

Milena Lopreite

University of Parma, Department of Economics
Italy

milena.lopreite@nemo.unipr.it

Via J. Kennedy, 6
43100 Parma (ITALY)
Telephone number +39 3491092564

THE ENDOGENOUS MONEY HYPOTHESIS AND SECURITIZATION: THE EURO AREA CASE (1999-2010).

Milena Lopreite

University of Parma, Department of Economics

Italy

milena.lopreite@nemo.unipr.it¹

Abstract

I examine the endogenous money supply hypothesis in the Euro Area using data from 1999 to 2010. I make extensive use of Vector Autoregression (VAR) models with Granger causality procedure to analyze non-cointegrated series and Vector Error Correction (VEC) models for cointegrated series.

The cointegration analyses reveals a bidirectional causality between loans and M1 both in the short and long run whereas loans causes variations in the M2 mainly in the short run. However, according to the Granger causality test there is a one-way causality from loans to M3 but not from loans to industrial production index. The results are confirmed by adjusting the loans series for securitization activity in the Euro Area and partially support the accommodationist view.

JEL classification numbers:E12, E51, E52.

Key Words: bank channel lending, money supply endogeneity, securitization, long-run cointegrating relationship.

1. Introduction

According to the Post-Keynesian economists the money supply is endogenous and determined by credit-money demand. The use of credit-money originated from debt and credit decisions gives a central role to the banking system (Kaldor and Trevithick 1982) and the process of money creation becomes independent from the Central Bank actions (Cottrell 1986; Laidler 1992).

The endogeneity of money implies a causality direction from loans to bank deposits. The loans demand is affected by nominal wages: an increase in firms' labor demand leads to higher wages costs resulting in an increase of loans demand. The output growth depends on increases of aggregate demand consequential in raises of money stock.

However, according to Keynesians, the monetary policy affects both the monetary base and money supply. Changes in money supply causes interest rates fluctuations which in turn affect investments and income.

Post-Keynesian economists argue that the global demand (PY) determines the amount of money transactions (MV). In this case, the direction of causality according to the quantity theory of money is reversed. The credit-money is anticipated by the banking system to finance entrepreneurs' requests. Consequently, the quantity of money is determined endogenously by the market demand. According to this theory, the high powered money is "a credit result and not the cause of it" (Arestis 1988). This inversion of relationship can be represented through the credit multiplier overthrow (Lavoie 1984; Arestis 1988). In fact, the money base in accordance with the Post-

¹ Large part of this paper has been written while the author was affiliated with the Department of Economics and Statistics at University of Calabria.

Keynesians is a banking process to obtain reserves from the Central Bank. However, it could happen that the requests to refinance deposits exceed the capacity of the individual bank, which is forced to refund from the Central Bank: through this process additional monetary base is created (Arestis 1988). This reversed causal relationship between payment and high powered money implies that the Central Bank controls the money supply through the interest rate (Shanmugam, Nair and Li 2003).

This vision contrasts the exogenous multiplier approach on the monetary base. According to the theory of the money multiplier, the Central Bank controls monetary base by setting the money stock equal to a given target value (Moore 1989).

The debate between Post-Keynesians is about the role of the banking system in satisfying loans demand. The Accommodationists argue that the Central Bank sets the cost of short term liquidity using the interest rate (overnight interest rate). In granting loans to the credit-worthy borrowers, the banking system by setting a loan rate equal to a fixed markup on the overnight interest rate acts as price setters (sets loan rate) and quantity takers (doesn't affect loans amount)(Moore 1988). Instead, the Structuralists argue that the Central Bank controls reserves (Palley 1996), while the banking system manages liability to increase its own loans/reserves rate (Pollin 1991). In accordance with the Structuralists, in fact, the markup changes cyclically and in relation to risk positions (Vera 2001).

Supporters of Post-Keynesian theory found the following empirical evidence to confirm this theory (Shanmugam, Nair and Li 2003):

1. The econometric results confirm that the money supply is passive (Nell 2000; Vera 2001; Shanmugam, Nair and Li 2003);
2. The hypothesis of endogenous money can be explained with other many economical variables. According to this aspect Cifter and Ozun (2007) analyze the correlation between money, interest, inflation and productivity using VEC models.

In this paper, I analyze the money endogeneity in a short term study of the Euro Area during the two main crises: the bursts of the dot-com bubble (1998-1999) and the sub-prime mortgage crisis (2008-2009). I adjust loans series for securitization activity to investigate whether the European banking system obtaining additional liquidity independently of the Central Bank reserve could shelter its own loans supply from the effect of monetary policy (Altunbas, Gambacorta and Marquez 2007).

Finally, I extend the evidence of endogenous money hypothesis on other advanced countries. In fact, there is a small amount of empirical evidence available on developed countries (Moore 1998; Palley 1994; Howells and Hussein 1998; Nell 2000; Vera 2001; Shanmugam, Nair and Li 2003) and a study on Euro Area could fill this gap. I focus my analysis in particular on the aggregate M3. In fact, in the study period European Central Bank uses the M3 money supply as its monetary target.

The paper is organized as follows: Section 2 briefly discusses the literature on passive money hypothesis. Section 3 describes the data and tests stationarity and cointegration. Section 4 implements VAR models applying Granger causality test for non cointegrated series, VECM models based on causality test for cointegrated series and discusses the implications of the results. Section 5 concludes and suggests direction for futures investigations.

2. Literature Review

The theories that support the Post-Keynesian view consider different causal relationships.

According to the accommodationalists (Moore 1989) there is full settlement of the reserve demand by the Central Bank versus banking system that totally accommodates loans requests. Consequently, there is a one-way causal relationship from loans (L) to Monetary Base (BM) and from loans (L) to the monetary aggregates (M1-M2-M3). Furthermore, debtors establish their own loans demand considering future income expectations. At the same time, the deposits created with new loans are used to finance increases in aggregate demand. To sum up the accommodationist view (Moore 1989; Pollin 1991) involves a two-way causality relationship between money revenue (GDP) and money supply (M1-M2-M3).

The structuralist hypothesis (Pollin 1991; Palley 1996, 1998) combines the classic characteristics of the monetarism (the Central Bank controls reserves supply) with the accommodationist view. This vision implies bidirectional causality from the monetary base (BM) to loans (L), from money supply (M1, M2, M3) to loans (L) and from the money multiplier (M1/B, M2/B, M3/B) to loans (L). Structuralists consider the use of alternative financing forms (*securitization*) to partially exceed reserves shortage (Palley 1996). Considering the relationship between income (GDP) and money supply (M1, M2, M3), the structuralists view is consistent with the accommodationalism, which implies bi-directionality between the two variables.

The exponents of the liquidity preference view (Howells 1995) support the *core* of the accommodationalists that argues a causal relationship from loans (L) to the money supply (M1, M2, M3). However, the economic units have independent liquidity preference on how much money they wish to hold so a supply excess may exist (Howells 1995). In this case, the liquidity preference view implies two-way causality from money supply (M1, M2, M3) to loans (L).

In the Post Keynesian economics the first work on passive money is carried out by Pollin (1991) that obtains results supporting structuralist view for USA during 1953-1988. Vera (2001) finds outcomes sustaining accommodationalist and structuralist theories for Spain in the period between 1987-1998 using Granger causality test applied to money multipliers (M1/B, M2/B, M3/B) and loans data. Nell (2000-2001) examines the relationships between money supply, money circulation velocity and loans using VEC models for South Africa during 1966-1997 and confirm all Post-Keynesian approaches (Structuralist, Accomodationalist and liquidity preference theorist). Shanmungan Nair and Li (2003), analyze the relationships between money base, money supply, credit and industrial production index with VEC models and Granger causality test in Malaysia in the period between 1985-2000: their results support the accomodationalist and liquidity preference theorists. Lavoie (2005) test the endogeneity of money in Canada and in United States obtaining results that sustain accomodationalist view. Ahmad and Ahmed (2006) apply VAR models for non cointegrated series (short term test) and VEC models (long term test) for cointegrated series on passivity money hypothesis for Pakistan during 1980-2003. The short term results confirm the structuralist and liquidity preference approaches while the long-run test puts in evidence the active role of Pakistan Central Bank to set money supply. Gunduz (2001), Seyrek, Duman and Sarikaya (2004) analyze the role of Turkish channel lending during 1986-1998 applying VAR models. Their findings support an active role of the monetary policy.

Finally, Cifter and Ozun (2007) examine the passive money hypothesis in Turkey for the period between 1997-2006 using money base, money supply, industrial production index, interest rate, inflation rate, and exchange rate through a VEC models. Their results partially support the accomodationalist theorists because there is one-way causality relationship from credit to money base and from credit to money supply but there isn't a causal relationship between money supply and industrial production index.

Table 1: The endogenous money hypothesis: a comparison of the three approaches

Accommodationist view (Moore 1989)	Structuralist view (Palley 1996, 1998; Pollin 1991)	Liquidity preference theorists (Howells 1995)
${}^a\text{ld}_L \rightarrow {}^b\text{ld}_M3, \text{ld}_{BM}$ $\text{ld}_{IPI} \leftrightarrow \text{ld}_M3$	$\text{ld}_L \leftrightarrow \text{ld}_{BM}, \text{ld}_M3, \text{ld}_{M3/B}$ $\text{ld}_{IPI} \leftrightarrow {}^c\text{ld}_M3$	$\text{ld}_L \leftrightarrow \text{ld}_M3$

Notes: ^a I define variables as: ld_{BM} = first difference of log monetary base (BM); ld_M3 =first difference of log money supply (M3); ld_L =first difference of log loans (L); $\text{ld}_{M3/B}$ =first difference of log M3 money multiplier (M3/B); ld_{IPI} = first difference of log industrial production index (proxy of GDP using monthly data). ^bThe symbol \rightarrow implies one-way causality direction. ^c The symbol \leftrightarrow implies two-way causality direction.

3.Data and Methodology

3.1. Data

I employ monthly data drawn from European Central Bank Statistical Data Warehouse. The variables are: loans (L), M1 money supply ($M1_t$), M2 money supply ($M2_t$), M3 money supply ($M3_t$) and monetary base (BM_t).² Following Vera (2001) I decompose the money supply into monetary base (BM) and money multipliers ($M1_B$, $M2_B$, $M3_B$). This helped testing the significance of liability management as a source of loan demand accommodation.

The sample examined is the European area³. I transform data by taking logarithms to stabilize variance⁴. The sample period is from 1999:02 to 2010:12. I choose 1999 as the base year of this study because there is a single monetary policy whereby all banks are subject to one monetary regime.

² I consider the monetary aggregates of the European area according to the ECB definition in the following way: M0 (monetary base) is Currency (banknotes and coins) in circulation plus the minimum reserves credit institutions are required to hold with the Eurosystem and any excess reserves they may voluntarily hold in the Eurosystem's deposit facility, all of which are liabilities on the Eurosystem's balance sheet. M1: currency in circulation + overnight deposits; M2: M1 + deposits with an agreed maturity of up to two years + deposits redeemable at notice of up to three months; M3: M2 + repurchase agreements+ money market fund shares and units as well as debt securities with a maturity of up to two years. Finally, loans comprise credit granted by the banking system to households and enterprises (nonbank private sector) in the European area excluding the interbank positions and the government. This series is not adjusted for securitization. All the considered variables are in million of Euro.

³For my analysis I consider the countries: Belgium, Germany, Greece, Spain, Estonia, Ireland, France, Italy, Cyprus, Luxembourg, Malta, Netherlands, Austria, Portugal, Slovenia, Slovakia and Finland. I also consider only the countries that in the same time and jointly adopted unique monetary policy as: Belgium, Germany, Spain, Ireland, France, Italy, Luxembourg, Netherlands, Austria, Portugal and Finland. The results confirm my precedent analysis (with the all countries).

⁴I define variables as follows:

l_{BM} =log of monetary base (BM);

l_{M1} =log of money supply (M1);

l_{M2} =log of money supply (M2);

l_{M3} =log of money supply (M3);

l_L =log of loans (L);

$\text{l}_{M1/B}$ =log of M1 money multiplier (M1/B);

$\text{l}_{M2/B}$ =log of M2 money multiplier (M2/B);

$\text{l}_{M3/B}$ =log of M3 money multiplier (M3/B).

The number of observations is 143. A large sample size enhances the power of my estimation. I seasonally adjust series using Tramo/Seats procedure (to avoid problems related to series seasonality). They exhibit typical pattern for non stationary series with increasing trends (Figure 1, Figure 3) except for money multipliers that show stochastic trends (Figure 2).

Figure 1: Series in log-levels of base money and monetary aggregates seasonally adjusted

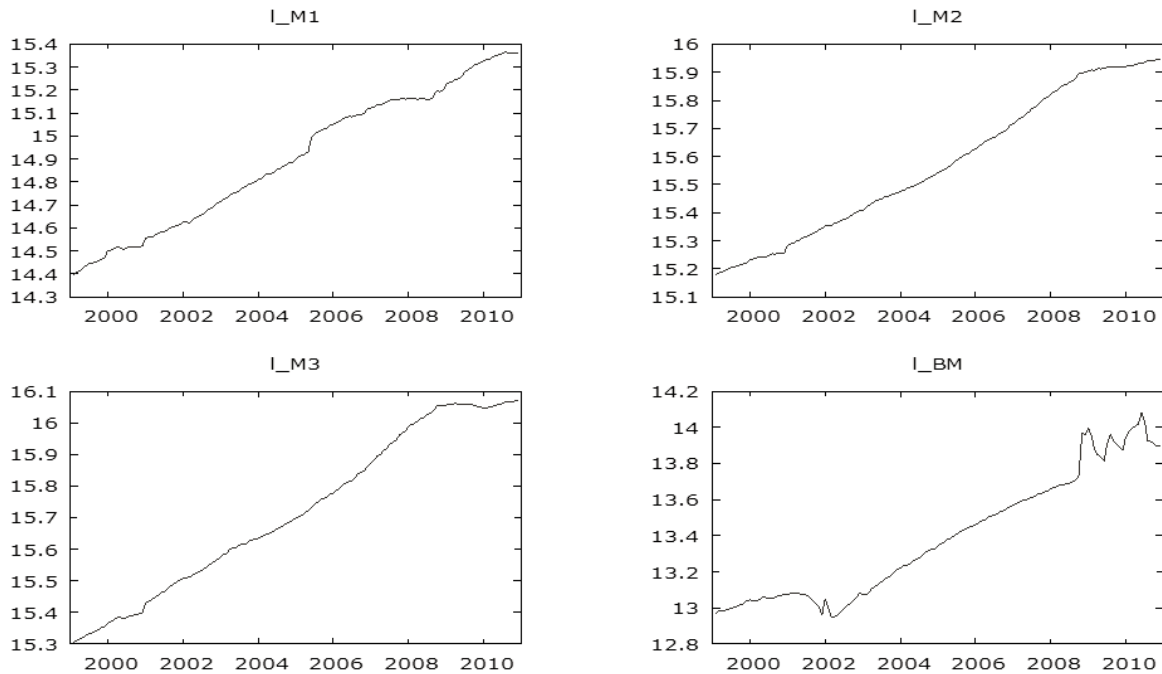


Figure 2: Series in log-levels of loans and money multipliers seasonally adjusted

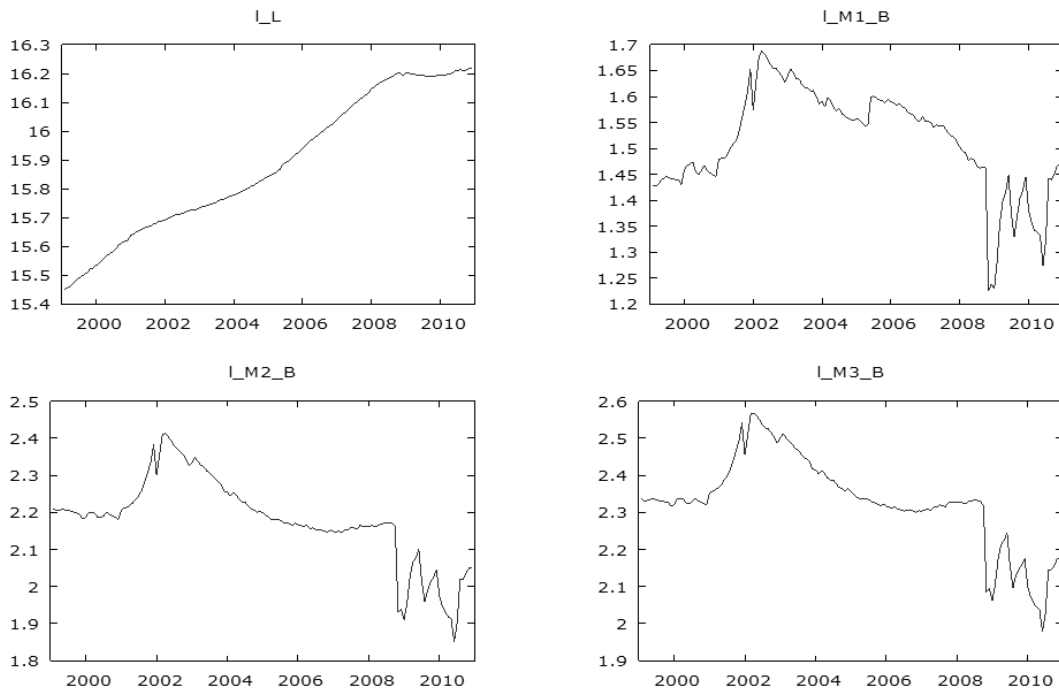
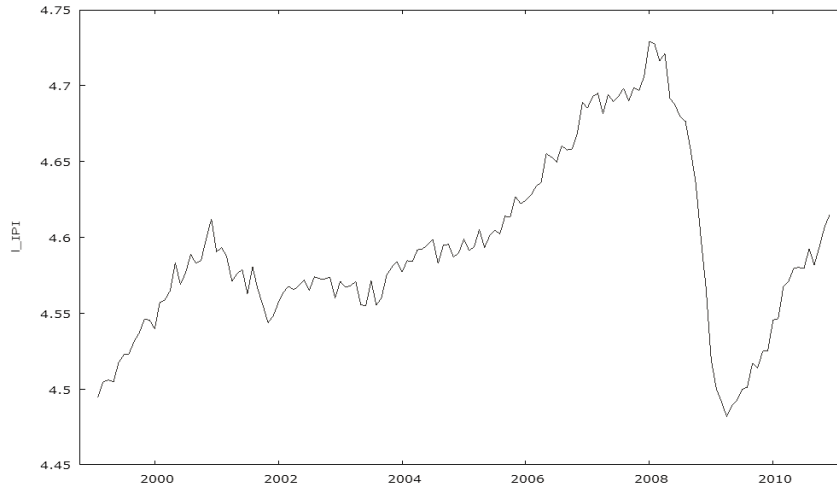


Figure 3: Series in log-levels of industrial production index seasonally adjusted



3.2 Unit roots test

From the inspection of the series in log-levels reported in Figure 1, Figure 2 and Figure 3 all variables seem to be $I(1)$, or not stationary. I transform them into first difference to eliminate trend. I apply unit roots test to analyze variables integration's order.

To test the presence of unit root I follow two steps:

(a) I select the deterministic part. In this case I consider a model with trend and constant;

(b) I select the initial lags order. The monthly data suggest to start with a lags order at least equal to 12.

The graphical inspection of the series in log-levels (Figure 1, Figure 2, Figure 3) underlines a possible presence of unit root that it is jointly confirmed by the ADF test, KPSS test and PP test.

The series appear persistent as shown in Table 2. The ADF test and PP test, in fact, never reject at the 5% level of significance the null hypothesis of unit root's presence, while the KPSS test never accept at the 5% level of significance the null hypothesis of unit root's absence⁵.

Table 2: Unit root test of series in log-levels^a

Variables	Lags	ADF Test (p-value)	KPSS Test (test statistic)	PP Test (test statistic)	Results
I_L	13	0.72	1.12 ^b	-1.73 ^c	I(1)
I_BM	8	0.96	1.63	-1.46	I(1)
I_M1	13	0.88	1.12	-1.89	I(1)
I_M2	6	0.77	2.13	-1.36	I(1)
I_M3	3	0.63	3.63	-1.83	I(1)
I_M1_B	8	0.51	1.66	-1.4	I(1)
I_M2_B	8	0.76	1.11	-2.14	I(1)
I_M3_B	8	0.76	0.8	-1.79	I(1)
I_IPI	13	0.39	1.85	-1.93	I(1)

Notes: ^a The results confirm graphical intuition. ^b The critical value at the 5% level of significance is equal to 0.46 and the critical value at the 1% level of significance is equal to 0.73 so the null hypothesis H_0 : no unit roots is rejected. ^c The critical value at the 5% level of

⁵ I also perform the tests based to the other specification to insure the robustness of the acceptance of null hypothesis of a unit root for underlying data-generating process.

significance is equal to -2.88 and the critical value at the 1% level of significance is equal to -3.47 so the null hypothesis H_0 : presence of unit roots is not rejected.

I apply the ADF test, PP test and KPSS test to the variables in log-levels transformed into first-order differences. The results are reported in Table 3:

Table 3: Unit roots test of series in log first-order differences

Variables	Lags	ADF Test ^a (p-value)	KPSS Test (test statistic)	PP Test (test statistic)	Results
ld_L ^b	12	0	0.25 ^c	-18.78 ^d	I(0)
ld_BM	13	0.08	0.14	-10.46	I(0)
ld_M1	12	0.02	0.12	-11.32	I(0)
ld_M2	12	0	0.17	-12.36	I(0)
ld_M3	2	0.003	0.58	-9.83	I(0)
ld_M1_B	13	0.048	0.10	-10.98	I(0)
ld_M2_B	13	0.048	0.11	-10.90	I(0)
ld_M3_B	13	0.007	0.10	-10.79	I(0)
I_d_IPI	10	0.004	0.09	-24.08	I(0)

^a For the ADF test and KPSS test I use Gretl package, while for the Phillips Perron test I use E-Views 7 package. ^b I apply to loans series the Hodrick- Prescott filter to remove trend. ^c The critical value at the 5% level of significance is equal to 0.46, the critical value at the 1% level of significance is equal to 0.73. In this case the statistic test results accept the null hypothesis H_0 : no unit root presence. ^d The critical value at the 5% level of significance is equal to -2.88, the critical value at the 1% level of significance is equal to -3.47. In this case the statistic test results reject the null hypothesis H_0 : unit root presence.

The PP, ADF and KPSS test jointly confirm the stationarity of the series, so I can confirm that they don't contain more than one unit root and are integrated of order 1 in log-levels.

3.3 Cointegration Analysis

Contrarily to Shanmugam, Nair and Li (2003), where residuals based on cointegration analysis of Engle-Granger (1987) are used, I apply the the Johansen (1991) procedure on bivariate VAR models to consider multiple cointegration relationships, as in Cifter and Ozun (2007).

Since the variables individually follow non stationary I(1) processes in levels and they become I(0) in their first-order differences, I can apply Johansen cointegration test. I run the test inserting the lags order that minimizes the three informative criterions and the option “*unrestricted constant*”. I insert dummies to capture the effects of Central Bank interventions and business cycle effects.

The trace test and the maximal eigenvalue test reveal one cointegrating vector at 5% level of significance among Loans-M1 and Loans-M2 (Table 4).

A nonzero cointegrating vector represents the influence from a long-term force. The cointegrating vector specifies a long term relation among the levels of loans, M1, and M2. Any deviation from this relation will cause the loans to change and the impact of this deviation will last for a long period of time because it is the levels of the variables that cause the loans change. Since a nonzero cointegrating vector has enduring effect, it represents the influence in the long run.

The results are shown in Table 4.

Table 4: The maximal Eigenvalue Test and the Trace Test of Johansen (1991)

Variables	Lags	H ₀	λ_{trace}^a Stat.	λ_{max} Stat.	Results
l_L and l_BM	3	r=0	10.95 [0.21] ^b	7.75 [0.21]	Not Cointegrated
l_L and l_M1^c	2	r=0	13.60 [0.079]	13.051 [0.07]	Cointegrated
		r=1	0.55 [0.48]	0.45 [0.48]	
l_L and l_M2^d	2	r=0	20.31 [0.007]	17.43 [0.02]	Cointegrated
		r=1	2.87 [0.59]	2.87 [0.59]	
l_L and l_M3	2	r=0	13.28 [0.10]	8.20 [0.36]	Not Cointegrated
l_L and l_M1_B	3	r=0	11.86 [0.16]	6.75 [0.52]	Not Cointegrated
l_L and l_M2_B	3	r=0	10.9 [0.21]	7.55 [0.43]	Not Cointegrated
l_L and l_M3_B	3	r=0	10.14 [0.27]	6.95 [0.50]	Not Cointegrated
l_L and l_IPI	4	r=0	13.69 [0.29]	10.24 [0.2]	Not Cointegrated
l_M1 and l_IPI	4	r=0	12.48 [0.13]	10.43 [0.18]	Not Cointegrated
l_M2 and l_IPI	4	r=0	3.58 [0.9]	3.24 [0.9]	Not Cointegrated
l_M3 and l_IPI	4	r=0	5.31 [0.77]	3.21 [0.92]	Not Cointegrated
l_BM and l_IPI	4	r=0	3.3 [0.94]	3.3 [0.91]	Not Cointegrated

Notes: ^a I extract the asymptotic critical values for the statistic LR from Osterwald-Lenum (1992). ^b The values in parentheses are the respective *p-values*. ^c I accept for this relationship the cointegration relationship at the 10% level of significance to analyze the long-run effect. ^d For an anomalous series behavior in 2001:01 I add a dummy variable that results statistically significant.

Using Johansen procedure I obtain zero cointegrating vector among loans-monetary base, loans-M3, loans-money multipliers, loans-IPI and IPI-M1, M2, M3, BM. So, according to Vera (2001) and Shanmugam, Nair and Li (2003) rather than the levels, I use in my analysis variables first-order differences to obtain stationary VAR models.

I test also, for each relationship, the absence of autocorrelation and conditional heteroskedasticity (arch effects) in the residual for the robustness of the results⁶.

3.4 A VAR model to test the hypothesis of money endogeneity in the Euro Zone

I estimate bivariate VAR models for not cointegrated and stationary series. I select the optimal lags order for each VAR model considering the three informative criterions⁷ that it is equal to 3 for the relationship loans-monetary base (BM) and loans-Money multipliers (M1/B, M2/B, M3/B) while is equal to 1 for the relationship loans-M3:

$$\begin{bmatrix} \Delta l_{L_t} \\ \Delta l_{M1_B t} \end{bmatrix} = \begin{bmatrix} a_1 \\ a_2 \end{bmatrix} + A_1 \begin{bmatrix} \Delta l_{L_{t-1}} \\ \Delta l_{M1_B t-1} \end{bmatrix} + A_2 \begin{bmatrix} \Delta l_{L_{t-2}} \\ \Delta l_{M1_B t-2} \end{bmatrix} + \begin{bmatrix} \varepsilon_1 \\ \varepsilon_2 \end{bmatrix} \quad (1)$$

$$\begin{bmatrix} \Delta l_{L_t} \\ \Delta l_{M2_B t} \end{bmatrix} = \begin{bmatrix} a_1 \\ a_2 \end{bmatrix} + A_1 \begin{bmatrix} \Delta l_{L_{t-1}} \\ \Delta l_{M2_B t-1} \end{bmatrix} + A_2 \begin{bmatrix} \Delta l_{L_{t-2}} \\ \Delta l_{M2_B t-2} \end{bmatrix} + \begin{bmatrix} \varepsilon_1 \\ \varepsilon_2 \end{bmatrix} \quad (2)$$

$$\begin{bmatrix} \Delta l_{L_t} \\ \Delta l_{M3_B t} \end{bmatrix} = \begin{bmatrix} a_1 \\ a_2 \end{bmatrix} + A_1 \begin{bmatrix} \Delta l_{L_{t-1}} \\ \Delta l_{M3_B t-1} \end{bmatrix} + A_2 \begin{bmatrix} \Delta l_{L_{t-2}} \\ \Delta l_{M3_B t-2} \end{bmatrix} + \begin{bmatrix} \varepsilon_1 \\ \varepsilon_2 \end{bmatrix} \quad (3)$$

$$\begin{bmatrix} \Delta l_{L_t} \\ \Delta l_{BM_t} \end{bmatrix} = \begin{bmatrix} a_1 \\ a_2 \end{bmatrix} + A_1 \begin{bmatrix} \Delta l_{L_{t-1}} \\ \Delta l_{BM_{t-1}} \end{bmatrix} + A_2 \begin{bmatrix} \Delta l_{L_{t-2}} \\ \Delta l_{BM_{t-2}} \end{bmatrix} + \begin{bmatrix} \varepsilon_1 \\ \varepsilon_2 \end{bmatrix} \quad (4)$$

$$\begin{bmatrix} \Delta l_{L_t} \\ \Delta l_{M3_t} \end{bmatrix} = \begin{bmatrix} a_1 \\ a_2 \end{bmatrix} + A_1 \begin{bmatrix} \Delta l_{L_{t-1}} \\ \Delta l_{M3_{t-1}} \end{bmatrix} + \begin{bmatrix} \varepsilon_1 \\ \varepsilon_2 \end{bmatrix} \quad (5)$$

For each VAR model I apply Wald test to analyze the endogenous money hypothesis. The results are reported in Table 5, 6, 7, 8.

I test also that there isn't autocorrelation and arch effect in the residuals (here not reported). This confirms the robustness of the results.

Table 5: Wald test for the lags' significance of money multipliers, base money and M3 in the loans regression.

	$\Delta l_{M1_B t}$	$\Delta l_{M2_B t}$	$\Delta l_{M3_B t}$	Δl_{BM_t}	Δl_{M3_t}	Results
Lag 1	0.84 [0.35] ^a	1.19 [0.27]	1.13 [0.28]	1.34 [0.24]	0.12 [0.72]	Not Significant
Lag 2	18.20 [0]	11.62 [0]	10.10 [0.001]	11.80 [0]	NO	Significant

Notes: ^a The values in parentheses are the respective *p-values*.

⁶ Supplementary appendices including these results are available from the author upon request.

⁷ Akaike Information Criterion (AIC), Hannan-Quinn Information Criterion and Schwartz Information Criterion (SIC).

Table 6: Wald test for the lags' significance of loans in the money multipliers, base money and M3 regression.

	ΔI_{M1_Bt}	ΔI_{M2_Bt}	ΔI_{M3_Bt}	ΔI_{BMt}	ΔI_{M3t}	Results
Lag 1	2.24	0.3	0.22	1.34	5.51	Significant in the M3 Regression
ΔI_{Lt}	[0.13] ^a	[0.58]	[0.63]	[0.24]	[0.02]	
Lag 2	0.07	0.08	0.11	11.80	NO	Not Significant
ΔI_{Lt}	[0.93]	[0.77]	[0.74]	[0.78]		

Notes:^a The values in parentheses are the respective *p-values*.

Table 7: Wald test for the jointly lags' significance of money multipliers, base money and M3 in the loans regression.

	ΔI_{M1_Bt}	ΔI_{M2_Bt}	ΔI_{M3_Bt}	ΔI_{BMt}	Results
ΔI_{Lt}	10.66 [0] ^a	6.56 [0.001]	5.64 [0.004]	6.57 [0.001]	Significant

Notes:^a The values in parentheses are the respective *p-values*.

Table 8: Wald test for the jointly lags' significance of loans in the money multipliers, base money and M3 regression.

Dependent Variable	ΔI_{Lt}	Results
ΔI_{M1_Bt}	1.94 [0.14]	Not Significant
I_{M2_Bt}	0.15 [0.85]	Not Significant
ΔI_{M3_Bt}	0.11 [0.89]	Not Significant
ΔI_{BMt}	0.11 [0.89]	Not Significant

According to the Wald test I find that money multipliers and base money are statistically significant in explaining the short term loans dynamic while the explanatory power of loans is relatively weak in the short run (Table 5, 7, 8). I find that only the first loans lag (Table 6)

influences the monetary aggregate M3 and this result partially supports money endogeneity in the European area.

To improve the economical results interpretation, I apply Granger causality test (Table 9).

There is a Granger-causality at 5% level of significance between loans and monetary base (also considered the optimal lag order) with a direction of causality from the monetary base to the loans, from money multipliers (M1/B, M2/B, M3/B) to the loans, from industrial production index to the loans, money supply (M1, M2) and money base.

In general, Granger-causality test underlines that the hypothesis of money endogeneity is weakly confirmed in the Euro area. In fact, when considering the optimal lags order loans Granger-Cause the money supply M3 but do not Granger-Cause industrial production index. This result partially support the accomodationalist view.

Repeating the analysis for lag length, varying from optimal lag order to 12 does not affect the results. This confirms the robustness of the test.

Table 9: Granger causality test^a

Variables	Optimal lags ^b (p.value)	6 Lags (p.value)	8 Lags (p.value)	12 Lags (p.value)
$\Delta I_{L_t} \rightarrow \Delta I_{M1_B t}$	0.52	0.44	0.6	0.05
$\Delta I_{M1_B t} \rightarrow \Delta I_{PR t}$	0.03**	0.05**	0.01***	0.1
$\Delta I_{L_t} \rightarrow \Delta I_{M2_B t}$	0.89	0.61	0.78	0.08
$\Delta I_{M2_B t} \rightarrow \Delta I_{L t}$	0.01***	0.04**	0.04**	0.16
$\Delta I_{L_t} \rightarrow \Delta I_{M3_B t}$	0.9	0.58	0.72	0.06
$\Delta I_{M3_B t} \rightarrow \Delta I_{L t}$	0.01***	0.06*	0.06*	0.21
$\Delta I_{L_t} \rightarrow \Delta I_{BM t}$	0.7	0.6	0.7	0.05
$\Delta I_{BM t} \rightarrow \Delta I_{L t}$	0.01***	0.03**	0.03**	0.12
$\Delta I_{L_t} \rightarrow \Delta I_{M3 t}$	0.06*	0.77	0.85	0.79
$\Delta I_{M3 t} \rightarrow \Delta I_{L t}$	0.86	0.19	0.27	0.51
$\Delta I_{L t} \rightarrow \Delta I_{IPI t}$	0.7	0.8	0.7	0.8
$\Delta I_{IPI t} \rightarrow \Delta I_{L t}$	0.01***	0.03**	0.07*	0.04***

$\Delta I_{IP1t} \rightarrow \Delta I_{M1t}$	0.02**	0.008***	0.001***	0.03**
$\Delta I_{M1t} \rightarrow \Delta I_{IP1t}$	0.28	0.22	0.009	0.01
$\Delta I_{IP1t} \rightarrow \Delta I_{M2t}$	0.02**	0.05**	0.0005***	0.003***
$\Delta I_{M2t} \rightarrow \Delta I_{IP1t}$	0.6	0.005	0.09	0.3
$\Delta I_{IP1t} \rightarrow \Delta I_{M3t}$	0.09*	0.008***	0.01***	0.002***
$\Delta I_{M3t} \rightarrow \Delta I_{IP1t}$	0.9	0.6	0.7	0.9
$\Delta I_{IP1t} \rightarrow \Delta I_{BMt}$	0.0098***	0.009***	0.008***	0.009***
$\Delta I_{BMt} \rightarrow \Delta I_{IP1t}$	0.31	0.4	0.5	0.5

Notes: ^a Ho: No *Granger-causality*. ^b For the lag selection I use the three informative criterions. The optimal lags is equal to 2 for all relationships except the for Loans-M3 that optimal lag is equal to 1. ^c Considering the optimal lag, loans *Granger-Cause* M3 at the 5% level of significance supporting the accommodationalist view. (*), (**), (***) indicates statistically significant at the 10%, 5% and 1% percent level.

3.5 The vector error correction models

For the analysis of cointegrated series I apply VEC models using Wald test to analyze short term relationships (Luetkepohl and Reimers 1992a; Shanmugan, Nair and Li 2003; Cifter and Ozun 2007). I use cointegration modeling to separate the potential long term relationship between money supply M1 and loans, money supply M2 and loans from their short term adjustment mechanisms.

Johansen (1991) describes cointegrated variables (loans, M1, M2) as being in equilibrium when the stationary linear combination of their levels is at its unconditional mean that is usually assumed to be zero. The system is out of equilibrium when this combination of levels (loans, M1 and M2) is not zero. However, since the combination is stationary, there is always a tendency for the system to return to equilibrium. The nonzero stationary cointegration vector is defined “equilibrium error” (EC).

I make the analysis of long run relationship considering EC parameter (Shanmugan, Nair and Li 2003; Cifter and Ozun 2007). The error correction models imply a situation in which a long-term relationship exists among the variables (loans, M1, M2) in the economy and in which the equilibrium error induces change in the depend variable.

I estimate a vector error correction model of order 1 with rank one for the relationships Loans-M1, and Loans-M2. Since VECM order is one and the rank is one it is not necessary to impose other constraints for a correct interpretation ((Luetkepohl and Reimers 1992a).

$$\begin{bmatrix} \Delta l_{Lt} \\ \Delta l_{M1t} \end{bmatrix} = \Phi d_t + \begin{bmatrix} b \\ \alpha_1 \\ \alpha_2 \end{bmatrix} \begin{bmatrix} \beta_0 & \beta_1 & \beta_2 \end{bmatrix} \begin{bmatrix} 1 \\ l_{Lt-1} \\ l_{M1t-1} \end{bmatrix} + \begin{bmatrix} v_1 \\ v_2 \end{bmatrix} \quad (6)$$

$$\begin{bmatrix} \Delta l_{Lt} \\ \Delta l_{M2t} \end{bmatrix} = \Phi d_t + \begin{bmatrix} b \\ \alpha_1 \\ \alpha_2 \end{bmatrix} \begin{bmatrix} \beta_0 & \beta_1 & \beta_2 \end{bmatrix} \begin{bmatrix} 1 \\ l_{Lt-1} \\ l_{M2t-1} \end{bmatrix} + \begin{bmatrix} D_1 \\ D_2 \end{bmatrix} DC^8 + \begin{bmatrix} v_1 \\ v_2 \end{bmatrix} \quad (7)$$

Table 10: Causality test for the money endogeneity hypothesis based on vector Error Correction Model

	Short term Effect	Long term Effect	VECM	
	Wald Test	EC _{t-1}	Short term	Long Term
Dependent Variable:				
IM1				
IL	2.98 (0.03)	-0.02 (0.09)	IL=>IM1	IL=>IM1
Dependent Variable:				
IL				
IM1	7.37 (0)	-0.02 (0)	IM1=>IL	IM1=>IL
Dependent Variable:				
IM2				
IL	8.85 (0)	-0.009 (0.94)	IL=>IM2	IL≠>IM2
Dependent Variable:				
IL				
IM2	0.38 (0.67)	0.05 (0)	IM2≠>IL	IM2=>IL

The results reported in Table 10 reveal that M2 influences loans in the long run because the cointegrating vector involve M2 (influence factor 0.05) but this relationship doesn't exist in the short term in which loans condition M2 money supply (influence factor 8.85).

The earlier results of Granger causality test (Table 9) show a short term one-way causality from the M2 money multiplier (M2_B) to the loans, from monetary base to the loans and from industrial production index to the loans. This implies that the Post-Keynesian view may not hold true in the case of Euro Area's M2 money supply.

In the case of the monetary aggregate M1 there is in the long and in the short period a bidirectional causality between M1 and loans that may support the theoretical suppositions of the liquidity preference view.

⁸ For both series I add a dummy variable in 2001:01 as dot-com bubble effect.

However, in the short term I obtain that Granger causality runs from base money M1 money multiplier (M1_B) and industrial production index (IPI) to the bank lending and not vice versa. In this case the absence of causality from total bank loans to the M1 money multiplier (M1_B) don't sustain the structuralist view showing lack evidence to support the use of liability management among European banks.

4. Robustness check: The securitization effect

In this section I test the robustness of the results by adjusting the loans series for securitization for securitization to analyze if the banking system can insolate from monetary policy negative shocks through securitization.

I estimate VAR models of order three for not cointegrated series testing the endogenous money hypothesis with Granger Causality Test. The results are reported in Table 11.

Table 11: Granger Causality test

Variables ^a	Optimal Lags	4 Lags (p.value)	8 Lags (p.value)	12 Lags (p.value)
$\Delta I_{L\ sec_t} \rightarrow \Delta I_{IPI_t}$	0.7	0.8	0.7	0.8
$\Delta I_{IPI_t} \rightarrow \Delta I_{L\ sec_t}$	0.01***	0.05**	0.04**	0.1
$\Delta I_{L\ sec_t} \rightarrow \Delta I_{M1_t}$	0.61	0.76	0.61	0.11
$\Delta I_{M1_t} \rightarrow \Delta I_{L\ sec_t}$	0.09*	0.06*	0.05**	0.81
$\Delta I_{L\ sec_t} \rightarrow \Delta I_{M2_B_t}$	0.85	0.75	0.76	0.71
$\Delta I_{M2_B_t} \rightarrow \Delta I_{L\ sec_t}$	0.02**	0.07*	0.06*	0.35
$\Delta I_{L\ sec_t} \rightarrow \Delta I_{M3_t}$	0.01***	0.04**	0.04**	0.55
$\Delta I_{M3_t} \rightarrow \Delta I_{L\ sec_t}$	0.84	0.81	0.2	0.44
$\Delta I_{L\ sec_t} \rightarrow \Delta I_{BM_t}$	0.33	0.66	0.61	0.59
$\Delta I_{BM_t} \rightarrow \Delta I_{L\ sec_t}$	0.02**	0.05**	0.04**	0.36

$\Delta I_{L_sec_t} \rightarrow \Delta I_{M1_B_t}$	0.64	0.65	0.83	0.71
$\Delta I_{M1_B_t} \rightarrow \Delta I_{L_sec_t}$	0.04**	0.06*	0.07*	0.21
$\Delta I_{L_sec_t} \rightarrow \Delta I_{M3_B_t}$	0.82	0.71	0.67	0.70
$\Delta I_{M3_B_t} \rightarrow \Delta I_{L_sec_t}$	0.02**	0.06*	0.19	0.38

Notes: ^a The Arch test and the autocorrelation test (not reported here) confirm the absence of heteroscedasticity and of autocorrelation. (*), (**), (***) indicates statistically significant at the 10%, 5% and 1% percent level.

As shown in Table 11 the results of the previous sections are confirmed. In fact, I find one-way Granger Causality at the level of 5% of significance from money multipliers (M1_B, M2_B, M3_B), monetary base (BM), M2 money aggregate and industrial production index (IPI) to loans.

In the case of money supply M3 there is an inversion of Granger causality direction that runs from loans to M3 weakly supporting the accommodationist view. Finally, the same earlier results are confirmed applying the VEC model for cointegrating relationships. The results are reported in the Table 12.

Table 12: Causality test based on Vector Error Correction Model to test endogeneity of money

	Short Term	Long term	VECM	
	Effect	Effect		
	Wald Test	EC _{t-1}	Short Term	Long Term
Dependent Variable:				
IM2				
IL_SEC	16.50 (0)	-0.01 (0.15)	IL_SEC=>IM2	IL_SEC ≠>IM2
Dependent Variable:				
IL_SEC				
IM2	0.29 (0.74)	0.06 (0)	IM2≠>IL_SEC	IM2=>IL_SEC

I find that M2 money supply affects loans in the long run (influence factor 0.06) whereas loans causes variations of money supply M2 in the short run. So, I can conclude that the relationship among European banking system and monetary policy doesn't change with securitization activity.

CONCLUSIONS

I focus the analysis on the relationship between European banking system and monetary policy conducted by the European Central Bank during the years 1999-2010. In this work I consider money supply, monetary base, money multipliers, credit capacity and industrial production index to test the passive money hypothesis.

I implement two type of models according to the presence or not of cointegration with a double objective: to test the endogenous money hypothesis and to analyze the effect of securitization on monetary transmission mechanism.

The main results consist in: a) two-way elasticity both in the long period and in the short term among loans and M1 money supply; b) elasticity in the short period of M2 money supply to the loans and inelasticity in the long period; c) Granger causality from the monetary base to the loans and from Money multipliers (M1_B, M2_B, M3_B) to the loans; d) Granger causality from the loans to the M3 money supply; e) Granger causality from industrial production index to the M1, M2, M3, loans and monetary base but not vice versa.

I replicate the earlier analysis considering the loans series adjusted for securitization to evaluate if the banking system obtaining additional liquidity through securitization has an active role in the monetary mechanism transmission. The results underlines partially independence of banking system to the monetary policy.

To sum up, M2 influences loans in the long run but this relationship doesn't exist in the short term. From the Granger causality test results there is a one-way direction causality from the M2 money multiplier (M2_B) to the loans, from monetary base to the loans and from industrial production index to the loans. This implies that the Post-Keynesian view may not hold true in the case of Euro Area's M2 money supply.

In the case of the monetary aggregate M1 there is in the long and in the short period a bidirectional causality between M1 and loans that may support the liquidity preference view.

However, in the short term I obtain that Granger causality runs from base money M1 money multiplier (M1_B) and industrial production index (IPI) to the bank lending and not vice versa. In this case the absence of causality from total bank loans to the M1 money multiplier (M1_B) doesn't sustain the structuralist view showing lack of evidence to support the use of liability management among European banks.

Finally, there is a short run one-direction causality from loans to M3 but not from loans to industrial production index. This result show that money supply in the Euro Area is endogenous in nature weakly supported by the accommodatist view but the results don't confirm the structuralist vision and the theory of preference for the liquidity.

These results suggests further investigations. Understanding whether other factors could affect the analysis is of primary importance. Also, the securitization activity could be influenced by cyclic effects that the models implemented in this paper are not able to capture. The use of more sophisticated tools, such as Regime Switching variants, could be needed to discriminate among the theories that support the Post-Keynesian view.

REFERENCES

- Ahmad, N., and F. Ahmet. "The long-run and Short-run Endogeneity of Money Supply in Pakistan: An Empirical investigation". *State Bank of Pakistan- Research Bulletin*, 2006:2.
- Altunbas, Y., Gambacorta, L., and D. Marquez-Ibanez. "Securitisation and the bank lending channel", *Banca d'Italia, Working Paper* 653 (2007).
- Arestis, P. *Post-Keynesian Monetary Economics; New Approach to Financial Modelling*. Aldershot, Edward Elgar, 1988.
- Arestis, P. "The Nature and Role of Monetary Policy when Money is Endogenous". *Cambridge Journal of Economics* 30, no. 6 (2006):847-870.
- Arestis, P., and O. Howells. "Theoretical reflections on endogenous money: the problem with convenience lending". *Cambridge Journal of Economics* 20, (1996): 539-551.
- Bernanke, B. "Alternative explanations of the money-income correlation". *Carnegie- Rochester Conference Series on Public Policy* 25, (1986):49-99.
- Bertocco, G. "The New Keynesian Monetary Theory: a critical analysis". *Studi Economici* 83, (2004):65-94.
- Bertocco, G. "The role of Credit in a Keynesian Monetary Economy". *Review of Political Economy*. 17, no.4 (2005): 489-511.
- Bibow, J. "Some reflections on Keynes's Finance Motive for the demand for money". *Cambridge Journal of Economics* 19, (1995):647-666.
- Bibow, J. "On Keynesian theories of liquidity preference". *Manchester School* 66, (1998): 238-73.
- Cifter, A., and A. Ozun . "Monetary Transmission Mechanism in the New Economy: evidence from Turkey (1997-2006)". *MPRA Paper* 2486, (2007).
- Cottrell, A. "The Endogeneity of Money-Income Causality". *Scottish Journal of Political Economy*, 33, (1986):2-27.
- Cottrell, A. "Post Keynesian Monetary Economics: a critical survey". *Cambridge Journal of Economics* 11, no. 3 (1994):488-490.
- Davidson, P. "The Dual Faced Keynesian Revolution". *Journal of Post Keynesian Economics* 2, (1980):291-307.
- Davidson, P. "On The Endogeneity of Money Once More". *Journal of Post Keynesian Economics* 21, no. 3 (1989):441-454.
- Davidson, P. *Money: cause or effect? exogenous or endogenous?* in: E. Nell & W. Semmler (Eds) *Nicholas Kaldor and Mainstream Economics*, (1991)
- Davidson, P. *Post Keynesian Macroeconomic Theory*. Aldershot, Edward Elgar, (1994)
- Davidson, P. *Endogenous money, the production process, and inflation analysis*, in: M. Musella & C. Panico (Eds) *The Money Supply in the Economic Process: a Post Keynesian perspective*. Aldershot, Edward Elgar, (1995)
- Deleplace, G., and E. Nell. *Money in Motion: The Post Keynesian and Circulation Approach*. New York: St Martin Press, (1996).
- Dow, S. "Horizontalism: a critique". *Cambridge Journal of Economics*, 20, (1996):497-508.
- Engle, R. F., and J. Granger. *Long-run economic relationships*. Oxford, UK: Oxford University Press, 1991.
- Fontana, G. "Post Keynesian Approaches to Endogenous Money: a time framework explanation". *Review of Political Economy*, 15, no. 3 (2003):291-314.
- Fontana, G. "Hicks on monetary theory and history: money as endogenous money". *Cambridge Journal of Economics*, 28, (2004):73-88.
- Fontana, G., and E. Venturino. "Endogenous Money Supply: an analytical approach". *Scottish Journal of Political Economy* 50, no. 4 (2003):398-415.
- Gunzug, L. "Turkiye'de Parasal Aktarim Mekanizmasi ve Banka Kredit Kanali. *IMKB Dergisi (ISE Review)*, 18 (2001).
- Hamilton, J.D. *Time Series Analysis*. Princenton: Princeton University Press, 1994.

- Harris, R.I.D. *Using cointegration analysis in econometric modelling*. Harlow: Prentice Hall, 1995.
- Howells, P. "The Demand for Endogenous Money". *Journal of Post Keynesian Economics*, 18, (1995):89-106.
- Howells, P., and K. Hussein. "The Endogeneity of Money. Evidence From the G7". *Scottish Journal of Political Economy* 45, no. 3 (1998):329-340.
- Howells, P. "The Endogeneity of Money: Empirical Evidence". *Repec working paper* 513, (2005).
- Johansen, S. *Likelihood-Based Inference in Cointegrated Vector Auto-Regressive Models*. Oxford: Oxford University Press, 1995.
- Juselius, K. *The Cointegrated VAR Model*. Oxford: Oxford University Press, 2006.
- Kaldor, N. "The New Monetarism". *Lloyds Bank Review* 97, (1970):1-17.
- Kaldor, N., and J.Trevithick. *The Scourge of Monetarism*. New York: Oxford University Press, 1982.
- Keynes, J. M. *The distinction between a co-operative economy and an entrepreneur economy*, in: J.M. Keynes, *The Collected Writings*, London: Macmillan Press, 29,(1933):76- 106.
- Lavoie, M. "The Endogenous Flow of Credit and the Post Keynesian Theory of Money". *Journal of Economic Issues* 8, no.3(1984):771-797.
- Lavoie, M. "Horizontalism, structuralism, liquidity preference and the principle of increasing risk". *Scottish Journal of Political Economy* (1996):275-300.
- Lavoie, M. "Monetary base endogeneity and the new procedures of the asset-based Canadian and American monetary systems". *Journal of Post Keynesian Economics*, 27, no.4 (2005):689-709.
- Lavoie, M. "A Post-Keynesian Amendment To The New Consensus On Monetary Policy". *Metroeconomica* 57, no.2 (2006):165-192.
- Lenum, O. "A Note with Quantiles of the Asymptotic Distribution of the Maximum Likelihood Cointegration Rank Test Statistics". *Oxford Bulletin of Economics & Statistics* 54, no.3 (1992): 461-72.
- Luetkepohl, H., and H. E. Reimers . "Granger-causality in cointegrated VAR processes The case of the term structure". *Economics Letters*, 40, no. 3 (1992):263-268.
- Moore, B. "The Endogenous Money Stock". *Journal of Post Keynesian Economics* 2, no.1 (1979) 49-70.
- Moore, B. *Horizontalists and Verticalists: The Macroeconomics of Credit Money*. Cambridge: Cambridge University Press, 1988a.
- Moore, B. "The Endogeneity of Money: a comment". *Scottish Journal of Political Economy* 35 (1988b):291-94.
- Moore, B. "The Endogeneity of Credit Money". *Review of Political Economy* 1, no.1 (1989):64-93.
- Moore, B. "Money supply endogeneity: Reserve price setting or reserve quantity setting?" *Journal of Post Keynesian Economics* 13,(1991):404-413.
- Moore, B. "Accommodation to Accommodationism: A note". *Journal of Post Keynesian Economics* 21 (1998):175-178.
- 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* 23, no.2, (2000-2001):313-329.
- Palley, T. "The endogenous money supply: consensus and disagreement". *Journal of Post Keynesian Economics* 13 (1991) :397-403.
- Palley, T. "Accommodationism versus Structuralism: Time for an Accommodation". *Journal of Post Keynesian Economics* 18, no.4 (1996a):585-594.
- Palley, T. *Post Keynesian Economics Debt, Distribution and the Macroeconomy*. London Macmillan, 1996b.
- Palley, T. "Accommodationism, Structuralism and Superstructuralism". *Journal of Post Keynesian Economics* 21, no.1 (1998):171-173.
- Palley, T. "Endogenous money: What is and why it matters". *Metroeconomica* 53 (2002):152-180.
- Palley, T. "Endogenous Money :Implications for the money supply process, Interest Rates and Macroeconomics". *Political Economy Research Institute working paper* 178, (2008).

- Pollin, R. "Two theories of money supply endogeneity: some empirical evidence". *Journal of Post Keynesian Economics* 13,(1991):336-96.
- Seyrek, I., Duman M., and ve. Sarikaya. M. "Parasal Aktarım Mekanizması ve Para Politikası Aracı. Türkiye'de Aktarım Mekanizması". *C.U. İktisadi İdari Bilimler Dergisi* 5, no.1 (2004).
- Shanmugam, B., Nair, M., and O.W Li. "The Endogenous Money Hypothesis: Empirical Evidence from Malaysia (1985-2000)". *Journal of Post Keynesian Economics* 25, no. 4 (2003):599-611.
- Sims, C.A. "Macroeconomics and Reality". *Econometrica* 48,(1980):1-48.
- Vera, A.P. "The Endogenous money hypothesis: some evidence from Spain (1987-1998)". *Journal of Post Keynesian Economics* 23, no. 3(2001):509-526.
- Wray, L. "Keynesian monetary theory: liquidity preference or black box horizontalism". *Journal of Economic Issues* 29,(1995):273-83.