The Exogeneous and Endogeneous Money Supply Arguments: The Case Of Turkey

Bilge KÖKSEL, Gaziantep University, TR
bkoksel@gantep.edu.tr

Abstract
The roots of the exogeneous and endogeneous money supply arguments have gone back to debate between Currency School and Banking School since nineteenth century. Orthodox approaches such as Monetarist School assumes exogeneity of money suuply. Exogeneity means, money supply is determined by central bank. On the other hand, Post Keynesian economists have argued that money supply is endogeneous. It means, central bank cannot control the money supply and money supply is determined by credit demand. The purpose of this study is to test money supply is endogeneous or exogeneous for the Turkish economy in 2006:1-2015:11 period by using Johansen cointegration analysis. The analysis period has started since 2006. Because the definition of the money supply is changed in December 2005. And moreoever, inflation targeting regime has been implemented since 2006. Inflation targeting regime assumes exogeneity of money supply. In order to test endegeneous money supply hypothesis, the total bank credits to the private sector are taken as an independent variable and money supply in the form of M2 is a dependent variable. Vice versa is true for testing exogeneous money supply hypothesis. According to the empirical findings, there is a bidirectional long run relationship between bank credits and money supply.

1.Introduction

The modern monetary economics have two opposing views in how money supply is determined. According to the Monetarist School money supply is exogeneously determined. On the other hand, Post Keynesian Economists have argued that money supply is endogeneous.

Exogeneity means, money supply is determined by central bank. The cenral bank manages the monetary base by its main policy instruments such as open market operations and reserve ratio. An increase in money supply leads to a decrease in interest rates. As a result aggregate demend increases. Exogeneous money supply changes effective only in the short run. In the long run, money is neutral.

One of the main tenets of Post Keynesian economics is that money is endogeneous, meaning that the supply of money is the outcome of purposeful interactions between economic agents. More precisely, the endogeneity of money relies on the following causation the supply of money is determined by the demand for credit (bank loans), and the latter originates within the system to finance the production process or upsurge of speculative purposes. The main implication of this theory, then, is that money is never neutral. Money is nedeed for, and is the purpose of, financing the core activities of capitalist economies. In a nutshell, money is the wheel of trade and growth of modern economics (Fontana,2004: 367-368).

According to the Pollin (1991), there are two approaches within the framework of endogeneous money supply determination. These are the accommodanist (horizontalist) and structuralist approaches. The difference between them stems from the determinaton of the interest rates and the roles of the central bank.

Over the course of the 1970's and 1980's, B. Moore played the major role in developing the "horizontalist" approach to money that emphasizes the non-discretionary nature of reserves. This effectiveliy reserves the "deposit multiplier" of the money and banking textbooks, arguing that "loans make deposits" and "deposits make reserves". The focus is on the private decisions made by banks and their customers, which determine the supply of loans and deposits, hence the supply of credit money that "endogeneously" expands to meet the needs of trade. The central bank can only "exogeneously" set the short term interest rate at which it reserves "horizontally" on demand to banks (Wray, 2007:10). According to the accommodationist approach, the credit-money supply endogeneously to

changes in firms' demand for working capital. The exogeneous variable for the entire process of money cretaion is the price of credit, through the intermediation of banks, under the control of the central bank. Accommodationists have challenged mainstream monatary theory by arguing for the credit nature of money and the role of bank lending in meeting the needs for trade of firms (Fontana,2003:296-297).

Although it is fully acknowledged that the endogeneous nature of the money supply process has its origins in the views expressed by the accomodationist approach, structuralists argue that full accommodation is an unrealistic real world asssumption and assert that the demand for credit at least, to some extent, quantity constrained by the central bank and commercial banks. Structuralists such as Palley (1994) and Pollin (1991) argue that accomodation depends on both stance of the monetary authorities and private initiatives of banks. Through open market operations, central banks have the option to place significant quantity constraints on reserve availability. In the strsucturalist view, discount window borrowing is not a close substitute for nonborrowed funds restricted by open market operations. An important feature of the structuralist endogeneity approach is their empasis on liability management practices that allow banks to partly overcome reserve constraints imposed by central bank (Nell, 1999:4-5).

Indeed these two approaches are complementary rather than competing ones. The comparision of them is summarized below.

Table 1. The Comparision of Accommodationist (Horizontalist) and Structuralist Approaches.

	Reserves of Banks	**Interest Rates**
Accommodationist (Horizontalist)	Central bank provides.	Central bank determines.
Structuralist	Bank provides as a result of financial innovations.	Determined by liquidity preference in the market.

Ref: Özgür (2008), H.Ü. İktisadi ve İdari Bilimler Fakültesi Dergisi, Cilt 26, sayı 2, s.62.

2. Literature

The question of whether money supply is endogeneous or exogeneous is an important topic in monetary theory. In the literature there is a limitted empirical study upon this topic. These studies support the endogeneity of money supply hypothesis.

Kaldor (1986) is one of the earliest empirical study in this topic. He analyzed UK economy between 1966-1979 period by using OLS (Ordinary Least Square) method. His findings are consistent with the endogeneity of money supply.

Moore (1988) extended it for the U.S. economy for 1973-1981 period by using quarterly data with Granger Causality tests. According to the analysis, he concluded endogeneity of money supply.

Palley (1994) investigated this hypothesis for the U.S. economy for 1973-1990 period. His findings supported the endogenous money supply hypothesis, especially structuralist approach.

Howells and Hussein (1998) analysed seven developed countries such as Canada France, Germany, Japan, Italy, U.K. and U.S. for the 1957-1993 period by using cointegration tests. Empirical findings suggest money supply is endogeneous for these countries.

Nell (1999) tested this hypothesis for South Africa over the 1966-1997 period by using cointegration tests. According to the empirical findings money supply is endogeneously determined.

Vera (2001) using the time series data from Spain for the 1987-1998 period by using Granger causality tests. The evidence is strongly consistent with the endogeneous money supply hypothesis.

The studies about Turkey have gone back to recent time and most of them verify the endogeneous money supply hypothesis.

Günal (1999) has analysed the relation between different money supply definitions and the bank credits to given to the both private and public sector in 1987-1997 period. The empirical results have supported the endogeneity of money supply hypothesis.

Işık (2000) has investigated the relation between total credits, monetary base and money multiplier by using quarterly data in 1987:1-1999:4 period. The empirical results of this study are consistent with the structuralist approach within the endogeneous money supply arguments.

Karaduman (2003) has used Granger causality tests in order to determine the direction of the causality from credits to money supply and from monetary base to credits in

1987-2002 period. According to the empirical results money supply is endegeneously determined.

Karabulut (2005) has used Granger causality tests to analyse the relationship between money supply and money demand for 1986:1-2004:1 period. The results are consistent with the structuralist view.

Tokucu (2008) has analysed the relation between bank credits to the private sector and money supply and monetary base by using VAR model in 1989:1-2005:4 period. The empirical results of this study have shown bidirectional causality. It shows both the central bank and commercial banks are efficient in the money supply determination process. But the causality from credits to the money supply confirms the endogeneity of money supply.

Işık ve Kahyaoğlu (2009) have analysed the relation between stock of the credits and monetary base in 1987:1-2007:3 period in Turkey. The empirical results of the study has supported the accommodationist approach.

Özgür (2011) has examined the relationship between bank credits to the private sector and broad money (M2,M3,M3A,M2Y and LO) by using cointegration and vector error correction models for the 1987:1-2009:2 period. There is a long run relationship between M2, M3,M3A and bank credits in a cointegration framework, but not with M2Y and LO which include foreign exchange deposits.

2. Econometric Method

In this part of the study, we first represent testing for cointegration using Johansen's methodology. Johansen's methodology takes its starting point in the vector autoregression (VAR)

$$\Delta y_t = \mu + \Pi y_{t-1} + \sum_{i=1}^{p-1} \Gamma_i \Delta y_{t-i} + \varepsilon_t \qquad (1)$$

where y_t is an $n \times 1$ vector of variables that are integrated of order one and ε_t is an $n \times 1$ vector of innovations. If the coefficient matrix Π has reduced rank $r < n$, then there exist $n \times r$ matrices α and β each with rank r such that $\Pi = \alpha\beta'$ and $\beta'y_t$ is stationary. r is the number of cointegrating relationships and each column of β is a cointegrating vector. Johansen proposes two different likelihood ratio tests of the reduced rank of the Π matrix: the trace test and the

maximum eigenvalue test, shown in Eqs. (2) and (3), respectively. For a detailed description of Johansen's methodology, see Johansen (1995) ve Johansen ve Juselius (1990).

$$Trace = -T \sum_{i=r+1}^{n} \ln(1 - \hat{\lambda}_i) \qquad (2)$$

$$Max-eigen = -T\ln(1 - \hat{\lambda}_{r+1}) \qquad (3)$$

Here T is the sample size and $\hat{\lambda}_i$ is the ith largest canonical correlation of Δy_t with y_{t-1} after correcting for lagged differences and deterministic variables when present. Neither of the test statistics follows a χ^2-distribution in general; asymptotic critical values can be found in Johansen and Juselius (1990) and Osterwald-Lenum (1992). In the bivariate case, for example, the hypothesis of no cointegration cannot be rejected if either (i) $\beta = (1\ 0)'$ and (ii) $\beta = (0\ 1)'$. In both cases, one would conclude that there is no cointegration between y_{1t} and y_{2t}, but rather, if restriction (i) is judged valid, that y_{1t} is stationary and that it can therefore not have a long-run relationship with y_{2t}, and vice versa if restriction (ii) is instead judged valid (Hjalmarsson and Österholm, 2010).

3. Empirical Analysis

In this study, the hypothesis of money supply whether exogeneous or endogeneous is tried to test in Turkish economy for the 2006:1-2015:11 period. The analysis period has begun since 2006. There are two reasons for that. The first one is, the definition of money supply is changed at the end of 2005. The second and the most important one, Turkey has implemented inflation targeting regime since the beginning of 2006. Inflation targeting regime which based on Monetarist approach has an assumption of exogeneous money supply. For that perpective, how money supply is determined in those period is a crucial matter.
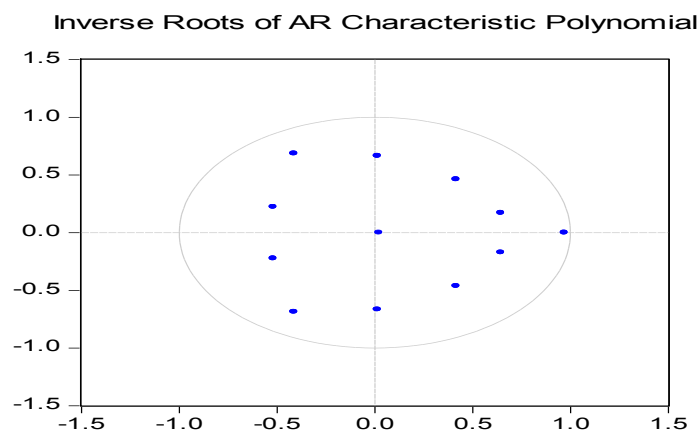
The datas are obtained from CBRT (Central Bank Republic of Turkey) Electronic Data Delivery System. The banking sector dominates in the financial system in Turkey. For that reason, in order to test endogeneous money supply hypothesis, we can look a causality from bank credits to the money supply in the form of M2. In this case, bank credits are taken as an independent variable, M2 is a dependent variable. According to the Post Keynesian literature all variables are nominal (Işık and Kahyaoğlu, 2009: 10). A dummy variable is used for October 2008.

First we look at the correlation from bank credits to money supply in order to test endogeneity of money supply hypothesis.

$$lnM2_t = \beta_0 + \beta_1 lnCRE_t + \mu_t$$

The optimum lenth of lag is 4 according to the Schwartz information criteria (SIC). There is no autocorrelation problem for VAR (4) model. In addition, it seems that inverse roots of AR process therefore the parameters are stable.

Lags	LM-Stat	Prob
1	6.101729	0.7297
2	6.291958	0.7104
3	3.029139	0.9631
4	10.44030	0.3160
5	2.331048	0.9851
6	12.40673	0.1913
7	14.00962	0.1220
8	9.684519	0.3766
9	4.203354	0.8975
10	9.539023	0.3891
11	5.722710	0.7673
12	10.91133	0.2818

Inverse Roots of AR Characteristic Polynomial

The finding of cointegration between money supply and bank credits series imply that there is a long run relationship between them. We begin by considering a Vector Error Correction (VEC) model of the money supply and bank credits series. We emphasize that a VEC model is cointegrated VAR model that has the cointegrating relationship(s) specified in the model. This specification allows the endogenous variables to converge to the long-run equilibrium as well as considering short-run adjustment dynamics to be included in the analysis. Cointegration is tested by employing Johansen's methodology (1988, 1991) which includes two complementary tests: the trace and maximum eigenvalue tests (Tansel,Özdemir

and Aksoy,2015:4). These test results are reported below. According to the trace and maximum eigen value tests at least one cointegration vector.

UnrestrictedCointegrationRank Test (Trace)				
Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.258418	44.38784	35.19275	0.0039
At most 1	0.066584	10.3034	20.26184	0.6098
At most 2	0.021264	2.450270	9.164546	0.6874

Trace test indicates 1 cointegratingeqn(s) at the 0.05 level
* denotesrejection of thehypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

UnrestrictedCointegrationRank Test (Maximum Eigenvalue)				
Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.258418	34.08250	22.29962	0.0007
At most 1	0.066584	7.855070	15.89210	0.5651
At most 2	0.021264	2.450270	9.164546	0.6874

Max-eigenvalue test indicates 1 cointegratingeqn(s) at the 0.05 level
* denotesrejection of thehypothesis at the 0.05 level

Normalized Long Run Equation

| CointegratingEq:	CointEq1
LNMONEY(-1)	1.000000
LNCREDİT(-1)	-0.639010 (0.12323) [-5.18546]
D08(-1)	-0.136507 (0.18547) [-0.73601]
C	-6.523571 (2.36394) [-2.75961]

$$\ln M2_t = 6.523 + 0.639\ CRE_t$$

According to the results, the coefficient of the slope is statistically significant in 0.05 level. The value of the long term prediction is around 0.639. This finding show us one unit increase in bank credits lead to 0.639 change in money supply.

Let's we consider the causality fom money supply to bank credits .

$$lnCRE_t = \beta_0 + \beta_1 M2_t + \mu_t$$

The optimum lenth of lag is 4 according to the Schwartz information criteria (SIC). There is no autocorrelation problem for VAR (4) model. In addition, it seems that inverse roots of AR process therefore the parameters are stable.

Lags	LM-Stat	Prob
1	6.101729	0.7297
2	6.291958	0.7104
3	3.029139	0.9631
4	10.44030	0.3160
5	2.331048	0.9851
6	12.40673	0.1913
7	14.00962	0.1220
8	9.684519	0.3766
9	4.203354	0.8975
10	9.539023	0.3891
11	5.722710	0.7673
12	10.91133	0.2818

Inverse Roots of AR Characteristic Polynomial
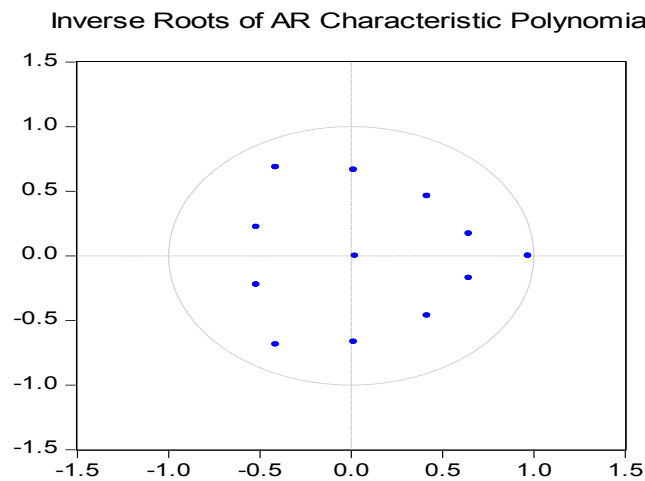
Cointegration Test

UnrestrictedCointegrationRank Test (Trace)				
Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.258418	44.38784	35.19275	0.0039
At most 1	0.066584	10.30534	20.26184	0.6098
At most 2	0.021264	2.450270	9.164546	0.6874

Trace test indicates 1 cointegratingeqn(s) at the 0.05 level

* denotesrejection of thehypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

UnrestrictedCointegrationRank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.258418	34.08250	22.29962	0.0007
At most 1	0.066584	7.855070	15.89210	0.5651
At most 2	0.021264	2.450270	9.164546	0.6874

Max-eigenvalue test indicates 1 cointegratingeqn(s) at the 0.05 level
* denotesrejection of thehypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Normalized Long Run Equation

CointegratingEq:	CointEq1
LNCREDİT(-1)	1.000000
LNMONEY(-1)	-1.564922 (0.32500) [-4.81521]
D08(-1)	0.213623 (0.32140) [0.66467]
C	10.20888 (6.36024) [1.60511]

$$\ln CRE_t = 10.208 + 1.564 \ln M2_t$$

Acoording to the results, the coefficient of the slope is statistically significant in 0.05 level. The value of the long term prediction is around 1.564. This finding show us one unit increase in money supply leads to 1.564 unit change in bank credits.

In the case of the cointegration between series, the convergence of the long run equilibrium of the series are examined by VECM (Vector Error Correction Model). VECM is cointegrated VAR model that has the cointegrating relationships specified in the model (Tansel, Özdemir and Aksoy,2015:5).

ErrorCorrection:	D(LNCREDİT)	D(LNMONEY)	D(D08)

CointEq1	-0.013596	-0.011835	-0.007825
	(0.00235)	(0.00246)	(0.01873)
	[-5.78781]	[-4.81766]	[-0.41785]

The coefficient of the ECT is negative and statistically significant for credits and money supply variable. For that reason, there is a bidirectional causality relationship between bank credits and money supply series in the long run.

VEC GrangerCausality/BlockExogeneityWaldTests			
Dependentvariable: D(LNCREDIT)			
Excluded	Chi-sq	df	Prob.
D(LNMONEY)	10.30947	4	0.0355
D(D08)	2.240144	4	0.6917
Dependentvariable: D(LNMONEY)			
Excluded	Chi-sq	df	Prob.
D(LNCREDİT)	6.956928	4	0.1382
D(D08)	8.926398	4	0.0630

But in the short run there is a unidirectional causality from money supply to bank credits. So, domestic bank credits are not a cause of money suuply in the short run.

4.Conclusions

The question of whether money supply is endogeneous or exogeneous is an important topic in monetary theory. According to the Monetarist School money supply is exogeneously determined. Exogeneity means, money supply is determined by central bank. On the other hand, Post Keynesian Economists have argued that money supply is endogeneous. It means, central bank cannot control the money supply and money supply is determined by credit demand.

In this study, the hypothesis of money supply whether exogeneous or endogeneous is tried to test in Turkish economy for the 2006:1-2015:11 period by using Johansen cointegration method. According to the empirical results, there is a causality from bank

credits to money supply in short run. But in the long run there is a bidirectional causality between the variables. Although most of the literature confirms endogeneity of money supply, this study departs from the literature which examines the endogeneous/ exogeneous money supply hypothesis in the inflation targeting period. Inflation targeting regime based on exogeneous money supply argument. The long run relation between variables show us the impact of the inflation targeting strategy and also the role of the central bank as a last lender of resort. Most of the crisis stem from financal sector in Turkey and in the world. In a that kind of environment, the role of the central bank is very important. But it does not mean that, central bank fully accommodates banking sector. Since 2010, CBRT has changed the final target of the inflation targeting regime. Now, CBRT try to maintance price and financial stability together. It means in practise, inflation targeting regime becomes more flexible than the traditional inflation targeting regimes. In Turkey, banking sector dominates the financial system. Moreover, financial and real sector are closely related.

REFERENCES

Fontana, G. (2003). Post Keynesian Approach To Endogenous Money: A Time Framework Explanation. *Review of Political Economy*, Volume 15, Number 3, July 2003.

Fontana, G. (2004). Rethinking Endogenous Money: A Constructive Interpretation Of The Debate Between Horizontalist And Structuralists. *Metroeconomica* 55:4 (2004) ,367-385.

Günal, M. (1999). Para Arzının İçselliği Etkileri, Merkez Bankalarının Değişen Rolü ve Türkiye'de Gelişmeler. (Yayımlanmamış Doktora Tezi). Ankara Üniversitesi SBE, Ankara.

Hjalmarsson, E., Österholm, P. (2010). Testing For Cointegration Using The Johansen Methodology When Variables Are Near-Integrated: Size Distortions and Partial Remedies. *Empirical Economics*, 39, 51–76.

Howells, P., Hussein, K. (1998), The Endogeneity of Money: Empirical Evidence. *Scottis Journal of Political Economy*, Vol.45, No.3, 329-340.

Işık, S. (2000). Para Arzının Endojenliği Tartışması: Türkiye Örneği. (Yayımlanmamış Doktora Tezi). Hacettepe Üniversitesi. Ankara.

Işık, S., Kahyaoğlu, H. (2009). Para Arzının İçselliği Hipotezi: Türkiye'den Bulgu (1987-2007), Econ Anadolu 2009, 17-19 Haziran 2009, Eskişehir, Türkiye.

Johansen, S. (1988) Statistical Analysis Of Cointegration Vectors. *Journal Of Economic Dynamics and Control*, 12, 231–254.

Johansen, S., Juselius, K. (1990). Maximum Likelihood Estimation And Inference on Cointegration With Applications To The Demand For Money. *Oxf Bull Econo Stat,* 52:169 210.

Johansen, S. (1991). Estimation and Hypothesis Testing Of Cointegration Vectors in GaussianVector Autoregression Models. *Econometrica*, 59, 1551–1580.

Kaldor, N. (1986). *The Scourge of Monetarism (Radcliffe Lectures)*, Second Edition, Oxfor University Press, 1986,.

Karaduman, H. A. (2003). Post Keynesyen İktisatta ve Türkiye'de Para Arzının İçselliği. (Yayımlanmamış Yüksek Lisans Tezi), Yıldız Teknik Üniversitesi, İstanbul.

Karabulut (2005). Para Arzının Endogenliği ve Türkiye Örneği. *Yönetim*. Yıl 16, Sayı 51, Haziran 2005, 25-31.

Moore, B.J.(1988). The Endogeneous Money Supply. *Journal of Post Keynesian Economics,* 10 (3), 372-385.

Nell, K.S. (1999). The Endogenous Nature Of South Africa's Money Supply Under Direct and Indirect Monetary Control Measures, (Erişim adresi:ftp://ftp.repec.org/opt/ReDIF/RePEC).

Özgür, G. (2008). İçsel Para Teorisi'ne Genel Bir Bakış. *H.Ü. İktisadi ve İdari Bilimler Dergisi*, Cilt 26, Sayı 2.

Özgür, G. (2011). Türkiye Ekonomisinde Para Arzının İçsel Süreci. *Ekonomik Yaklaşım*, Cilt: 22, Sayı: 78.51-79.

Palley,T.I. (1994), The Endogeneous Money Supply: Consensus and Disagreement. *Journal of Post Keynesian Economics*, 13(3), 397-403.

Tansel, A., Özdemir, Z. A., Aksoy, E. (2015). Unemployment and Labor Force Participation in Turkey, *Turkish Economic Associatıon Discussion Paper*, 2015/5.

Tokucu, E. (2008).Yapısalcı Post Keynesyen İçsel Para Arzı Yaklaşımı ve Türkiye Ekonomisinde Geçerliliği: 1986-2005 Dönemi. (Yayımlanmamış Doktora Tezi). Marmara Üniversitesi, İstanbul.

Vera, A.P. (2001). The Endogeneous Money Hypothesis: Some Evidence From Spain (1987 1998). *Journal of Post Keynesian Economics*, 23 (3), 509-526.

Wray, L. R. (2007). Endogenous Money: Structuralist And Horizontalist. *The Levy Economics Instıtute Working Paper*. No. 51.