship between the supply of money and its determinants is considered a necessary condition for the formulation of monetary policy strategies based on intermediate monetary targeting. In the third stage the stability of the long-run coefficients are used to form the error-correction term in conjunction with the short run dynamics. As pointed by Laidler (1993) and noted by Bahmani-Oskooee (2001), some of the problems of instability could stem from inadequate modeling of the short-run dynamics characterizing departures from the long run relationship. Hence, it is expedient to incorporate the short run dynamics for constancy of long run parameters. In view of this we apply the CUSUM and CUSUMSQ tests proposed by Brown, Dublin and Evans (1975).

The CUSUM test is based on the cumulative sum of recursive residuals based on the first set of n observations. It is updated recursively and is plotted against the break points. If the plot of CUSUM statistic stays within 5% significance level, then estimated coeffients are said to be stable. Similar procedure is used to carry out the CUSUMSQ that is based on the squared recursive residuals. Since the plots of CUSUM and CUSUMSQ statistic for M1 and M2 do not cross the critical value lines, we are safe to conclude that M1 M2 and money supply is stable.

4. Concluding Remarks

The paper investigated the cointegrating property and stability of the supply of money function in Iran. The paper employed the ARDL approach together with CUSUM and CUSUMSQ tests. The results show that M1 and M2 is cointegrated with net claims on the government, net foreign assets, and rate of profit on bank deposit (interest rate) .With respect to stability, the results show that the estimated relation is somewhat stable most especially with CUSUM test. The question, then, is what are the implications of these findings on policy formulation in Iran?

One, the result shows that there is cointegration among M2,NFA, RP, NGB and a major implication of using interst rate elasticity estimates from M2 function is that money is endogenous and argues that endogeneity of money matters for both short run comparative static macroeconomics and longer run macro dynamics. Second, the endogeneity of money means that attempts to control the economy through monetarist styled money supply rules and targets are likely fail. This suggests that policy authorities should look to other means of control. The notion that the supply of money is, or could be, carefully controlled as in Friedman's famous money supply growth rate rule is also rejected.

Third, the money supply is a function of the currency-money ratio, the excess reserve ratio, the required reserve ratio and the monetary base .Therefore, monetary base is the main factor and main determinant of money supply. Among the three elements of monetary base, only the third part is under the control of central bank and the other two elements are fall out of the control limit of monetary authorities and therefore, considering the net foreign assets in the years before the revolution and share deficit of in the years before the revolution and share deficit of budget after revolution in the total monetary base, it become apparent that the money supply in Iran was affected by the rate of import and export , commercial policies and mainly under the influence of rate of sale of oil and annual budget and therefore, the Central Bank was only able to control once again the debt of banks by resorting to means i.e. authorized limitation of credit, rate of discount, determining the legal ratio, proportion of purchasing bonds. But considering that the share of debt of bank was little in the total monetary base and the share of money-multiplier was little in the growth of supply of money.

5. References

[1]   Brunner, Karl. A Schema for the Supply Theory of Money. International Economic Review. 1961, II, January, p p. 79-109.

[2]   Brunner, Karl and Meltzer, A.E. Predicting Velocity Implications for Theory and Policy. Journal of Finance, 1963. XVIII, May, pp. 319-354.

[3]   Cagan, Phillip. Determinants and Effects of changes In the Stock of Money 1875-1960. New York: National Bureau of Economic Research.1965, P.I.

[4]   Chor F. Tang. " How Stable is Demand for Money in Malaysia?, IUP, Journal of Monetary Economics. 2009 , (7), 3/4 85-100.

[5]   Friedman, M.and Schwartz, A.J.A Monetary History of the United States, 1867-1960.Princeton University Press, Princeton, NJ . 1963,

[6]   Gowland, D. Controlling the Money Supply, London: Croom Helm, 1982.

[7]   Goldfield, S. M. Commercial Bank Behavior and Economic Activity. Amsterdam: North-Holland Publishing Company, 1966.

[8]   Garfinkel, M. R., and Thornton, D.L. The Multiplier Approach to the Money Supply Process: A Precautionary

Note, Federal Reserve Bank of St. Louis Review, 1991. July/August.

[9] Hendershoot,P.H.,and DeLeeuw, F.Free Reserves, interest Rates andDeposits: A Synthesis. Journal of finance, 1970. 25, June, 599-614.

[10] Lavoie, M. Monetary base endogeneity and the new procedures of the asset-based Canadian and American monetary systems. Journal of Post Keynesian Economics, 2005. 27, 4: 689-709.

[11] Marcelin W. Diagne, " Real Money Demand, Income and Interest Rates in Senegal: Is there a long- Run Stable Relation?", International Advances in Economic Research,2010. , 6(2): 213-222.

[12] Meigs. A. J. Free Reserves and the Money Supply. Chicago; The University of Chicago Press, 1962.

[13] Modigliani, F.R.H. Rasche, and Cooper, J.P. Central Bank Policy, the Money Supply and the Short-Term Rate of Interest. Journal of Money, Credit and Banking, 1970. 2, May, 168-218.

[14] Nell, K.S. The Endogenous/Exogenous Nature of South Africa's Money Supply under Direct and Indirect Monetary Control Measures. Journal of Post Keynesian Economics, 2001. 23, 2: 313-329.

[15] Pollin, R.Two Theories of Money Supply Endogeneity: Some Empirical Evidence. Journal of Post Keynesian Economics, 1991,13,3:366-396.

[16] Shanmugam, B., Nair,M., and O.W. Li. The Endogenous Money Hypothesis: Empirical Evidence from Malaysia (1985-2000). Journal of Post Keynesian Economics, 2003. 25, 4: 599-611.

[17] Smith, P.E. Money Supply and Demand: A Cobweb? International Economic Review, 1967. 8, Feb, pp. 1-11.

[18] Teigan, R.L. Demand and Supply Functions for Money in the United States. Econometrica, 1964. 32, 0ct, pp. 476-509.

[19] Tuck C. Tang. "Money Demand Function for Southeast Asian Countries An Empirical view from Expenditure Components", Journal of Economic Studies , 2007 34 (6): 4765-496.

[20] Vera, A.P. The Endogenous money hypothesis: some evidence from Spain (1987-1998). Journal of Post Keynesian Economics, 2001. 23, 3: 509-526.