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Endogenous and Exogenous Money: an empirical investigation from Iran

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This paper is about money supply being determined by banking behaviour, or by the behaviour of central bank of Iran. That money is endogenously determined is a proposition of post-Keynesian (PK) economists suggesting that money supply is determined by the behaviour of commercial banks as banks adjust money creation in response to credit demands by the public. This theory challenges the monetarist view of exogenous money supply, where the central bank is said to control money supply. The empirical tests conducted begin with unit root and Johansen cointegration tests to test for stationarity of the variables and whether the variables are cointegrated, followed by vector error-correction models (VECM) and Granger causality tests to test whether there is one-way or bidirectional causality in the long run and in the short run. These tests are used to determine (1) whether money is endogenous or exogenous, (2) if money is endogenous, which of the three views of PK theory is supported in this study.

JEL Classification:E5, E51; E52; E61,C22

1. Introduction

Traditionally money supply has been regarded as exogenous. The Post-Keynesian economists have seriously questioned the validity of this general perception.1 On the basis of historical events and empirical evidences, researchers have strongly maintained that money supply is determined endogenously. This has been regarded as Post-Keynesian invention.

Then one of the controversial issues in monetary economics is the debate over the concept of exogenous and endogenous money. The debate has been going on since the 17th century and has its theoretical roots as well as its policy implications.

Exogenous money supply along with the stable money demand function is an important element in the Monetarists' model that asserts the effectiveness of monetary policy. On the other hand, post-Keynesians advocate the concept of endogeneity of money supply since the ultimate goal of the economic activity is to create money.

The debate over the exogenous and endogenous money supply concepts has become in recent years an empirical issue.

The main 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 in the Iran over the period 1968 to 2009. A second aim is to implement advance econometric causality techniques upon these theoretical debates. The

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paper is organized as follows: Section 2 is devoted to the theoretical debate and some relevant previous empirical works regarding the concepts of exogenous and endogenous money supply. Section 3 and 4 discusses the methodology used and presents the empirical results as well. Then this section justifies the implementation of the selected econometric methodology along with a brief discussion on the produced causality results to test. Section 5 concludes the paper.

2. Literature Review

2.1 Money supply: Exogenous and Endogenous

The question as to whether money supply is exogenous or endogenous has long been debated amongst monetary economists. Two schools of thought, originating from Keynesian and monetarist sources, have merged over time, resulting in a consensus that money is exogenous. On the other hand, post-Keynesians have come to support the idea that money is endogenous. However, the existence of evidence of money exogeneity means that the old school is still not out of consideration.

2.2. Orthodox monetary theory

Traditionally textbooks in economics of both introductory and more advanced levels (with the only exception insofar being Howells and Bain, 2003) introduce the orthodox monetary theory, based on the quantitative theory of money. Money supply is considered to be under control of the Central Bank (CB), and hence is an exogenous parameter, determined by the goals of monetary policy. The CB manages the monetary base (the sum of currency in circulation and required reserves of banking system) at its discretion with the main instruments being open market operations and the required reserve ratio (Burda and Wyplosz, 1997; Mishkin, 1995).

Further process of money creation goes through the operation of money multiplier. It is assumed to be constant or, at least, stable over time, allowing for the CB to effectively control the total money supply. Though the propensity to deposit and the credit demand are determined by the state of market and inner characteristics of economic agents, the Central Bank can influence substantially the volume of issued credits with its policy tools. This view also assumes the stable money demand function, which links monetary aggregates with the measure of total income in the economy. This allows monetary policy to be effective in controlling the aggregate demand (Burda and Wyplosz, 1997; Mishkin, 1995; Howells and Bain, 2003).

This view implies the transmission mechanism with money supply as the policy instrument. The logic goes as follows: changes in the money supply (e.g. increase) lead to corresponding non-equilibrium situation on the money market (excess supply of money), which translates into changes in the consumption and investment (increase) and in the nominal interest rates (fall). As a result of this, demand for money adjusts to equilibrate the situation on money market, and the aggregate demand changes accordingly (increases). This indirectly implies that for monetary policy to be effective demand for money has to be relatively inelastic, while

consumption and investment are supposed to be highly interest-elastic (Howells and Bain, 2003, p. 181).

In compliance with this approach, inflation is seen as a result of excessive money supply, since an increase in aggregate demand generated by the increase in money supply results in placing an upward pressure on prices under constrained production facilities.

2.2.1. Monetarism

We are departing now from the heterodox monetary theories and we move to the orthodox views. Friedman, presenting his monetarist' view, underlined that: "changes in the quantity of money as such in the long run have a negligible effect on real income so that non-monetary forces are 'all that matter' for changes in real income over decades and money 'does not matter' ... I regard the description as money is all that matters for changes in nominal income and for short - run changes in real income." (Friedman, 1974, p. 27). In simple words, according to monetarists, any exogenous money supply increase can produce, but only in the short run, an output effect.

2.2.2. New Keynesianism

New Keynesianism money theory is rather operating supplementary to the Orthodox "money channel". As a theory is dealing with the development of "credit channel" focusing primarily on commercial banks' asset management and the substitutability between its elements. For the new Keynesians, the importance "credit channel" is a supply driven one. This "channel" is implemented primarily through the Lending channel of the commercial banks but in link with the Balance sheet channel of the firms (Bernanke, B. & Gertler, M. (1995)). The general message of these two channels is the following: since other forms of credit satisfaction of firms are not perfect substitutes for bank loans, the loan supply curve will be shifted inwards. Therefore the loan supply channel is the dominant figure which is expected to affect investment and consequently the output outcome (e.g. BCsupply-driven ⇒ GDP).

2.3. Heterodox monetary theory

Heterodox monetary theory is an alternative to neo-classical monetary theory with completely different approach to the nature of money. In this view money supply is endogenous, and is determined within the economic system by the economy-wide need for credit. The major postulate of this theory is that it is the interest rate that CB can effectively control, and a number of Central Banks across the world practice managing the interest rate rather than any of the monetary aggregates (Borio, 1997). CB's short-term interest rate determines the costs of liquidity loss for the commercial banks when issuing credit, and serves as a bench-mark for short-term credit rates in the economy. Further process of interaction between the credit behaviour of commercial banks and resulting monetary aggregates and income changes is described differently in three approaches within this strand of thought: accommodationist, structuralist and liquidity preference. Let's now very briefly meet the schools commencing from the post-Keynesians.

2.3.1. Accommodatonism-(ex ante) Horizontialism

Accommodationalism is actually dealing with the attitude of both commercial and central bank towards the “protagonists” of the economy which are the economic agents and the firms in particular. In other words, Accommodationalism is the pure response of these institutions primarily towards the production needs. These needs are actually borrowing or aggregate demand needs proxied through demand for credit (loans).

2.3.2. Structuralism

Structuralism holds its roots back to the Minskyian (1957a, b) tradition. In this post Keynesian approach, although economic agents and firms play the important role in the economic system, central bank (and auxiliary the commercial banks) is a significant player and has the privilege to accommodate reserve needs or not. This view implies the abandonment of passive accommodation [horizontal credit supply function and horizontialism] and the adaptation of resistance on credit expansion. This could lead to an upward sloping money supply curve (Spiliotis, 1992, Palley, 1996). Moreover, the classical view regarding the direction of the money–income relationship - from the left to the right - is not challenged by the Structuralists.

2.3.3. Liquidity Preference2 (L.P.)

In this approach, the problems for the bank credit expansion (and satisfaction of aggregate loan demand needs of agents and firms) are primarily raised by the role and the behavior of households/agents (their deposits which is accounted in the liability side of the banks) in connection with commercial banks’ respond through their asset management policies.

2.4. Recent Studies

The implications of the Post Keynesian position for both macroeconomic theory and policy are fundamental. At the theoretical level, the Post Keynesian position implies rejection of all models of macroeconomic activity new classical, neoclassical, Keynesian, as well as traditional monetarist-that assign major independent influence to the behavior of the money supply. In terms of policy analysis, it suggests that central bank interventions to control the growth rate of money and credit are not nearly as potent a tool as they are assumed to be in the mainstream literature.

One perspective argues that when banks and other intermediaries hold insufficient reserves, central banks must necessarily accommodate their needs. We may thus refer to this approach as a theory of accommodative money supply endogeneity. Leading recent proponents of this view include Nicholas Kaldor (1982, 1985), Sidney Weintraub (1978a, 1978b), and Basil Moore, whose major book, Horizontalists and Verticalists (1988), among many other writings on the subject (e.g., Moore, 1979, 1983, 1985, 1988a, 1988b, 1989, 1991, 1998), provides the most thoroughgoing presentation of this approach.

According to the other perspective, central bank efforts to control the growth of nonborrowed reserves through open market restrictiveness exert significant quantity constraints on reserve availability. We may thus refer to this second Post Keynesian approach as a theory of structural endogeneity. Major recent contributors to this

approach include Hyman Minsky (1982. 1986), Stephen Rousseas (1985, 1989), and James Earley (1983; Earley and Evans. 1982). This approach focuses on the interaction between the monetary authority's policy reaction function and the asset and liability management activities of banks [Palley (1996)]. The exposition of the "structuralist" approach is based on Pollin (1991) and Palley (1991, 1994, 1996a, 1996b, 1998, 2003). Although Structuralists consider money supply to be upward sloping, they emphasize that banking system can effectively circumvent reserve constrained placed by central bank in the long run through innovation of banking services and financial instruments by providing more liquid perspective is less well developed than that of accommodative endogeneity.

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 and Spain respectively.

3. Methodology and Model

In order to test the exogeneity/endogeneity of money supply hypotheses, the causality concept known as Granger causality between the money supply with the bank credit is investigated using time series data from the Iran over the period 1968 to 2009.

As known, the causality test relationship requires the applications of three steps. First, the time series properties are analyzed in order to test their stationarity and to determine the order of integration. Second, the long run relationship between the variables is investigated using Co integration technique. Finally, the short run, as well as, the long run causality relationship between money supply, bank credit, monetary base, and income and money multiplier are investigated using the Vector Error Correction Model (VECM).

This section explains a number of econometric methodologies that will be used to test the research questions and hypotheses discussed in Section 2. The discussions start with the unit root tests followed by the Johansen co integration and the vector error-correction models. Trivariate causality tests are detailed next

The question as to whether money supply is exogenous or endogenous has long been debated amongst monetary economists. Two schools of thought, originating from Keynesian and monetarist sources, have merged over time, resulting in a consensus that money is exogenous. On the other hand, post Keynesians have come to support the idea that money is endogenous. However, the existence of evidence of money exogeneity means that the old school is still not out of consideration.

In summary, this paper aims to investigate the following research questions:
1. Is the money supply endogenous or exogenous in Iran?

2. If the money supply is endogenous, which of the three views (accommodationist, structuralist or liquidity preference) does it support?
2a. is the support for the views in (2) above different in the short-term than in the long-term?
Also, in summary, this paper aims to investigate the following Hypotheses:

The exogeneity/endogeneity of money supply hypotheses:

H0: MS causes BC only (suggesting money is exogenous)
H1: BC cause MS or there is bidirectional causality between MS and BC (implying money is endogenous)
2. Table 3.1 provides a summary about hypotheses of Monetarist and three money endogeneity views. Hypothesis 1 is not summarised in this table because the hypothesis is focused on examining whether money supply is exogenous or endogenous only and not which approach of monetary theory it falls under.

Table 3.1 Summary of causality implications of different approaches towards Monetary theory

Monetarist	Accommodationist	Structuralist	Liquidity Preference
MB⇒ BC	BC⇒MB	BC⇔MB	BC⇔MS
MS⇒ BC	BC⇒MS	BC⇔MM	
MS⇒Y	Y⇔ MS	Y⇔ MS	

Note: BL denotes bank credit, MB is monetary base, MM is money multiplier, MS is money supply and Y is income. ⇒ and ⇔ denote unidirectional and bidirectional causality respectively.

3.1. Unit Root Test

Unit root tests are performed on the variables so as to prepare the data set for co integration and causality tests. For co integration analysis to be valid, the unit root test investigates whether the order of integration of the variables of interest is similar – specifically, whether the order of integration is shown to be greater than zero. Thus, we first validate the stationarity properties of the variables, prior to conducting the co integration tests.

This involves testing the order of integration of the individual series under consideration. Several procedures for the test of order of integration have been developed. The most popular ones are Augmented Dickey-Fuller (ADF) test due to Dickey and Fuller (1979, 1981), and the Phillip-Perron (PP) due to Phillips (1987) and Phillips and Perron (1988). Augmented Dickey-Fuller test relies on rejecting a null hypothesis of unit root (the series are non-stationary) in favor of the alternative hypotheses of stationarity. The tests are conducted with and without a deterministic trend (t) for each of the series.

An economic time-series that follows a random walk process is called "nonstationary" over time. It may be made stationary by differencing d times. The variable, once established as stationary, is then referred to as integrated of order d or I (d).

3.2. The Johansen Co integration Test

This involves testing of the presence or otherwise of co integration between the series of the same order of integration through forming a co integration equation. The general concept of co integration between variables suggests that there exists equilibrium or a long-run relationship between a set of time-series variables, provided that the series is integrated of the same order. A lack of co integration suggests that such variables have no long-run relationship: in principal they can wander arbitrarily far away from each other (Dickey et. al., 1991).

The Johansen (1988) multivariate co integration test is essentially a likelihood ratio test based on a vector autoregressive (VAR) model that allows for possible dynamic interactions among variables. The Johansen (1988) co integration test is a more robust test than the Engle and Granger (1987) co integration test. According to Dickey, Jansen and Thornton (1991), the Engle and Granger (1987) test is sensitive to the choice of dependent variables, and thus may not be robust.

We employ the maximum likelihood test procedure established by Johansen and Juselius (1990) and Johansen (1991). Specifically, if Yt is a vector of n stochastic variables, then there exists a p-lag vector auto regression with Gaussian errors of the following form:

Johansen's methodology takes its starting point in the vector auto regression (VAR) of order P given by

$$y_t = \mu + \Delta y_{t-1} + \Delta + \cdots + \Delta \pi y_{t-p} + \varepsilon_t \quad (1)$$

Where

Yt is an nx1 vector of variables that are integrated of order commonly emoted (1) and ε_t is an nx1 vector of innovations.

This VAR can be rewritten as

$$\Delta y_t = \mu + \eta\, y_{t-1} + \sum_{i=1}^{p-1} \tau_i \Delta y_{t-1} + \varepsilon t \qquad (2)$$

Where

$$\Pi = \sum_{i=1}^{p} A_{i-1}$$

and $\tau_i = -\sum_{j=1}^{p} A_j$

$j = i+1$

To determine the number of co-integration vectors based on the likelihood ratio test (LR), Johansen (1988, 1989) and Johansen and Juselius (1990) suggested two statistic tests: the trace test (λ trace) and maximum eigenvalue test (λ trace) statistics. The first one(λ trace) tests the null hypothesis that the number of distinct cointegrating vector is less than or equal to q against a general unrestricted alternatives q = r. the test calculated as follows:

$$\lambda \text{ trace } (r) = -T \sum_{i=r+1}^{\kappa} \ln (1- \lambda_i) \qquad (3)$$

Where

T is the number of usable observations, and the λi,s are the estimated eigenvalue from the matrix.

The Second statistical test (λ max) is calculated according to the following formula

$$\lambda \max (r, r+1) = -T \ln (1 - \lambda_{i+1}) \qquad (4)$$

The test concerns a test of the null hypothesis that there is r of co-integrating vectors against the alternative that r + 1 co-integrating vector.

As for annual available data from 1968 to 2009, this study uses secondary data. The data source is from the Central Bank of Iran statistical bulletin and site which includes bank credit(BL), monetary base(MB), money supply(MS) and income(Y). Furthermore, as a result of the availability data in that period on an annual basis, we are limited to only annual data.

4. Results/Analysis

The analysis of the time series based on ADF and PP unit root tests indicates that the null hypothesis of the presence of a unit root can not be rejected for the levels of the time series of money supply, bank credit, monetary base, income and money multiplier variables since their computed values are less than the critical values at the 5 % level of significance. However, the results indicate that the null hypothesis is rejected for the first differences since their computed values exceed the critical values at the 5% level of significance. Therefore, the five time series are integrated of order one (I (1)). The results of ADF and PP unit root tests are presented in tables (3.2 and 3.3) respectively:

Table (3.2): ADF Unit Root Test

Variable	Level With intercept	Level With intercept and rend	First difference with intercept	First difference With intercept and Trend
Lms2	0.461974	-2.024659	-3.662837	-3.610392
lbc	1.245625	-2.087780	-2.762614	-2.909281
lmb	-0.054420	-2.286053	-3.964223	-3.636410
Ly	-0.563771	-1.226201	-6.190266	-6.500572
Lmm2	-1.963417	-3.522298	-1.756718	-1.838165

Critical values:	Intercept	Intercept and Trend
At (1%) level of Significance	-3.66	-4.29
At (5%) level of significance	-2.96	-3.57
At (10%) level of significance	-2.62	-3.22

Table (3.3): PP Unit Root Test

Variable	Level With intercept	Level With intercept and rend	First difference with intercept	First difference With intercept and Trend
Lms2	-0.474564	-2.257339	-3.645077	-3.610392
lbc	0.739357	-1.009143	-2.713724	-2.909281
lmb	-1.370174	-3.376559	-3.971358	-3.644001
ly	-0.897391	-1.507254	-6.231499	-7.832138
Lmm2	-1.005858	-1.902635	-4.326538	-4.210382

Critical values:	Intercept	Intercept and Trend
At (1%) level of Significance	-3.66	-4.29
At (5%) level of significance	-2.96	-3.57
At (10%) level of significance	-2.62	-3.22

4.1 Cointegration Test:

It is known that the cointegration results based on Johansen's (1988) procedure are sensitive to the choice of lag length in VAR (Cheung and Lai, 1993).Thus, the optimum lag lengths of the VAR are determined by minimising the Schwarz (1978) Bayesian Information Criteria (SBC). This criterion is designed to select the model

with the maximum information available. This is to be determined first before the Johansen (1988) cointegration tests are performed and the results presented later.

Since the time series of money supply, bank credit, monetary base, money multiplier, and income are integrated of order one i.e. I (1), they would be tested for the existence of a long run relationship. The non-stationary time series that have the same order of integration may be cointegrated if there exist some linear combination of the series that can be tested for stationarity i.e. (I (0)).

Tables (3.4) to (3.8) presents the result of the vector autoregressive model (VAR) which includes the results of the trace test (l trace) and the maximum eignvalue test (l trace) statistics for the existence of long run equilibrium between 1) money supply, bank credit and income, 2) monetary base and bank credit, and3) money multiplier and bank credit.

Table (3.4): Cointegration with unrestricted *Linear* intercept and no trend in the LMS2 and LBC VAR

Null Hypothesis	(λ max)	(λtrace)	95% critical value for maximum eigenvalues test	95% critical value for trace test
r = 0	25.00978	30.72805	19.38704	25.87211
r ≤ 1	5.718269	5.718269	12.51798	12.51798

Table (3.5): Cointegration with unrestricted Linear intercept and no trend in the LMS2 and LY VAR

Null Hypothesis	(λ max)	(λtrace)	95% critical value for maximum eigenvalues test	95% critical value for trace test
r = 0	25.54644	33.92 99	19.38704	25.87211
r ≤ 1	8.383549	8.383549	12.51798	12.51798

Table (3.6): Cointegration with unrestricted no intercept and no trend in the LMB and LBC VAR

Null Hypothesis	(λ max)	(λtrace)	95% critical value for maximum eigenvalues test	95% critical value for trace test
r = 0	15.32625	18.55611	11.22480	12.32090
r ≤ 1	3.229858	3.229858	4.129906	4.129906

Table (3.7): Cointegration with unrestricted no intercept and no trend in the LMM2 and LBC VAR

Null Hypothesis	*(λ max)*	*(λ trace)*	*95% critical value for maximum eigenvalues test*	*95% critical value for trace test*
r = 0	2. 0741	20.365 6	11.22480	12.32 90
r ≤ 1	7. 58041	7.758041	4.129906	4.129906

The null hypothesis of no cointegration based on both the maximum eigenvalue and the trace tests between:1) money supply, bank credit and income, 2) monetary base and bank credit, and3) money multiplier and bank credit is rejected at a (5%) level of significance. However, the alterative of the existence of at least one cointegrating equation could not be rejected. According to Granger (1988), the existence of cointegration between the time series under consideration suggests that there is a long run relationship between 1) money supply, bank credit and income, 2) monetary base and bank credit, and 3) money multiplier and bank credit, and that there exists causality in at least one direction between the variables.

4.2. The Vector Error Correction Model (VECM) :

Once the variables in a VAR system are cointegrated, following Johansen– Juselius (1990), we can use a vector error-correction model (VECM) in which an unconstrained VAR is used in order to assess the direction of Granger causality in both the short and long run. In addition, it can be utilized to estimate the speed of adjustment to the deviation from the long run equilibrium between 1) money supply, bank credit and income, 2) monetary base and bank credit, and 3) money multiplier and bank credit.

Then the purpose of the error correction model is to indicate the speed of adjustment from the short-run equilibrium to the long-run equilibrium state. The greater the co-efficient of the parameter, the higher the speed of adjustment of the model from the short-run to the long-run. An F- statistics that tests jointly the significance of the coefficients of the explanatory variables in their first differences is used to determine the short run causality relationship, while, the long run causality relationship can be determined by utilizing a standard t- test on the lagged error terms.

We represent equations of money supply, income, monetary base and bank credit with an error correction form that allows for inclusion of long-run information thus, the error correction models (ECM) can be formulated as follows:

$$\Delta MS_t = \alpha 0 + \sum \alpha 1 \, \Delta BC_{t-1} + \sum \alpha 2 \, \Delta MS_{t-1} + \lambda Ec_{t-1+}\mu_t \qquad (2)$$

$$\Delta Y_t = \alpha 0 + \sum \alpha 1 \, \Delta MS_{t-1} + \sum \alpha 2 \, \Delta Y_{t-1} + \lambda Ec_{t-1+}\mu t \qquad (5)$$

$$\Delta MB_t = \alpha 0 + \sum \alpha 1 \, \Delta BC_{t-1} + \sum \alpha 2 \, \Delta MB_{t-1} + \lambda Ec_{t-1+}\mu_t \qquad (6)$$

$$\Delta BC_t = \alpha 0 + \sum \alpha 1 \, \Delta MM_{t-1} + \sum \alpha 2 \, \Delta BC_{t-1} + \lambda Ec_{t-1} + \mu_t \qquad (7)$$

Where

Δ is the first difference operator

λ is the error correction coefficient and the remaining variables are as defined above.

Then λ represent the error-correction term lagged residuals from the Cointegration relations. The error correction terms (λ) will capture the speed of the short run adjustments towards the long run equilibrium. Furthermore, the VECM is used to differentiate between causality in the short and long run.

The result of the short run dynamics as well as the short and long run causality tests between the 1) money supply, bank credit and income, 2) monetary base and bank credit, and 3) money multiplier and bank credit, in the Iran utilizing the VECM estimation is shown in table(3.5).

Table (3.5): Estimates for VECM Regression

Equation	ECT	t-stst	Conclusion
MS-BC BC-MS	- 0.046 - 0.056	- 1.48 - 0.85	BC----->MS
MS-Y Y-MS	0.0038 -0.012	0.766 -1.53	MS -----> Y
BC-MB MB-BC	-0.0095 -0.81	-0.225 -2.3	BC----->MB
BC –MM MM-BC	0.0079 -0.18	1.106 -2/717	BC----->MM

Table (3.6): Granger causality tests results

Relation	***Granger tests***	
	F- statistic	Probability
MS to BC	2.39	0.079
BC to MS	4.72	0.006
MS to Y	3.38	0.026
Y to MS	1.34	0.286
BC to MB	23.03	4.E-05
MB to BC	2.15	0.152
BC to MM	7.97	0.001
MM to BC	0.56	0.557

4.3. Short and Long Run Causality

The long-run elasticity estimates and the corresponding causality results from the error correction models and a Granger causality technique for the second sub period are given in tables (3.5) and (3.6).

Granger causality tests are conducted to determine whether the current and lagged values of one variable affect another. One implication of Granger representation theorem is that if two variables, say Xt and Yt are co-integrated and each is individually 1(1), then either Xt must Granger-cause Yt or Yt must Granger-cause Xt. This causality of co-integrated variables is captured in Vector Error Correction Model (VECM). In a VECM long and short-run parameters are separated.

The results from the first regressions reflect the Causality from bank credit(BC) to money supply(MS) confirms the endogenous nature of the money supply.

The second set of regression provides a summary of the results presented thus far. Unidirectional causality from income (Y) to money supply reflects the exogenous nature of money supply over the period (Monetarist approaches).

The results from the third regressions reflect the significant change toward more market-oriented monetary policy measures, in this case unidirectional causality from bank credit (BC) to monetary base (MB).

The fourth set of regressions depicts unidirectional causality from bank credit (BC) to money multiplier (MM). The result again shows that credit is exogenous from the point of the banking system.

5. Conclusion

The goal of the paper was to investigate the direction of causality in both the short and long run in order to test the endogeneity/ exogeneity hypotheses of money supply in the Iran. Data properties were analyzed in order to determine their stationarity using the ADF and PP unit root tests which indicated that money supply, bank credit, monetary base, income and money multiplier are integrated of order one i.e. I(1). The results of the cointegration test based on the maximum eigenvalue and trace tests indicated the existence of cointegration between money supply, bank credit, monetary base, and income and money multiplier. Therefore, the time series under consideration have a long run equilibrium relationship although they may be in disequilibrium in the short run.

A VECM based on unrestricted VAR was utilized in order to investigate the short run dynamics and determine the direction of causality in both the short and long run. The lagged error term coefficient in the money supply, monetary base, income and money multiplier equations ($et-1$) was negative and statistically significant.

The significant error term in the money supply, monetary base, and income and money multiplier equations supports the existence of a long run equilibrium relationship between 1) money supply, bank credit and income, 2) monetary base and bank credit, and 3) money multiplier and bank credit.

Furthermore, the estimates of the VECM present the direction of Granger causality in both the short and long run. The long run causality test from the VECM indicated that causality runs from 1) bank credit to money supply, 2) income to money supply, 3) bank credit to monetary base and, and 4) bank credit to money multiplier since the coefficients of the error terms in the 1) money supply, 2) monetary base, 3) income and,4) money multiplier equations were statistically significant and negative based on the standard t-test which means that the error term (e t−1) contributes in explaining the changes in money supply, 2) monetary base, 3) income and,4) money multiplier.

Therefore, there is unidirectional causality running from BC----->MS, MS -----> Y, BC-->MB and BC----->MM in the Iran in the long run.

This empirical result are strongly consistent with a Post Keynesian hypothesis that indicates the money supply is endogenous since loans make deposits, and the decision to borrow is made by credit –worthy borrowers, not the banks or the central.

Though the empirical result are strongly consistent with a Post Keynesian hypothesis that indicates the money supply is endogenous. Real world situation does contradict that the decision to borrow is made by credit –worthy borrowers, not the banks or the central. Therefore, it is necessary in future studies in this area, more research should be done.

Using annual available series from 1968 to 2009, we estimated the error-correction models (ECM) of money supply, income, monetary base and bank credit. Furthermore, as a result of the availability data in that period on an annual basis, we are limited to only annual data.

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