MONETARY POLICY IMPLEMENTATION AND MONEY DEMAND INSTABILITY DURING THE FINANCIAL CRISIS

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Abstract

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The author focuses on the money endogeneity in the context of common monetary policy implementation in the euro area. The empirical analysis shows money demand function instability during the financial crisis. The instability is described by decrease in credit money creation and money velocity changes. The cointegration tests identifed long-run positive relationship between monetary aggregates and economic activity. Concurrently, the economic activity is treated to be weakly exogenous in the model.

The conclusions are discussed with Postkeynesians' assumption, that central banks cannot fix the stock of money in a country. The causality is directed from economic activity to money demand.

money endogeneity, cointegration, money velocity, weak exogeneity

The primary target of most central banks in developed economies is to maintain price stability, subsequently they support of a sustainable economic growth, full employment and effective utilization of resources in general. The main-stream economic discussions about the monetary policy implementation and its efficiency focus on the central banks' instruments and operative/short-term targets determination (interbank interest rate in most cases) or/and relation between intermediate and final targets in the sense of transmission mechanism. Many academics and researchers around the world are trying to identify monetary policy rules which are robust as a guideline for the conduct of monetary policy. Let us an example the work of Taylor and others, which inspired his interest rate rule. In this field was published variety of econometric models which differ in size, degree of openness or forward looking assumption. Even the most complex model is not able to describe exactly global economic system, just because it is based on past observations. However, the monetary policy efficiency is based on the ability to manipulate significant market distortions which are often caused by unexpected shocks or structural changes in the market.

The period of nineties of the 20th century until the mid-2007 is characterized by stable environment of low inflation and sustainable economic growth in most European countries. How and if any, monetary policy caused the stable development of micro- and macroeconomic environment is discussable. The issue of monetary policy efficiency was actually opened after the financial crisis in 2007. In the years 2007–2010, the investment and economic activity significantly decreased across the euro area. Broader money aggregates decline together with investment activity. The growth of the money aggregate M3 declined markedly throughout –0.4% in February 2010 (Fig. 1). This development contrasts sharply with the growth of money aggregate M1, that between 2009 and 2010 exceeds the limit of 10% (up to 12.8% in September 2009).

Since the intensification of the financial crisis in September 2008 and throughout 2009, the European Central Bank (ECB) continued to

reduce official interest rates to 1.0 per cent, which corresponds to the lowest level observed among euro area countries in recent history. Despite strong monetary expansion, however, there has been no increase in the intermediate and broad money.

The monetary policy implementation in the euro area was based on two pillars. The first one was economic analysis, consisting in short-term to medium-term targeting of macroeconomic indicators. The second, monetary analysis is based on the fact that monetary growth and inflation are closely related in the medium to long run. The monetary aggregate M3 was used by the ECB as the 'reference value'. This ECB's reference value for M3 growth was set at 4.5% p.a. by the Governing Council in December 1998 (ECB, 2004, pp. 64).

The money growth targeting is the basic principle of the classical monetary theory. Beginning late 80s, several countries began introducing inflation target regimes with explicit quantitative inflation targets. The collapse of the previously stable relationship between the money growth and inflation caused the impact of exogenous factors. (Issing, 1997, pp. 78) The theory argues that the change in inflation is directly proportional to the changes in money supply under assumption of constant level of final production and velocity of money. The assumption of constant velocity of money or at least its easy predictability became unrealistic. The reason was particularly the openness of the economies and development of financial innovations. The monetary authorities extended monetary aggregates, but the money supply is influenced by endogeneity as well. Therefore, the ECB changed the both of pillars (in May 2003) and focused only on the inflation targeting which can currently be described as mainstream of modern monetary economics.

Hagen and Hofmann (2009) summarize that last decade is characteristic not only by low inflation rate but also weak relationship between inflation and economic growth gap. Traditional signals of the inflation pressures in tems of monetary or economic growth gap is not possible to apply. The central bank should turn away from stabilization of high-frequency movements in prices and focuse primarily on the long-term trend.

In times of instability at the market of interbank deposits due to various demand and supply shocks, the short-term interest rates are optimal monetary policy operational target with low volatility. (Bindseil, 2004) This recommendation is fully consistent with the money endogeneity and Post-Keynesians' assumptions, that central bank determines money supply indirectly, through economic and investment activity which affect money demand.

Chatelain *et al.* (2003) argues that the traditional interest rate channel has a lot of noises. An alternative is the "broader interest rate channel" defined by the net cash flow in individual companies through microeconomic data. Consequently, monetary policy implementation is dependent on debt of enterprises and capital sources. The debt of enterprises fluctuates from 48% in Germany to 71% in Italy and Spain. The interest rate channel is heterogeneous across the whole euro area.

This paper deals with monetary policy efficiency in the euro area. The author focuses on the money market instability as the result of the investment and economic activity movements during the crisis years. The main contributions consist in money endogeneity consequences which appear during the investment and economic activity fall. The main objective of this paper is to provide recommendation for monetary policy implementation in the euro area during the last financial crisis

The first theoretical part of the paper summarizes the main stream economic arguments which help to understand imbalances at the money market. The second, empirical part of the paper focuses on the (1) money demand instability and (2) money endogeneity tests. The results are discussed in the context of monetary policy efficienccy in the euro area.

Theoretical framework

A definition of money differs with regard to the degree of liquidity of the euro area residents' assets. M1 is the sum of banknotes and coins, as well as balances which can immediately be converted into currency or used for cashless payments (overnight deposits), M2 is the sum of M1, deposits with an agreed maturity of up to two years and deposits redeemable at notice of up to three months and M3 represents the sum of M2, repurchase agreements, money market fund shares/units and debt securities up to two years.

Assume that the monetary aggregates reflect the money demand of individuals and enterprises as well. The development of the monetary aggregates and trends in money-holding are obvious, the economic agents prefer short-term assets against their long-term forms during the financial crisis. Important role in this behaviour play aversion to risk and anticipation of future income. From a Keynesian point of view the transaction motive dominates the speculative. The economists call this situation as a liquidity trap. Demand for money becomes elastic, increases in the money stock will fail to further lower interest rates and, therefore, fail to stimulate investments and economic activity. However, Keynesian economists assumed money exogeneity and endogenous nature of interest rates. The money exogeneity assumption seems to be wrong because the size of euro area banking system and the possibility of deposits multiplication. Endogenous nature of interest rate in the euro area is controversial topic. On the one hand, the central bank determines interest rates through its instruments, on the other hand, it responds to the macroeconomic indicators prediction. Even with a high degree of ECB independence is significant its responsibility to achieve its targets.
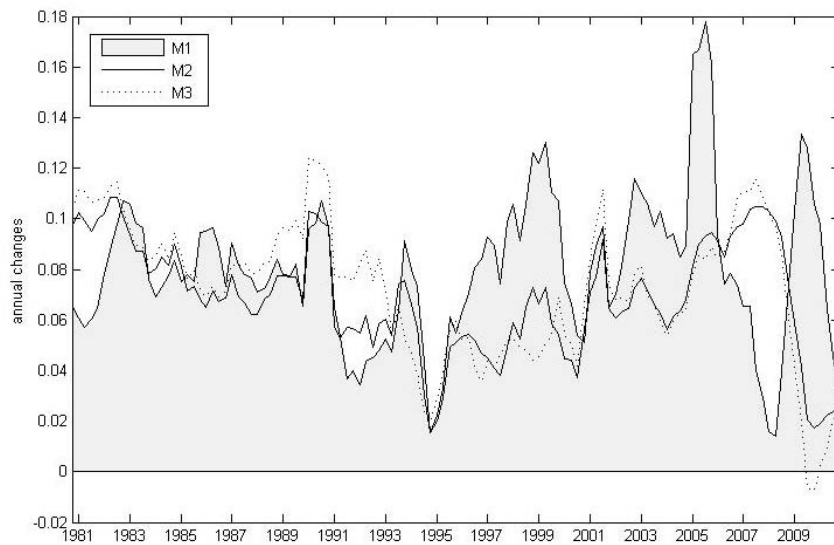
1: *Monetary aggregates in the euro area (Source: Eurostat)*
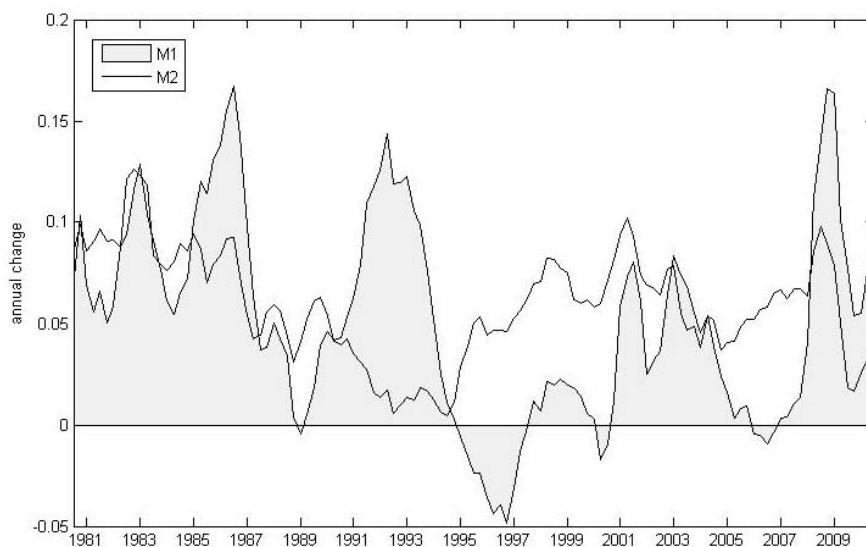
2: *Monetary aggregates in the USA (Source: Federal reserve system)*

However, the monetary aggregates do not represent only the money demand but also the supply which is mainly determined by credit multipliers which is directly linked to lending money creation in banking system. This process is limited by economic depression or inflation anticipation, investment decrease, cash transactions or illegal enterprises and share of required minimum reserves. Generally speaking, the creation of money in banking system is determined by amount of cash balances deposited in commercial banks and demand for loans by economic agents (individuals and enterprises).

Decreases in investment activity and short-term asset holding were significant during the economic crisis during the years 2008 and 2009 or during the Asian financial crisis in the years 1997 and 1998 (Fig. 1).

The imbalances between the monetary aggregates are significant not only in the euro area. The monetary aggregate M2 significantly exceeds narrow money in the USA (2008–2009) as well. Beginning of the nineties was marked by Japan crisis, when the stock index Nikkei-225 lost in one year over 40%. Even today, twenty years after the outbreak of the crisis, the Japanese economy recovered and Japan's financial system continues to burden the bad loans, estimated at 550 billion USD. The investment and economic activity was also affected by war in the Persian Gulf. Significant gap between the monetary aggregates is apparent after the year 1986, after Monday 19 October, when during one day Dow Jones Industrial Average lost nearly 23%. Although the slump lasted only two months, it exceeds 30%. The markets were at their highs once again after two years (Fig. 2).

All the above events were not accompanied only by changes in preferences of economic agents, but also by decreases in investment activity and thus money creation in banking system. The key question is what determines money supply and demand in the huge monetary union.

Keynes distinguishes transaction and speculative motive for money holding which is often linked to uncertainty. However, the uncertainty is just used to mean absence of certainty. The Keynesians' contribution to explain the uncertainty lies in the changing importance of individual motives for holding money of the total demand for money. As will be shown in the empirical analysis, the Keynesian money demand function is not stable over time. However, Keynes accepted equilibrium as an organizing concept and treated the macro economy in terms of marginal efficiency of capital (Johnson *et al.*, 2004, p. 224).

The Post-Keynesians on the other hand say that the developed capitalist market economies are inherently unstable. They are convinced that money creation is given by its own market economy and not the result of central bank activity. Post-Keynesian economics provides appropriate theoretical background for the gap in monetary aggregates. The reasons of money endogeneity are explained by Moore (1978, 1979, 1981), Kaldor (1981), Weintraub (1982) or Arestis (1988). Despite of many discussion between the Horizontalists and the Structuralists about the limitations and money properties, assume that money are not invariant over space and time.[1]

Barker (2010, pp. 215) defines invariance of money over space "that at any given moment large numbers of almost simultaneous, identical transactions can take place over a monetary area." However, the money are used to pay for goods and services at different location, markets and conditions which changes over time. The Single Market of European Union guarantee the free movements of goods, capital, services and people, but these four freedoms do not guarantee full competition and identical transaction over the euro area. The differences increase during the periods of economic depressions.

However, from the empirical point of view, we can assume that supply and demand for money is still balanced. There are many theoretical arguments that explain the adjustment mechanism of money demand and supply interactions which primarily describe monetary policy transmission mechanism. Basic transmission mechanism was defined by Alfred Marshall. If the money demand drops below the level of money supply, real cash balance and balance on current accounts will be higher than requested. The effort for reduction of redundant money will increase expenditures on goods and

services. Higher expenditures will increase prices which will result in increased demand for money. The so called indirect transmission mechanism based on interest rate changes was defined by David Ricardo. In the case of higher supply of money than the demand, the interest rate decreases. The decrease increases demand for investments, then increase in prices of investment goods and costs of production of consumer's goods follows. The increase of costs of production of consumer's goods stimulates the increase of their price. In the case of the price increase, the demand for money rises until the balance between demand and supply of money is reached.

Generally, from the Post-Keynesian point of view, the endogenous money approach supposes that commercial banks and the central bank are both "passive" players in the money creation process. The central bank can determine money supply indirectly through interest rates which affect economic and investment activity and money demand, to create money supply. Supposing that the causality leads not from the amount of money in the economy to investment and economic activity but the other way round, this leads to balancing demand and supply of money on the money market through multiplication effect of creation noncash money directly connected with providing loans.

If the changes in economic and investment activity reflect in demand for money to which the money supply adapts using creation of noncash money, the changing velocity of money is a mechanism balancing money market (Kapounek, 2010).

The significant decrease of money velocity in the euro area after 2008 is significant at the Fig. 3 (monetary aggregate M1). Money velocity changes, which are developed in the quantity theory, play the crucial role in the adjustment mechanism of money demand and supply balancing. Assume that velocity can be divided into transitory and persistent component, where the inverse of the transitory component is possible to be interpreted as monetary overhang or excess liquidity. Changes in investment or economic activity correspond to changes in velocity of money. Shocks that cause a deviation from the potential output will most likely be attributed to the cyclical components of money velocity. The return of money velocity to its equilibrium is accompanied by the return of the output to its potential. El-Shagi and Giesen (2010) argue that this might incorrectly be interpreted as positive growth effect of excess of liquidity, even though there is no causality between liquidity and investment or economic activity.

However, there are significant differences between the monetary aggregates which correspond to motives for holding money. The preference of

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1   The author distinguish horizontalism, structuralism and relative version of money endogeneity theory. To discuss monetary policy limitations in this paper is applied horizontalism as a radical endogeneity theory.
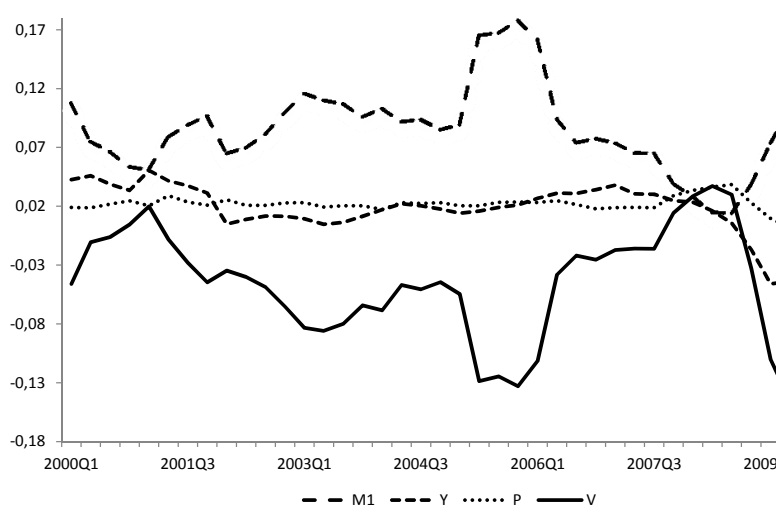
3: *Variables of quantity equation of money (Source: Eurostat)*

economic agents changed during the economic crisis. With increasing uncertainty the economic agents prefer liquid money funds on the demand-side economy. While the narrow money grew in the euro area, investment and economic activity declined. The money supply accommodated its demand through money velocity changes (Fig. 3) and credit money creation process.

MATERIAL AND METHODS

The economic crisis in the euro area during the last years points out the instability of money market. The monetary policy efficiency consists precisely in reduction of the uncertainty and instability which is caused by credit money creation process. Money demand stability is a necessary condition to establish direct link between the relevant monetary aggregate and nominal income. Stable money demand function enhances the ability of monetary authorities to reach predetermined monetary growth targets. Stability of this relationship is basic condition of ECB's single monetary policy implementation from the monetary point of view.

The empirical definition of stability is different from economic interpretation. Thomas (1993) defines stability as the constant relationship between the money demand and only a few variables. Stability was tested for regression parameters in time and low variance of residuals. Common econometric tool is CUSUM test (cumulative sum of the recursive residuals, (Brown, Durbin and Evans, 1975) and Hansen's test (parameter instability in linear models, Hansen (1992)). According to the theoretical background, the author applies the stability test with the keynesian's money demand function assumptions:

$$\frac{M^d}{P} = f\left(\underset{+}{Y}, \underset{-}{IR}\right),$$ （1）

where M^d represents nominal stock of the money (M1, M2 and M3), P is aggregate price level (HICP), Y real income (log GDP) and IR represents short-term interest rate (money market short term interest rate).

Concurrently, the euro area represents huge monetary union where upper limit of credit money creation disappears. Although the ECB may have certain control over the money supply, it cannot fix the stock of money in the euro area. The money supply is not an exogenously set policy variable but is the result of the portfolio decisions of the bank and non-bank private sector. *Thus, even if a central bank can directly set the value of its own liabilities, the money supply is endogenously determined as a residual of the economic process* (Fontana and Palacio-Vera, 2003). If money is a residual of economic processes, the rate of change in monetary aggregates is, in fact, a function of the aggregate demand and economy fluctuations. The implied direction of causality would then be from 'changes in nominal income' to 'changes in the stock of the money', which in turn has an impact on the short term interest rates of the interbank market (Poměnková and Kapounek, 2009).

Consequently, with the endogenous money assumption, the ECB's monetary policy performance is limited. The determination of money supply is indirect and interest rate transmission mechanism channel is applicable. The interest rates influence the investment and economic activities which determine money demand. Subsequently, the stock of money (supply) is determined by its demand.

The applied time series involve nonstationary and trending variables. The cointegration analysis assume if two series are integrated to different orders, then linear combinations of them will be integrated to the higher of the two orders. *If y_t and x_t are each drifting upward with their own trend, then unless there is some relationship between those trend, the difference between them should also be growing, with yet another trend. … if the two series are both I(1), then this partial difference between them might be stable around a fixed mean. The*

implication would be that the series are drifting together at roughly the same rate as reports Greene (2003). Such as these time series are cointegrated. There exists a cointegrating vector [1; −β].

In this paper will be used Johansen's approach, which is based on estimation of the Vector Error Correction Model (VECM) by maximum likelihood under various assumptions about the trend or intercept parameters and the number of cointegrating vectors, and then conduct likelihood ratio tests as states Johansen (1988), Johansen (1991) and Johansen (1994).

This approach reflects that all variables are possibly endogenous. The coefficients estimated on the error correction term show how important these channels are for specific variables. To find causal directin between variables Granger causality tests are often used. However, as these tests are based on differenced data, they provide insights into the short-run dynamics between the variables. Therefore, the concept of long-run weak exogeneity is more appropriate for cointegrating time series (Fidrmuc and Reiner, 2011).

The empirical analysis uses seasonally adjusted data set of Eurostat in the period 1999/Q1–2011/Q2, concretely GDP in millions of euro, monetary aggregares M1, M2, M3, 1-months rates at money market and GDP deflator. The data are chain-linked volumes, reference year is 2000. The logarithmic transformation was applied to reduce heteroscedasticity of residuals. The Augmented Dickey Fuller test (ADF test) as the unit root test was applied in the form:

$$\Delta y_t = \alpha y_{t-1} + x'_t \delta + \beta_1 \Delta y_{t-1} + \beta_2 \Delta y_{t-2} + \dots + \beta_p \Delta y_{t-p} + \varepsilon_t,$$

(2)

where ρ_i is the sum of the autoregressive coefficients in an AR-model or order p_i, and ε_t is white noise. The optimal lag length of the AR-model is obtained on the basis of Akaike's and Bayesian information criterion under the null hypothesis, y_t is assumed to have a unit root.

RESULTS

The estimated models presented in Tab. I identify causality between interest rate, economic activity and money demand (money aggregates) at 1% significance level. All models meet theoretical assumptions about the money demand instability as well. Significant lags were not identified. Fig. 4 presents CUSUM and recursive residuals test results. First indications of instability are significant in the year 2005 and year 2008–2009 when financial crisis culminated. The recursive residuals correspond with time periods when money velocity significantly decreased (Fig. 3).

The results of the unit root tests are shown in Tab. II. The ADF tests provide evidence for the hypothesis that monetary aggregates, economic activity and aggregate prices are nonstationary in levels, but have stationary first differences. Tab. II. indicates that these variables are integrated of order one, i.e. I(1).

The Johansen test is applied to test for the existence and rank of a possible cointegration relationship between the two variables, selected

I: *OLS estimation and Hansen instability test*

Variable	OLS estimation				Hansen test	
	Parameter	SEE	T-Stat	P-value	T-stat	P-value
Monetary aggregate M1						
Constant	−176222704.90	9047743.40	−19.477	0.0000	1.0934	0.0000
Y	12489023.10	628808.50	19.8614	0.0000	1.0980	0.0000
IR	−165945.80	33537.1000	−4.9481	0.0000	0.8104	0.0000
Joint					3.7208	0.0000
Variance					0.3415	0.1100
Monetary aggregate M2						
Constant	−293170548.40	19119841.6	−15.3333	0.0000		0.0000
Y	20817013.60	1328808.50	15.6659	0.0000	1.1305	0.0000
IR	−198430.40	70871.10	−2.7999	0.0078	0.8322	0.0000
Joint					3.1783	0.0000
Variance					0.9894	0.0000
Monetary aggregate M3						
Constant	−349559287.80	20937364.80	−16.6955	0.0000	1.1019	0.0000
Y	24804510.00	1455124.40	17.0463	0.0000	1.1053	0.0000
IR	−211857.20	77608.00	−2.7298	0.0093	0.8143	0.0000
Joint					3.1018	0.0000
Variance					0.9839	0.0000
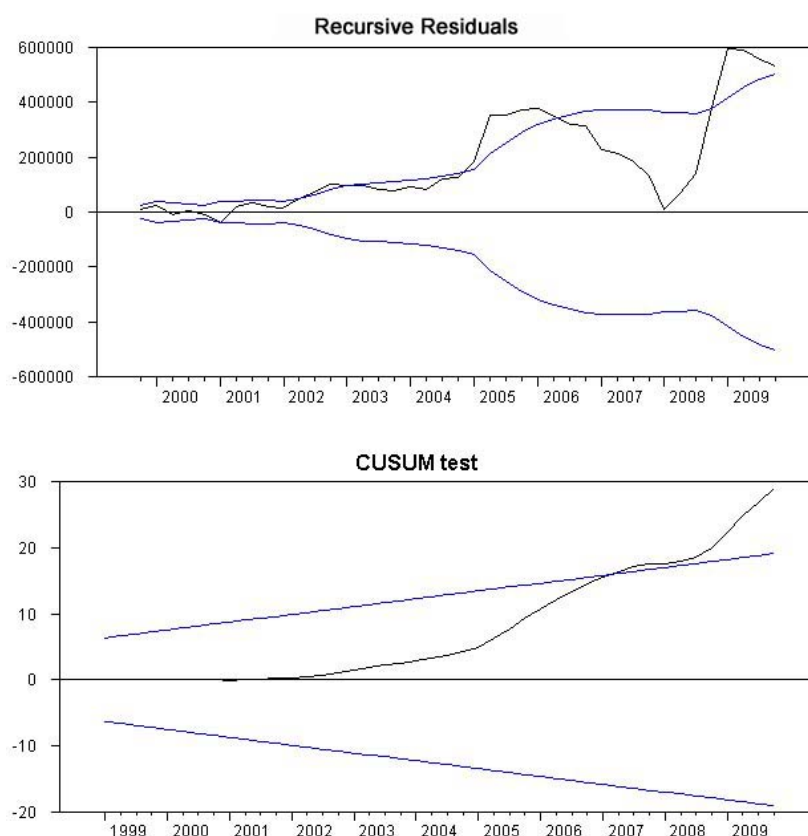
4: *CUSUM test for monetary aggregate M1 in the euro area*

II: *Unit root tests*

Variable	Levels		First differences	
	lag	t-stats	lag	t-stats
M1	1	–1.2576	0	–4.7528***
M2	1	–0.9402	0	–3.348*
M3	6	–2.8063	0	–3.6684**
Y	1	–2.3216	0	–4.1487**
P	0	0.5133	0	–6.3409***
IR	1	–3.5898*	8	–3.4126*

Notes: Lags are identified by Akaike and Bayesian Information Criterion
*, ** and *** Denote significance at the 10, 5 and 1% level

monetary aggregate and economic activity. The results in Tab. III reject the null hypothesis of zero cointegrating vectors. Both the trace test and the maximum eigenvalue test confirm one cointegrated relationship between the variables at standard significance levels (Bask and Fidrmuc, 2008).

III: *Unrestricted cointegration Rank Test*

Series	Trace Statistic	p-value	Max-Eigen Statistic	p-value
M1/P, Y	13.587	0.095	10.662	0.172
M2/P, Y	17.316	0.026	15.684	0.030
M3/P, Y	20.881	0.007	18.093	0.012

Tab IV. shows the results for the setup with monetary aggregate M1, M2, M3 and economic activity. The cointegration tests identifed that the long-run monetary aggregate is significantly determined by economic activity. There is long-run positive relationship.

The error correction estimation in Tab. IV. indicates if and at which speed the variable of interest reacts to a disequilibrium in the long-term relationship. The adjustment coefficient for the monetary aggregate M1 is negative and insignificant, however the adjustment coefficient on economic activity is significant and negative.

In the case of monetary aggregates M2 and M3 the parameters of economic activity are not significant. Thus, the economic activity is treated to be weakly

IV: *Vector Error Correction Estimates*

Cointegrating equation	Cointegrated vector			Error correction			
	Y_{t-1}	t-stat	const.	M/P	t-stat	Y	t-stat
$M1_{t-1}/P_{t-1}$	4.963	9.220	–61.262	–0.021	–0.962	–0.031	–3.183
$M2_{t-1}/P_{t-1}$	3.290	15.519	–36.499	0.063	3.510	0.005	0.264
$M3_{t-1}/P_{t-1}$	3.113	20.536	–33.799	0.106	3.883	0.017	0.686

exogenous in the model. Only monetary aggregates (M2, M3) adapt to the long-term equilibrium while economic growth does not tend to this equilibrium relation.

DISCUSSIONS AND CONCLUSIONS

The author argues that the money stock is influenced by investment and economic activity. Concurrently, the credit money creation is source of economic system instability, where money supply is balanced by velocity of money and determined by money demand. The euro area is huge monetary union with large financial system where the upper limit of money creation vanishes. For that reason, the euro area is appropriate model of the economy for money endogeneity assumptions application.

However, banks do not meet all the demands for loans. The horizontalism is limited by credibility of borrowers and other restrictions on the lending channel of banks that relate to riskiness of their investment environment. Moore (1996) assumes that banks do refuse credit to many borrowers, and central banks may not fully accommodate. Rochon (2006) concludes that *While credit-led and demand-determined, economic activity is limited by the willingness of banks to supply credit. And while microuncertainty can affect an individual firm's ability to raise proceeds, it is perhaps the macrouncertainty that banks fear most.*

Absolute money endogeneity theory assumes infinitely elastic money supply. However, banking sector has some limitations in lending process. The economic agents (or enterprises) have different credibility at various levels of interest rates. From the specific point the money supply is not infinitely elastic but increasing. This approach is known as relative version of money endogeneity theory. The liquidity of commercial banks has also impact on the credits which are offered by banking sector (Wray, 1990). The tendency to offer more credits

with lower interest rates increases with economic expansion too.

The impact of banking system money creation on the stock of the money in the economy is determined by financial market size and share of small and medium enterprises, which are dependent on the credit financing of commercial banks. The money endogeneity is limited also by liquidity sources of commercial banks. Small regional commercial banks are directly dependent on the interbank market and central bank – their money supply is exogenously determined.

The empirical analysis identified money demand instability during the financial crisis when investment activity rapidly decreased. The author identified cointegration vector, long-term relationship between monetary aggregates and economic activity. The VECMs estimates show that economic activity is weakly exogenous in the model of M2 and M3.

This conclusion is very important for monetary policy implementation in the euro area. The central bank is able to determine the money stock in the economy indirectly, through the interest rates and its impact on the investment and economic activity. According to the Post-Keynesians assumptions administrative instruments are very important. The target of central bank is not only maintaining price stability but also financial system stabilization and sufficient liquidity arrangement.

The passive role of central bank in the process of monetary policy implementation in the euro area is recommendable. The optimal ECB's target is maintaining low and stable interest rates to support sustainable economic growth in the euro area. Price stability is recommended field of national governments excluding situation of symmetric and significant inflation shock in the all member states.

SUMMARY

The author discusses the monetary policy efficiency during the financial crisis in the years 2007–2010. Since the ECB continuously reduced official interest rates, there has been no increase in the intermediate and broad money. The author argues that the reason is significant decrease of money velocity in the Eruozone after 2008. Money velocity changes play the crucial role in adjustment mechanism of demand and supply. If the changes in economic and investment activity reflect in demand for money to which the money supply adapts using creation of noncash money, the changing velocity of money is a mechanism balancing money market. Concurrently, the instability of money

demand function was identified by CUSUM and Hansen test. The preferences of ecoonomic agents changed during the economic crisis.

Another part of the paper focuses on the causality identification between the monetary aggregates and economic activity. The Johansen test is applied to test for the existence and rank of a possible cointegration relationship.

The author assumes that the euro area represents huge monetary union where upper limit of credit money creation disappears. Although the ECB may have certain control over the money supply, it cannot fix the stock of money in the euro area. The money supply is not an exogenously set policy variable but is the result of the portfolio decisions of the bank and non-bank private sector. Finally, the central bank plays the passive role and cannot fix the stock of money in a country. The central bank is able to determine the money stock in the economy indirectly, through the interest rates and its impact on the investment and economic activity.

Finally, the author provides a few recommendations for monetary authorities which are based in Post-Keynesian economy – (1) low and stable interest rates to support sustainable economic growth, (2) financial system stabilization by administrative instruments.

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