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# Transcending the new macroeconomic orthodoxy in the Eurozone: a Post-Keynesian view*

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***Abstract***

*The main aim of this paper is to empirically test the endogenous money hypothesis for the Eurozone. Based on data on loans to private sector, deposits, monetary aggregates, prices and GDP we use three empirical approaches to test the hypothesis: (i) moving correlation; (ii) Granger causality tests and (iii) original framework for the analysis based on the structural VAR model. The empirical results confirm our main hypothesis on the endogeneity of money in the Eurozone as they show that the commonly accepted neoclassical relations between monetary variables, inflation and economic activity are reversed in case of Eurozone and that the direction of influence goes from loans to deposits and from real sector of the economy towards the monetary sector. The basic conclusion from carried out research is that ECB should implement measures directly aimed at stimulation of domestic demand (monetary-supported tax cut).*

***Key words:*** *macroeconomic orthodoxy, eurozone, post-Keynesian approach, endogenous money, ECB*

***JEL classification:*** *B52, C01, E12, E51, E52, F34, F50, G01, G20, P48*

## 1. Introduction

The last couple of decades have been overshadowed by many controversies regarding macroeconomic theory and its role in policy making. The key contestants for academic supremacy have been new Keynesian, new-classical/supply-side and

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monetarist views. However, these divergent schools of economic thought converged somehow on crucial aspects of the so-called new economic orthodoxy in the years before the global financial crisis. This orthodoxy relied rather on common language than on shared understanding of key macroeconomic concepts. It embraced several important aspects such as rational expectations hypothesis, efficiency hypothesis in international finance, the NAIRU, Barro's Ricardian equivalence theorem, quantity theory of money, conventional money multiplier with corresponding fractional-reserve banking and the idea of expansionary fiscal contractions (Lavoie, 2016; Turner, 2014; Blyth, 2013). This translated into policy framework which included two very important and interrelated features.

The rational expectations and efficient market hypothesis revolution was primarily dedicated to the analysis of how financial market participants assess the value of various financial instruments, without regard for the relationship between monetary system and financial markets. This has essentially driven the wedge between financial theory and the role of macroeconomics. On the other hand, the neoclassical synthesis developed a macroeconomic theory by disregarding the paramount significance of monetary theory. The crisis and post-crisis experience vividly display the fact that macroeconomic theory was not only an innocent bystander of the ongoing economic and financial turmoil. It largely legitimized and tolerated the growing intra-Eurozone imbalances by neglecting private sector balance sheets and overstating problems arising from public sector balance sheets (Jordà, Schularick and Taylor, 2013; Turner, 2014) Due to the lack of space we will limit our empirical inquiry only to several components emanating from the new economic orthodoxy. Those are primarily the tenability of conventional money multiplier model and secondarily, the relevance of quantity theory of money and Barro's Ricardian equivalence theorem. Our central assumption is that in a sophisticated monetary economy money supply cannot be treated as some sort of exogenous variable but has to be viewed as an endogenous part of the economic system, in line with the basic tenets of the Post-Keynesian thought (Seccareccia, 2015).

The *hypothesis* of this paper is that money in the Eurozone is endogenous, which means that there is a reversed causality between loans on the one hand and deposits, economic activity and inflation on the other, contrary to the relations presumed in the neoclassical/orthodox literature. The *main contribution* of this paper is the original empirical approach based on the structural VAR analysis, which was never used for the analysis of the money endogeneity hypothesis in the Eurozone. The findings of our empirical analysis critically question soundness of policy approach pursued in the Eurozone before and in the wake of the euro crisis. Having said that, we propose some novel and heterodox policy measures in order to overcome the current low-growth equilibrium.

This paper will be structured into seven parts. After introduction we give a brief literature overview in the second part. We define what constitutes endogenous

money hypothesis and contrast it with conventional money multiplier model. The third part outlines our methodological approach. Our theoretical framework is summarized in three key relations. The fourth part lays out data and proceeds with empirical analysis. The fifth part introduces results. The sixth part gives important insights distilled from the successful confirmation of our money endogeneity hypothesis for the Eurozone. We elaborate on the largely unsuccessful crisis management in the Eurozone, which has its roots in the inability to incorporate money endogeneity into mainstream macroeconomic framework. We also elaborate on some heterodox concepts that may serve as useful alternatives to the current policy-making, as a part of the new reform agenda. In the final part we conclude.

## 2. Literature review

The conventional money multiplier model implies that the initial inflow of money is multiplied by the banking system, based on stipulated reserve requirement or reserve ratio (Colander, 2001; Samuelson and Nordhaus, 2007). In essence, commercial bank money is equal to central bank money times the multiplier (1/r). This view presupposes that a given reserve is lent out by the bank, then deposited at a different bank, lent out again, repeating itself in a process of geometric series. This is the 'reserves first' model of money creation. In his *Macroeconomics* Gregory Mankiw (1997) defines saving as the supply of loans and desribes the process whereby individuals lend their saving directly to willing investors or they stash their saving in bank accounts as a part of financial intermediation. This model contains several important implications. First, the central bank of each state in question has the ability to control the total money supply. Ostensibly, it can do so by applying key monetary policy tools such as: open market operations, discount rate and reserve requirements. Second important corollary to this view is the need for commercial banks to take in deposits before they can lend them out in the process called maturity transformation.

As opposed to the conventional money multiplier model as of an explanation of how banking systems operate we rely on the assumption of money endogeneity. Money endogeneity implies that money supply cannot be set by the *exogenous* monetary authority but that it is determined by the demand and preferences of economic agents in the economy, primarily consumers and business sector. As the profit rate rises and falls, so do financial sector reserves because it accommodates loan demand which is derived from the interplay between expectations, revenues, and interest rates. More precisely, in this view the causality between loans and deposits is reversed in comparison to the neoclassical and broadly excepted view, where the causality goes from deposits to loans. The rise in borrowing increases the total sum of deposits in the system while paying back loans works in the opposite direction. Therefore, the total sum of loans is not the equivalent of the total amount of deposits because banks are not

obliged to raise appropriate amount of deposits prior to new loans being provisioned (Kotarski and Brkić, 2016). This is the 'loans first' model of money creation. To paraphrase Say's law of demand, in our view "loans create deposits". Also, as for the money multiplier concept in Post-Keynesian economics, bank money is not a multiple of high-powered money, as claimed by neoclassical theorists, but rather high-powered money is a quotient of the quantity of bank money (Lavoie, 2006).

All of this is in stark contrast with Krugman's assumption on loan provision based on different intertemporal preferences between debtors and creditors, the so-called patient and impatient agents who embrace or abstain from consumption (Eggertsson and Krugman, 2012). On the contrary, endogenous monetary theory stipulates that the new purchasing power does not come at the expense of the existing purchasing power (when abstracting from the inflation impact) by patient agents. Impatient agent's purchasing power is directly increased based on lender's estimation of his credibility and subsequent credit money creation (Keen, 2012).

Any solvent bank can obtain financing either from a central bank by providing collateral, using refinancing options or by borrowing at the interbank market which further pushes underlying asset prices upwards. Hence, banks are not sufficiently constrained in credit money creation either by reserve requirements or by the discount rate which means that central banks have a really limited ability to control the money supply. This also means that deposit multiplication in a fractional reserve banking system conforms more to the image of an expanding and contracting bubble instead of a pyramid with a clearly defined apex (Kotarski and Brkić, 2016). In this kind of monetary arrangement, the overall level of debt in the economy is greater than the amount of money in circulation. The money base does not lead a business cycle but it lags behing it (Kydland and Prescott, 1990). Therefore, deleveraging is contractionary in a system where only a small portion of the money supply is not based on debt, as paying-off debts reduces the money supply which chokes the economy. On the other hand, in the leveraging phase of every business cycle financial entities follow every profitable opportunity to provide new loans while dealing with the issue of financing them afterwards. On this account there are three different sources of aggregate demand in a credit-based economy.

1. Demand which is derived out of retained earnings and wages for purchasing new investment and consumption goods (out of the existing stock of money)

2. Demand by the corporate and household sectors which is debt-financed by financial entities

3. Demand based on *Ponzi debt* which finances purchases of existing or new financial assets and which only indirectly stimulates demand in the real sector of the economy if a "wealth effect" prevails in contrast to an attempt at further speculation or wealth storage in particular asset classes (Keen, 2012).

Some critics of endogenous money approach may argue that we claim that there are no objective constraints to how much deposit money can be created. On the contrary, we argue that banks themselves are constrained by the: amount of profitable lending, risk-management strategies, regulatory policy on capital requirements, desired demand for money by households and businesses and central bank's policy (McLeay, Radia and Thomas, 2014). While banks can be severely constrained by liquidity and solvency problems in the midst of a deleveraging and debt-deflationary environment because of their capital base and collateral limitations, they can easily circumvent them in the expansionary phase of the business cycle. The Currency School which affirms the principle of scarcity and discipline, as well as Banking School broaching the principle of elasticity when it comes to the availability of liquidity, are both complementary since they explain different phases of the business cycle (Mehrling, 2011). Effectively, the business-cycle entails a changing balance between the concepts of discipline and elasticity The willingness of private agents to create deposit money is central to their distinction and to the fluctuation between economy-wide upswings and downswings.

Therefore, the liquidity preference can at times seriously impair both demand and supply of loans and undermine the efficacy of monetary policy at aggregate demand management. The Eurozone is a case in point. The demand for loans is seriously impaired when balance sheets are in a desperate need of repair due to debt incurred in the upswing phase of the business cycle. The opposite is the case when creditors supply less loans due to accumulation of non-performing loans. The outcome can be unequivocally depicted as a clogged monetary policy transmission mechanism, even while central banks try to boost lending and borrowing by injecting record sums of base money into the economy.

The new macroeconomic orthodoxy with regard to money and banking dominated economic thinking prior to the emergence of financial instability in the Eurozone. Unfortunately, it misinformed most policy-makers, market participants and academic economists since the main focus of policy-debates was on imbalances stemming from public sector balance sheets. Hence the emphasis on Stability and Growth Pact and 2% inflation target by the ECB. The dominant macroeconomic framework of the time implicitly relied on the Lawson doctrine which posits that private sector borrowing represents the behavior between 'consenting adults' and it should not be a cause for concern. This view is also closely linked with orthodox commodity-exchange theory of money creation which perceives money as a natural veil to the operations of the real economy, a medium that solely lubricates various transactions (Otero-Iglesias, 2014).

However, events which unfolded after the euro crisis should critically challenge that assumption of universally beneficial effects of financial deepening led by 'rational agents'. This assumption was refuted by the empirical research conducted by Òscar

Jordà, Moritz Schularick and Alan Taylor (2013). Their research demonstrates that from the historical point of view financial crises do not typically have their roots in fiscal excesses. In contrast, rising financialization characterized by mounting private debt serves as a crucial warning sign for financial instability. The new macroeconomic orthodoxy had been short-sighted as it totally neglected Wicksellian and Schumpeterian framework, which sets banks as the enablers of productive business investments by companies. Even worse, it failed to take into account the nascent view which portrays banks as independent creators of purchasing power that finance the purchase of already existing assets (Turner, 2012; Jorda, Schularick and Taylor, 2014). Therefore, the dominant macroeconomic framework which heavily imbued eurozone's policy regime was deeply misleading and dangerous, as evidenced by the worst financial crisis since the Great Depression. The Eurozone's policy regime failed to take into account not only the growing debt level which was producing very marginal increases in GDP. It also neglected unhealthy debt structure as a harbinger of future financial instability and painful deleveraging.

Furthermore, economists and policy-makers that coalesce under the umbrella of new macroeconomic orthodoxy have failed to appreciate the fundamentals of a sectoral balance approach. The sectoral balance approach postulates that the domestic output and job creation is indispensably linked to the readiness of the domestic private sector to increase its debt, public sector's capacity to issue new debt, as well as the ability of domestic private sector to build more financial claims on non-residents than *vice-versa*. The following macroeconomic entity postulates that private sector's net assets must come outside of it, either in the form of claims on foreign entities, as measured in the current account surplus, or in the form of government deficit. This can be expressed in two simple formulas which measure both flow and stock:

(1) Private Sector Surplus or Net Saving = Government Deficit + Current Account Balance

(2) Gross private financial claims = Gross private debt + Net government debt + Net financial international position

The entities presented above mean that the very act of financial saving requires funding and must be associated with a corresponding act of another entity incurring debt. In a monetary economy savings do not fund: they need to be funded by somebody else's debt (Terzi, 2015). To conclude, the failure to incorporate the endogenously defined money into economic analysis of the euro crisis inhibits proper problem identification and solution.

## 3. Methodological approach

However, when challenging the existing monetary and institutional framework in the EU, theoretical concepts and assumptions are not sufficient. Such endeavor requires stronger empirical rigor. Thus, in this section we will test our main assumption by using data on the money supply, loans, deposits and income in the first eleven Eurozone[3] members that introduced euro (Austria, Belgium, Finland, France, Germany, Ireland, Italy, Luxembourg, Netherlands, Portugal and Spain. We use those data as the aforementioned countries comprise the most economically significant part of the eurozone (EA) and because of the data availability, as our methodology requires longer time series.

The theoretical framework and rationale discussed above and presented in details in Lavoie (2006) can be summarized in several key relations:

R1. Loans "cause" deposits, i.e. changes in loans precede changes in deposits

R2. Loans "cause" money multiplier, i.e. high-powered money is a quotient of the quantity of bank money or there is a bi-directional "causality"

R3. Economic activity "causes" loans creation, i.e. changes in GDP growth precede changes in loans.

In addition, endogenous money in the Post-Keynesian theory leads to another reversed causality, between money and inflation. In this view inflation is mostly determined by cost-push factors, mainly reflecting the struggle (conflict for the distribution of income) between unions in different sectors and/or between the unions and employers. The first conflict leads to the so-called wage-wage spiral and the second one directly to the wage-price spiral. That said, the key difference between the new orthodoxy and Post-Keynesian view of inflation is that, for the former, inflation is an excess-demand phenomenon, while for the latter it is a supply-side issue (Lavoie, 2014). Having in mind that the causality in the endogenous money literature goes from money to demand and not vice versa it can be deduced that money supply does not determine the level of prices. So, as the inflation rate is explained through other causes, if anything, the causality between money and inflation is also reversed (Lavoie, 2006), which bring us to our last relation:

R4. Inflation "causes" loans and not *vice versa.*

As already stated, our main hypothesis is that money in the Eurozone is endogenous which can be tested by empirical valuation of the aforementioned relations. If the empirical analysis confirms all relations, or even few of them, with the (reversed)

[3] We use eurozone data as the whole institutional framework – Maaschtrict Treaty, Stability and Growth Pact, ECB mandate – is based on the idea of a single currency.

relation between loans and deposits being the key and crucial one, we will be able to confirm the validity of our main hypothesis. Although some relations can be seen as redundant (R1 and R2) we use both of them to provide a sort of robustness check of the empirical results. Also, confirmation of all relations can lead to stronger conclusions on the endogenous money theory validity in the Eurozone.

Due to a limited length of time series (64 observations), in order to empirically test these relations test, we estimate two separate 4-variable VAR models. In the first model we use annual changes in loans, deposits, domestic demand and prices, while in the second model we change deposits variable with the money multiplier variable.

Our baseline models take the form:

$$\sum_{s=0}^{p} A_s y_s = \varepsilon_t \tag{1}$$

where $y$ is a vector of endogenous variables which includes annual growth rates of loans ($L_t$), deposits ($DEP_t$) (model 1) or money multiplier ($MM_t$) (model 2), domestic demand ($DD_t$) and prices ($P_t$) for the period 2000Q1-2015Q4. Matrix $A_j$ is a matrix of structural coefficients which contains the information on the relationship among all variables in the model to period $p$. Vector $\varepsilon_t$ is a vector of independent, normally distributed random errors, with distribution MVN(0, I).

Model (1) cannot be directly estimated using OLS (because of contemporaneous effects, which are correlated with $\varepsilon_t$) so we estimate a reduced form model. Furthermore, the analysis is based on impulse response functions so it is necessary that shocks are mutually uncorrelated. By multiplying (1) with $A_0^{-1}$ the reduced form model (which we estimate) takes the form:

$$y = \sum_{s=1}^{p} B_s y_{t-s} + u_t \tag{2}$$

where $A_0^{-1}\varepsilon_t = u_t$, $MVN(0, \Sigma_u)$ and $B_j = A_0^{-1}A_j$, $j = 0, \ldots, p$.

Number of time lags in model (2) is set to 3, according to SC and AIC criteria. Greater number of lags isn't desirable due to the short length of time-series as well. For the model (2) adequacy and stability analysis is conducted. The results of the residual analysis (test of autocorrelation and heteroskedasticity test) and the stability test indicate that our models are adequate and stable (results at the end of Appendix). The next step of our analysis is to retrieve structural shocks, based on the information from model (2), in order to conduct impulse response analysis on mutually uncorrelated (interpretable) residuals.

According to Lutkepohl and Kratzig (2004), in impulse response analysis the emphasis has shifted from specifying the relations between the observable variables directly to interpreting the unexpected part of their changes or the shocks. Therefore, it is not uncommon to identify the structural innovations $\varepsilon_t$ directly from the forecast errors or reduced form residuals $u_t$. One way to do so is to think of the forecast errors as linear functions of the structural innovations so we have the relation

$$u_t = B\varepsilon_t \tag{3}$$

where $u_t = [l_t, dep_t, dd_t, p_t]'$ is a vector of reduced-form innovations in the first model, $u_t = [l_t, mm_t, dd_t, p_t]'$ in the second model, and $\varepsilon_t$ is a vector of structural (mutually uncorrelated) innovations, where $\Sigma_u = B\Sigma_\varepsilon B'$. Normalizing the variances of the structural innovations to one ($\varepsilon_t \sim (0, I_K)$ gives $\Sigma_u = BB'$. Due to the symmetry of the covariance matrix, these relations specify only $K(K+1)/2$ different equations and we need to impose $K(K-1)/2$ further relations to identify all $K2$ elements of $B$. As the number of endogenous variables is $K = 4$, we need to impose 6 restrictions. In order to identify this system, we make some assumptions on the economic mechanisms and interdependences, based on the theoretical framework discussed in the paper.

For better understanding of the identification process, equation (3) can be written in the form of the system of equations[4]:

$$l_t = a_1 dep_t + a_2 dd_t + a_3 p_t + \varepsilon_t^l \tag{4}$$

$$dep_t = b_1 l_t + b_2 dd_t + b_3 p_t + \varepsilon_t^{dep} \tag{5}$$

$$dd_t = c_1 l_t + c_2 dep_t + c_3 p_t + \varepsilon_t^{dd} \tag{6}$$

$$p_t = d_1 l_t + d_2 dep_t + c_3 dd_t + \varepsilon_t^p \tag{7}$$

Firstly, we assume that loans cannot instantaneously react to shocks in deposits ($a_1 = 0$), while they can react to shocks in domestic demand and prices. Secondly, we assume that deposits cannot instantaneously react to changes in domestic demand ($b_2 = 0$). Thirdly we assume that domestic demand cannot contemporaneously react to changes in loans ($c_1 = 0$) and finally we assume that none of the variables can determine prices, which gives us three restrictions ($d_1 = d_2 = d_3 = 0$). Thus, this system is just-identified.

[4] In model (2) DEP is substituted by MM.

## 4. Empirical data and analysis

Before we proceed with the discussion and presentation of the main results it is useful to present the basic information on the data used in the analysis. The main sources of data are European Central Bank Statistical Warehouse and Eurostat. Data series for loans for private sector is taken from the ECB and constructed as the sum of loans to household and corporate sector to exclude the effects of one-off shocks of increased lending to the public sector during the financial crisis. Deposits also refer to the ECB data on deposits of the private sector, comprised of total deposits of households and corporate sector. Money multiplier is the final data taken from the ECB data warehouse and is calculated as the ratio of monetary aggregate M1 and monetary base M0. Domestic demand is constructed as a sum of final consumption of households, government and NPISH and gross fixed investments, based on data from Eurostat. We use domestic demand to keep the analysis in the closed economy framework to exclude the potential effects of various external shocks on the Eurozone economy which could have significant impact on the main relations analyzed in this paper. Finally, for prices we use Eurostat data on the harmonized CPI for Eurozone members, as the headline and benchmark figure for inflation in the EA. Detailed description of data is provided in Table 1.

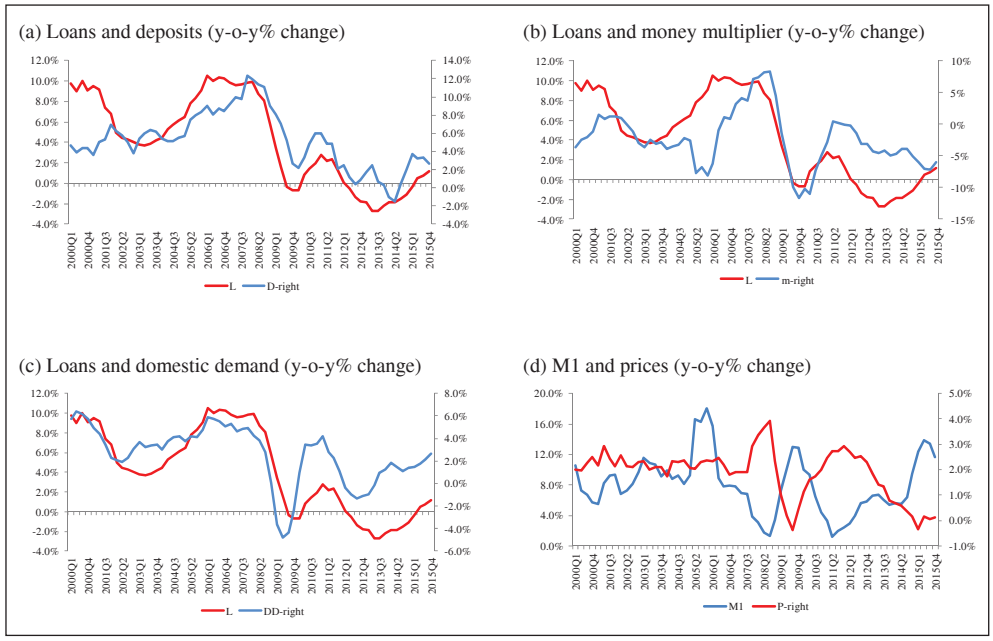
Table 1: Data description

| Variable | Period and frequency | Definitions and comments | Source | Unit |
|---|---|---|---|---|
| Loans (L) | Quarterly data; 1Q1999-4Q2015 | Sum of MFIs loans to corporate (C) and household (H) sector | European central bank; Monetary and financial statistics | millions of euro; annual percentage change |
| Deposits (DEP) | Quarterly data; 1Q1999-4Q2015 | Sum of deposits in MFIs of corporate and household sector | European central bank; Monetary and financial statistics | millions of euro; annual percentage change |
| Domestic demand (DD) | Quarterly data; 1Q1999-4Q2015 | Final consumption and gross capital formation | Eurostat; National accounts; ESA 2010 | millions of euro; annual percentage change |
| Inflation (P) | Quarterly data; 1Q1999-4Q2015 | Harmonized consumer prices index; EA 19 (due to the unavailability of the weights of EA 11 countries) | Eurostat; National accounts; ESA 2010 | Base index 2015=100; annual percentage change |
| Money multiplier (m) | Quarterly data; 1Q1999-4Q2015 | Money multiplier is calculated as the ratio of monetary aggregate M1 and monetary base M0 | European central bank; Monetary and financial statistics | ratio; annual percentage change |

Source: Authors

Figure 1 shows development of the data time series, with graphs structured in accordance to the stated relations. Thus, panel (a) shows the dynamics of loans and deposits, panel (b) loans and money multiplier. Panels (c) and (d) show supplementary relations in testing the validity of endogenous money hypotheses, namely loans and domestic demand growth in panel (c), while loans and inflation are showed in panel (d).

Figure 1: Loans, deposits, money multiplier, domestic demand and inflation in EA11 2000-2015




Source: Author's calculations according to data of the ECB

From these figures we can see that there is a relatively high correlation among the observed variables. At first, it seems that changes in loans precede changes in deposits and monetary multiplier, changes in domestic demand precede changes in loans and that prices and money supply are negatively correlated. Relation between loans and money supply is not so clear as the money supply is relatively volatile in the observed period. This "ocular approach" can be easily tested in more formal way, by using moving correlation which shows the correlation among the variables, dependent on the time lags and/or leads. Results of the moving correlation calculations are showed in Table 2.

Table 2: Moving correlations

| Correlation of loans with other variables | | | |
|---|---|---|---|
| Time | t-2 | t-1 | t |
| Deposits | 0.82 | 0.81 | 0.78 |
| Domestic demand | 0.34 | 0.47 | 0.61 |
| Money multiplier | 0.64 | 0.62 | 0.54 |
| Prices | 0.56 | 0.57 | 0.58 |

Source: Authors' calculations

Results presented in the Table 2 confirm our "ocular approach" conclusions. First, correlation between loans and deposits rises with time lags, which indicates that loans precede deposits. Secondly, correlation with domestic demand falls with time lags, meaning that loans most probably do not precede domestic demand. As for the money multiplier, correlation also increases with time lags, suggesting that loans do precede money multiplier. On the other hand, correlation between loans and prices falls with time lags. This "light calculation" is supportive to most of our relations as loans seem to precede deposits and money multiplier, domestic demand growth doesn't follow changes in loans and changes in loans seem not to precede changes in prices.

## 5. Results and discussion

The first step of the empirical analysis was to carry out the tests of Granger causality as this procedure gives us more reliable information on the causality among variables. Though, causality in Granger sense cannot be interpreted without the formal definition which states that variable X is said to be causal for a time series variable Y if the former helps to improve the forecasts of the latter (Lutkepohl and Kratzig, 2004). The results of Granger causality tests for the variables used in the relations R1-R4 are presented in Table 3, and detailed results are given in the Methodological appendix.

Table 3: Granger causality test results

| Granger causality of loans and corresponding variable | |
|---|---|
| Variable | Direction of causality |
| Deposits | L ⇒ DEP |
| Domestic demand | DD ⇒ L |
| Money multiplier | L ⇔ MM |
| Prices | P ⇒ L |

Note: The number of time lags is set to four as economic intuition suggests that most of the interrelations among variables occur thorough one year.

Source: Authors' calculations

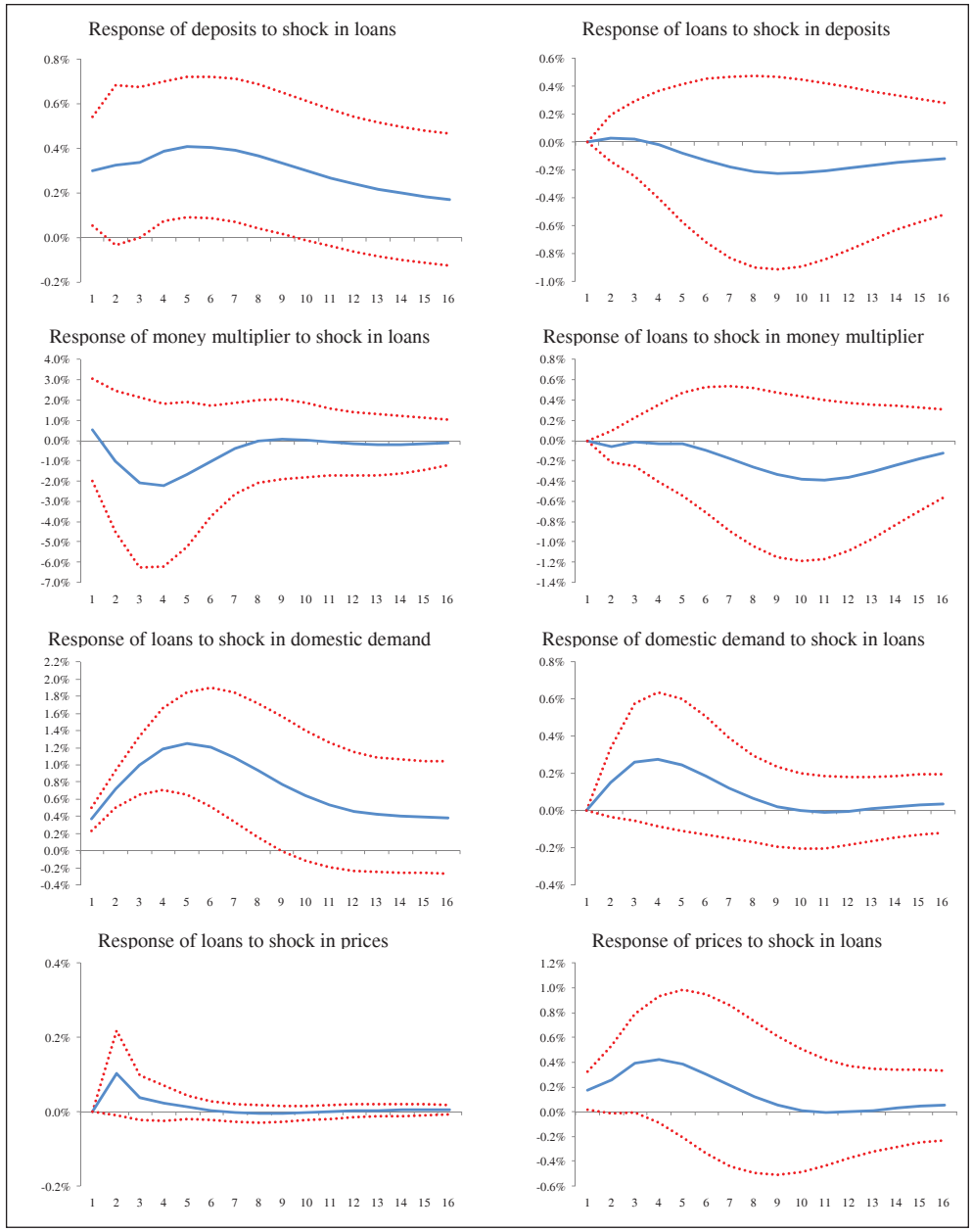
Granger causation results presented in Table 3 confirm most of the main relations. According to the results, loans "cause" deposits, there is a bi-directional causality between loans and money multiplier (which would confirm structuralist approach, according to Haghigat, 2011), domestic demand "causes" loans and prices "cause" loans, while there is no "causation" from loans to prices.

The final step of the empirical part of the paper is the analysis of dynamic relations among the variables, based on the vector auto regression framework. Unlike other authors who base their analysis on unrestricted VAR/VEC methodology (for detailed empirical literature review see Almutair, 2015; Lopreite, 2014; Vymyatnina, 2013) in this paper we develop a structural VAR (SVAR) approach with the identification scheme relying on the theoretical assumptions discussed above.

Results of the vector auto regression model estimations are most commonly presented in the form of impulse response functions (IRF). Thus, the main IRFs from the structural VAR model that are related to relations R1-R4 are shown on Figure 2. Model adequacy tests and impulse response functions of all variables in the estimated models are presented in the Methodological appendix.

Impulse response functions from our structural model are also mostly in line with our hypothesis. IRFs in the first row of Figure 2 show that loans have positive and statistically significant effect on deposits, while the effects of deposits on loans are not statistically significant. These results confirm the theoretical relation R1. On the other hand, relation R2 cannot be confirmed with this approach as the impulse response functions between loans and money multiplier are not statistically significant. As for the relation R3, results are supportive as the impulse response functions show that domestic demand has strong and positive effect on loans, while the reversed relation is not statistically significant. Finally, regarding relation R4, impulse response functions show that prices have positive and statistically significant (in the first year) on loans, while the effect of loans on prices is not statistically significant.

Figure 2: Impulse response functions (structural shocks)




Source: Authors' calculations

Before moving to the conclusion it is important to emphasize that there are some methodological issues related to the VAR approach. First, number of observations (64) is relatively small for the dynamic analysis in the 4- variable VAR framework,

which represents a limitation in the context of OLS and the CLT assumptions so it should be emphasized that obtained results are only indicative. Secondly, such short time series doesn't allow a standard robustness check conducted by splitting time series into two parts. Thirdly, in fifteen analyzed years eurozone experienced strong boom-bust cycle so future research should be based on regime-switching models which can capture the effects of such strong regime changes. Also, future research should include alternative control variables in the model and/or analyze endogenous money hypothesis in eurozone in the panel data framework. However it is important to notice that tests of the adequacy and stability of the used models are satisfied, which gives analytical credibility to the obtained results (see Methodological appendix). In addition, estimation of two separate models can also be seen as a robustness check as the main findings did not change (see IRFs in the Methodological appendix). Finally, structural VAR approach used in this paper can be seen as our main contribution to the empirical literature on endogenous money hypothesis as there are no published papers based on SVAR methodology to our knowledge.

## 6. Conclusion

Empirical results presented in the paper confirm our hypothesis on the endogenous money in the Eurozone. The main contribution of this research for economic literature and economic science respectively is the confirmation of the endogenous money hypothesis for the Eurozone based on the use of a structural VAR model. Unlike the simple VAR model, this model has never been used in the empirical analysis of endogenous money theory in the literature before. However there are the appropriate limitations inside this research. First, the number of observations is relatively small for the dynamic analysis, which represents a limitation in the context of OLS and the CLT assumptions so it should be emphasized that obtained results are only indicative. Secondly, such short time series doesn't allow a standard robustness check conducted by splitting time series into two parts. However it is important to notice that tests of the adequacy and stability of the used models are satisfied, which gives analytical credibility to the obtained results. In addition, estimation of two separate models can also be seen as a robustness check as the main findings did not change. Thirdly, in fifteen analyzed years Eurozone experienced strong boom-bust cycle so future research should be based on regime-switching models which can capture the effects of such strong regime changes. Also, future research should include alternative control variables in the model and/or analyze endogenous money hypothesis in Eurozone in the panel data framework. The main policy recommendations stem from the fact that current (neoclassical) monetary policy framework is not in line with the endogenous money theory, which strongly limits the possibilities of monetary policy in achieving the main goals. Thus, in order to ensure the effectiveness of monetary policy, policy makers in the EU and Eurozone should actively consider more unconventional policies which could directly stimulate spending of private and public sector, thus avoiding

non-functional monetary policy transmission channel. In our view monetary-supported tax cut, which comes under the headline of a permanent purchase of non-monetary financial assets by the ECB, would be the most effective tool. Such tool would bypass ineffective monetary policy, debt-funded fiscal deficits which increase the economy's total leverage and would directly stimulate spending by also circumventing Ricardian equivalence, which would be partially present in the case of a debt-funded stimulus.

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# Nadilaženje nove makroekonomske ortodoksije u eurozoni: post-kejnezijanski pogled

*Kristijan Kotarski*[1], *Milan Deskar-Škrbić*[2]

***Sažetak***

*Temeljna svrha ovog rada je empirijski testirati hipotezu endogenosti novca u eurozoni. Na temelju podataka o kreditima privatnom sektoru, depozitima, monetarnim agregatima, cijenama i BDP-u autori u radu koriste tri empirijska pristupa za testiranje hipoteze: (i) pomičnu korelaciju; (ii) Grangerov test uzročnosti i (iii) originalni metodološki okvir temeljen na strukturnom VAR modelu. Empirijski rezultati potvrđuju našu temeljnu hipotezu o endogenosti novca u eurozoni budući da pokazuju kako su općeprihvaćeni neoklasični odnosi između monetarnih varijabli, inflacije i ekonomske aktivnosti u slučaju eurozone preokrenuti te kako se smjer utjecaja kreće od kredita prema depozitima te od realnog sektora prema monetarnom sektoru. Temeljni zaključak provedenog istraživanja je da bi Europska središnja banka trebala implementirati mjere direktno usmjerene na poticanje agregatne potražnje (monetarno-financirano porezno rasterećenje).*

***Ključne riječi:*** *makroekonomska ortodoksija, eurozona, post-kejnezijanski pristup, endogenost novca, ECB*

***JEL klasifikacija:*** *B52, C01, E12, E51, E52, F34, F50, G01, G20, P48*

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# Appendices

Table A1: Results of the Granger tests of causality

Pairwise Granger Causality Tests
Date: 05/23/16 Time: 20:50
Sample: 2000Q1 2015Q4
Lags: 4

| Null Hypothesis: | Obs | F-Statistic | Prob. |
|---|---|---|---|
| DEP does not Granger Cause L | 60 | 0.25702 | 0.9040 |
| L does not Granger Cause DEP | | 3.49962 | 0.0134 |

Pairwise Granger Causality Tests
Date: 05/23/16 Time: 21:48
Sample: 2000Q1 2015Q4
Lags: 4

| Null Hypothesis: | Obs | F-Statistic | Prob. |
|---|---|---|---|
| DD does not Granger Cause L | 60 | 3.56551 | 0.0122 |
| L does not Granger Cause DD | | 1.47750 | 0.2227 |

Pairwise Granger Causality Tests
Date: 05/23/16 Time: 20:51
Sample: 2000Q1 2015Q4
Lags: 4

| Null Hypothesis: | Obs | F-Statistic | Prob. |
|---|---|---|---|
| M does not Granger Cause L | 60 | 4.07121 | 0.0061 |
| L does not Granger Cause M | | 2.33437 | 0.0680 |

Pairwise Granger Causality Tests
Date: 05/23/16 Time: 21:04
Sample: 2000Q1 2015Q4
Lags: 4

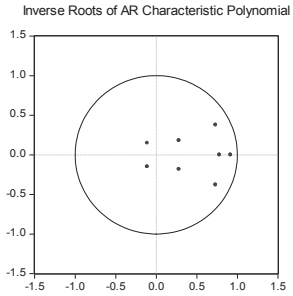
| Null Hypothesis: | Obs | F-Statistic | Prob. |
|---|---|---|---|
| P does not Granger Cause L | 60 | 3.69601 | 0.0102 |
| L does not Granger Cause P | | 2.04690 | 0.1016 |

Source: Authors' calculations

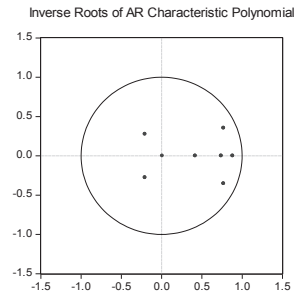
Figure A1: VAR stability and adequacy tests

Stability conditions satisfied

VAR 1




VAR 2




Correlation independence condition sastisfied

VAR Residual Serial Correlation LM Tests
Null Hypothesis: no serial correlation at lag order h
Date: 05/24/16 Time: 12:18
Sample: 2000Q1 2015Q4
Included observations: 61

| Lags | LM-Stat | Prob |
|---|---|---|
| 1 | 24.91495 | 0.0713 |
| 2 | 10.46075 | 0.8415 |
| 3 | 26.63794 | 0.0457 |
| 4 | 33.52543 | 0.0563 |
| 5 | 12.65055 | 0.6981 |
| 6 | 17.43397 | 0.3581 |
| 7 | 23.92976 | 0.0910 |
| 8 | 35.91340 | 0.0530 |
| 9 | 14.91518 | 0.5309 |
| 10 | 21.18900 | 0.1714 |
| 11 | 13.35423 | 0.6467 |
| 12 | 21.51631 | 0.1595 |

Probs from chi-square with 16 df.

VAR Residual Serial Correlation LM Tests
Null Hypothesis: no serial correlation at lag order h
Date: 05/24/16 Time: 12:19
Sample: 2000Q1 2015Q4
Included observations: 61

| Lags | LM-Stat | Prob |
|---|---|---|
| 1 | 18.81038 | 0.2786 |
| 2 | 18.62716 | 0.2885 |
| 3 | 25.92852 | 0.0550 |
| 4 | 22.93855 | 0.1154 |
| 5 | 17.46208 | 0.3563 |
| 6 | 20.89442 | 0.1826 |
| 7 | 13.08687 | 0.6664 |
| 8 | 30.77459 | 0.0344 |
| 9 | 16.99725 | 0.3858 |
| 10 | 31.05432 | 0.0332 |
| 11 | 17.99239 | 0.3243 |
| 12 | 16.10284 | 0.4458 |

Probs from chi-square with 16 df.

Homoskedasticity condition satisfied

VAR Residual Heteroskedasticity Tests: Includes Cross Terms
Date: 05/24/16 Time: 12:21
Sample: 2000Q1 2015Q4
Included observations: 61

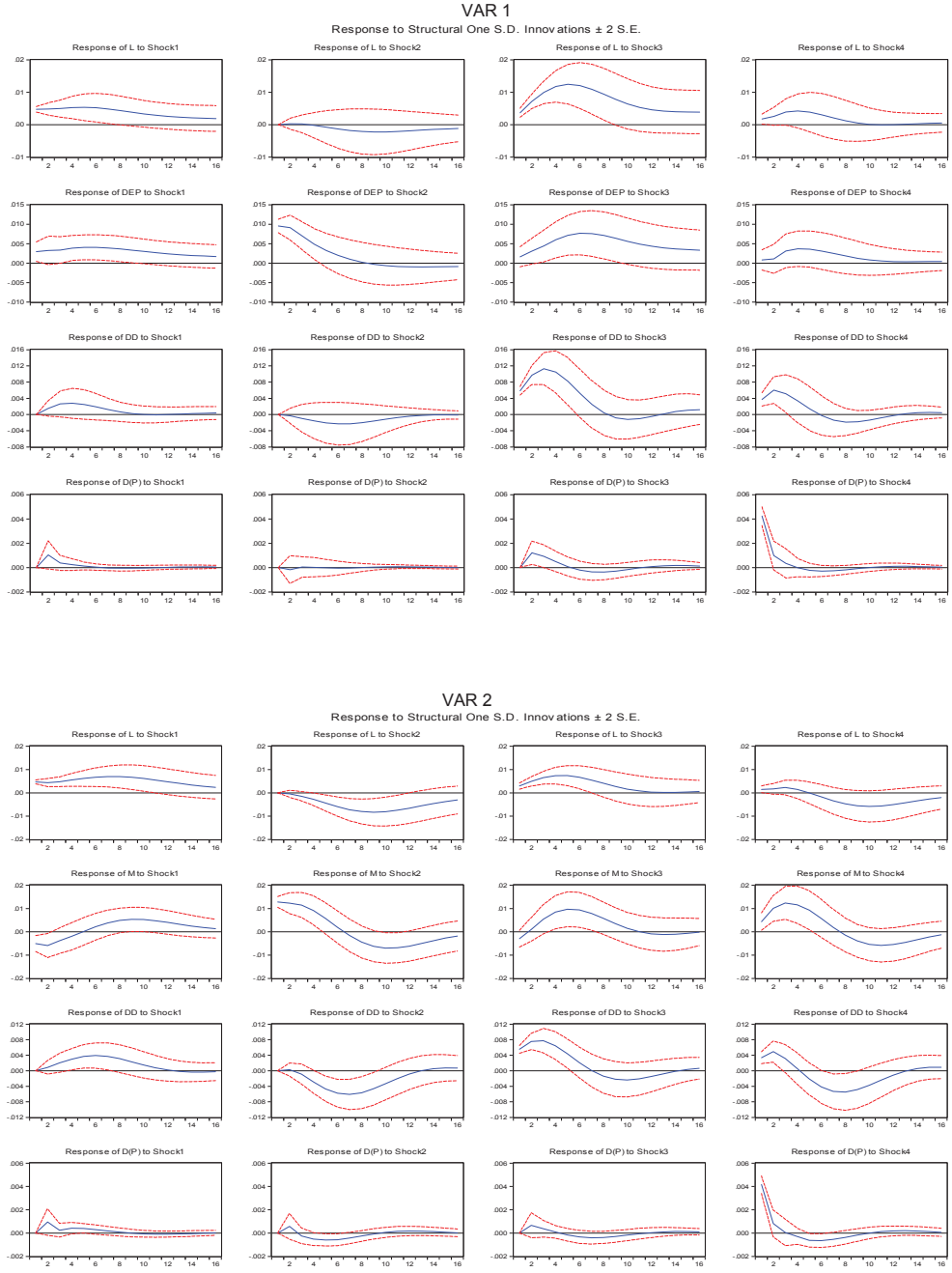
| Joint test: | | |
|---|---|---|
| Chi-sq | df | Prob. |
| 446.2675 | 440 | 0.4080 |

VAR Residual Heteroskedasticity Tests: Includes Cross Terms
Date: 05/24/16 Time: 12:20
Sample: 2000Q1 2015Q4
Included observations: 61

| Joint test: | | |
|---|---|---|
| Chi-sq | df | Prob. |
| 484.4711 | 440 | 0.0703 |

Source: Authors' calculations

Figure A2: Impulse response functions




Source: Authors' calculations