The Impacts of the Unconventional Monetary Policy Measures on the Money Stock Development in the USA and Euro area

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Abstract
After the outbreak of the financial crisis in 2007, the traditional monetary policy measures seemed to be ineffective in filling the monetary goals of the FED and ECB. The serious post-crisis consequences, especially the lack of liquidity and freezing of the interbank market forced them to come up with liquidity injections through different monetary tools. This liquidity was dedicated to be passed to the financial and subsequently to the real sector with the aim to restore the financial stability. In the following paper we study the relationship between the base money and monetary aggregates and calculate the money multipliers in USA and Euro area since the eruption of the financial crisis up to present time. This article shows how the huge supply of liquidity was expressed in the development of money stock and discusses whether the original intentions of the central banks were successful or not.

Keywords: unconventional monetary policy, money stock, monetary aggregate, multiplier

1. Introduction

The consequences of global financial crises stood central banks in front of the challenge of restoring stability. Functioning of financial markets has been severely disrupted and the financial crisis was transferred to the real economy, bringing the serious problems at the macroeconomic level in the short term. Government and monetary authorities struggled with the problem of restoring financial stability and re-starting the macro-economic systems at national, regional and international levels. Exactly from monetary authorities were expected most radical impulses in efforts to reverse the negative , recessive developments in the most advanced economies that were mostly affected by the crisis. The standard measures used in the previous period appeared to be insufficient, because of that new economic motives became real not only for banking system but also for whole financial system. Therefore central banks started with a series of unconventional instruments and declarations which received a summary indication "unconventional monetary policy".

The European Central Bank and the Federal Reserve System responded to this situation in particular by reducing its key interest rates and huge supply of liquidity to the banking sector. Supplying with a long-term liquidity with extended maturities and implementation of special futures contracts became wery important in these days. In reference to amplifying pressures in the interbank market even ECB loosened its strict rules on collateral accepted as consideration in their operations. Overview of unconventional monetary policy instruments can be seen in table 1.

Table 1: The unconventional policy measures od the FED and ECB

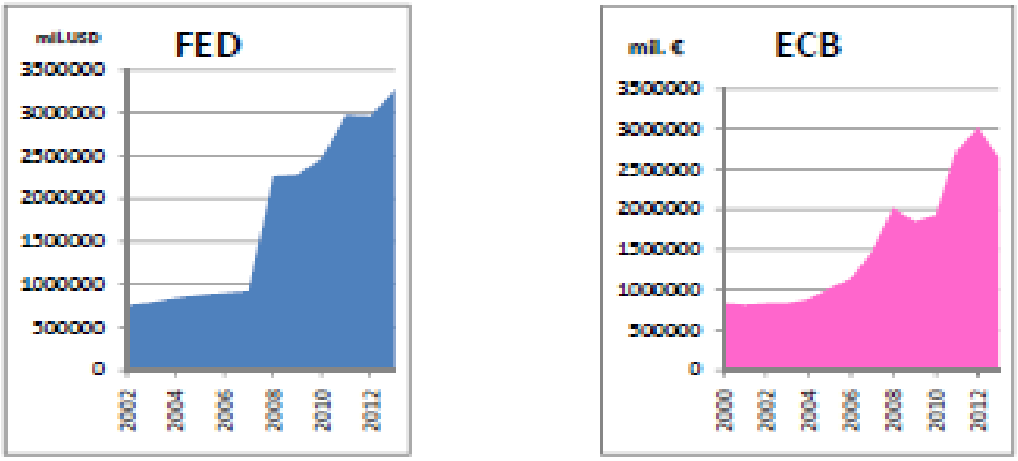
	ECB	**FED**
INTEREST RATE POLICY	reducing the main refinancing rate from 4.25% pre-crisis (2008), to 0.5% (current) disturbance of corridor of interest rates 150 basis points	reducing the federal funds rate from 5,25% pre-crisis (2007)to 0 - 0.25% (current)
LIQUIDITY EASING	fully satisfied demand at a fixed rate of refinancing operations the change in the structure and maturity of the MROs from 1 week to 2 weeks increasing the frequency of 3-months. operations, extension of maturity from 3 to 6 and 12 months. 2-times the long-term refinancing operation with a maturity of 36months special term operations with a maturity of 38 days, later in a variety of maintenance period of PMR extension of collateral swap lines with the Federal Reserve and the Swiss National Bank	Term Auction Facility Term Securities Lending Facility Primary Dealer Credit Facility swap lines with the central banks extension of collateral paying interest rates on required reserves, later also on excess reserves
DIRECT PURCHASE ON FINANCIAL MARKET	Covered Bonds Purchase Program (CBPP) Security Markets Program (SMP) Outright monetary transactions (OMT)	Asset-Backed Commercial Paper MMMF Liquidity Facility Money Market Investor Funding Facility Asset-Backed Security Loan Facility Commercial Paper Funding Facility MBS Purchase Program

Source: author

For both monetary authorities we can reach a common conclusion and that the one of the most significant impacts of the application of unconventional measures is a huge increase in the absolute value of their total assets. On Figure 1 can be viewed an overall increase in the volume of assets in balance sheets of Fed and the ECB. Fed more than tripled this volume over the years 2007-2013, it

Figure 1: Growth of assets in the balance sheets of FED and ECB as a result of unconventional monetary policy in the years 2002-12

a) FED (mil. USD) b) ECB (mil. €)



Source: www.federalreserve.gov a www.ecb.int

2. Teoretical framework

The dependance between money supply and the real GDP was the main topic of few authors. The theory says that increasing of money supply will automaticaly increase the real GDP in long term. This statimets were reviewed by authors Mohamadpour, Behravan, Espahbodi (2012) who aimed to unveil the relationships exists between monetary policy and GDP in Malaysia for quarterly data from 1991 to 2011 in their paper.

The result of Unit Root test on monetary policy variables namely M1, M2, and M3- and GDP revealed to be stationary only after first difference; yet, stayed level stationary for real interest rate. Co-integration analysis and Vector Error Correction Models (VECM) were also indicated a possibility of merely one long-run equilibrium relationship between real GDP regards to M1, M2, M3, and real interest rate. However, results of trace and maximum Eigenvalue methods suggested two co-integration equations amongst research variables. Altogether, VECM analysis indicates monetary supply variables included in the model (M1, M2, and M3) are statistically significant and havelong-term influence on GDP.

Carl E. Walsh (2010) was trying to find the relationship and empirical evidence between money, prices and output in long-term and short –term in his book „Monetary Theory and Policy“. He says that, almost all economists accept that the long-run effects of money fall entirely, or almost entirely, on prices, with little impact on real variables, but most economists also believe that monetary disturbances can have important effects on real variables such as output also in the short run.

3. Data description, methodology of the research

The following article focuses on examining the impact of unconventional monetary policies of central banks in the U.S. and euro area to the money supply developments. The paper used data from macroeconomic statistics of Fed and ECB collected on a monthly basis. It is studying the supply side of money and detects how money provided to the financial sector in the form of increasing the monetary base actually turned into an actual increase of the money supply which is measured by defined monetary aggregates

In examining the dependence between the monetary base and monetary aggregates we used simple regression model where the exogenous explanatory variable is supplied monetary base and the dependent variable is the money supply, measured in terms of M1.

4. Research

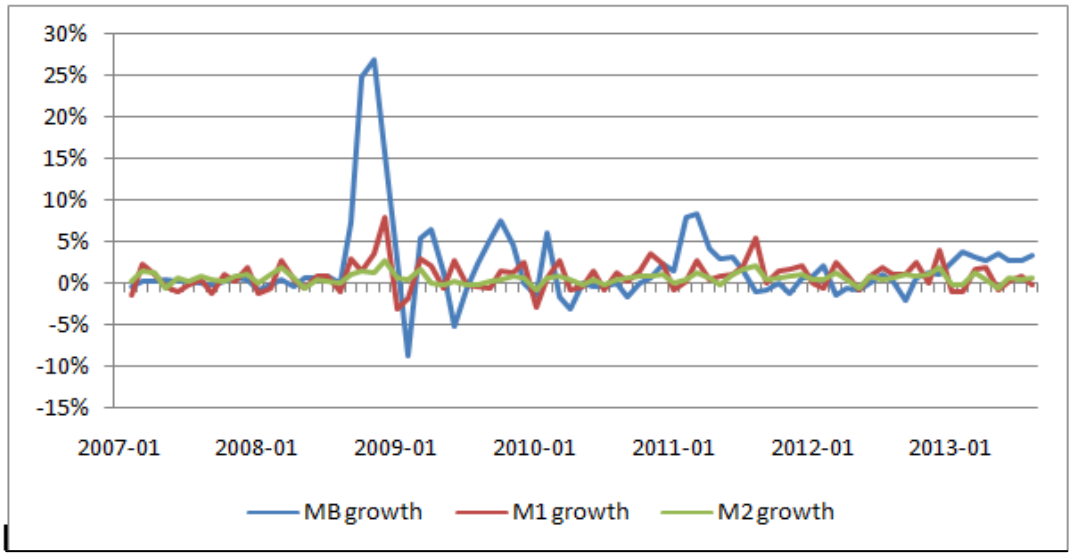
4.1 USA

Most of unconventional monetary instruments were linked directly with pouring massive amounts of liquidity into circulation with the result that monetary base has risen sharply from the 2007. This increase is reflected at the end of 2008 as a direct result of the launch of the first wave of quantitative easing QE1, mostly significant in the USA. Over one quarter amounted to almost 82% increase. Another significant increase was revealed in the end of 2010 as a result of measures QE lite and QE 2. From this period, the level of the monetary base was at about the same level. Its value changes oscillated around zero until 2012, since then we can see again a slight increase in relation to running a QE4. Although the Fed declared that the U.S. economy is still not ready for the exit strategies and supply of liquidity into the economy continues, it is significantly lower than it was in previous period.

The basic problem we encounter when we look at the evolution of the money supply. The development of monetary aggregates does not correlate with the above mentioned increases in the monetary base. On Figure 2 we can be observe increases in the monetary base as well as both sets on a monthly basis from the Year 2007 - 2013. Monetary aggregate M1 grew to 2008 at least as strongly as the monetary base, both aggregates M1 and M2 were mostly multiplied even more.

As we already indicated above year 2008 was specific in terms of the huge inflow of liquidity into the economy when Fed's assets have more than doubled. Values of both aggregates slightly increased , but this increase is well below the increase of monetary base during this period, what we can see also in decline of money multiplier in same period.

Figure 2: MB growth, M1 a M2growth



Source: www.federalreserve.gov

The main objective of pouring liquidity into the financial sector in the crisis period was mainly the inflow of resources into the real economy through its agents in the market. Increasing the amount of money would thus give rise to the multiplication of these resources.

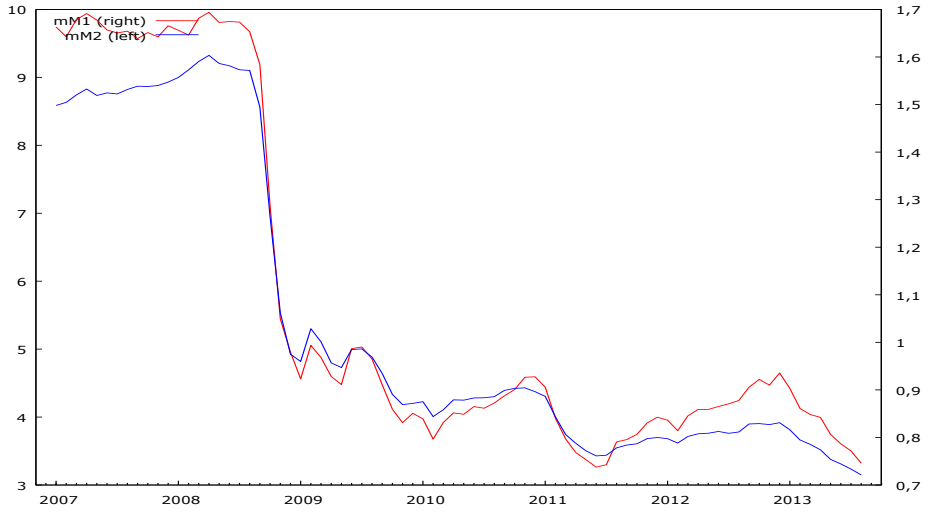
Paradoxically, looking at Figure 3, which shows the evolution of multipliers M1 and M2 do not confirm this theoretical presumption.

From February 2009, the multiplier M1 is constantly varying only in the order of 1, which means that the M1 multiplication is only in a minimum proportion, for more stages it even does not

occur at all. For example multiplier M1 reached negative values at the end of 2009, as confirmed by negative increments monetary aggregate M1 in the same period.

Same situation was also with money multiplier in case of money agregate M2. From August 2008 until the end of the same year fell by almost 5 percentage points and continued to decline until 2011, when it reached its lowest value. Nevertheless, it took values greater than 1, and thus increase the monetary base is also reflected as an increase in the money supply measured by M2 aggregate, but at a significantly lower rate

Figure 3: evolution of M1 and M2 multipliers



source: www.federalreserve.gov

When thinking about the above knowledge is necessary to ask why the intended effect of central bank capital injection into the real economy has not been achieved. Where and why was disrupted the multiplication of the monetary base? The basic reason that M1 is increasing significantly lower than supplied monetary base is the fact that the process of multiplication was inhibited by U.S. commercial banks and other economic entities, which accumulated liquidity in their accounts in the form of various types of financial reserves and collateral. On figure 4 we can observe a significant increase of excess reserves from the second half of 2008 in the United States.

Figure 4: required reserves and excess reserves in USA

source: www.federalreserve.gov

The reason for such behavior is that since October 2008, Fed started to change paying interest rate on reserve accounts. FED started to pay interest rate not only for required reserves but also for excess reserves. Since December 2008, this interest rate is same as the key Federal Funds Target Rate and it is in the same zone ranges up to now.

In order to monitor how the development of the money supply is dependent on changes in the monetary base, ceteris paribus, we created a simple regression model where the dependent variable is the monetary aggregate M1 and the independent variable is the monetary base.

M1growth = 3,0055e+06+ 0,108484 MB growth + e

Our conclusions stated above are confirmed - if the monetary base grow by 1000000 USD, increase of M1 will change only in the amount of 108 484 USD. This means that the increase in the monetary aggregate M1 is only 10%, compared with an increase of the monetary base, which we have confirmed in our previous assumptions. Huge increases in the monetary base although raise increases in the monetary aggregate M1, but many times lower.

Model 1: Cochrane-Orcutt, using observations 2007:03-2013:08 (T = 78)
Dependent variable: M1__mi__USD_
rho = 0,991617

	Coefficient	*Std. Error*	*t-ratio*	*p-value*	
const	3,0055e+06	506958	5,9285	<0,00001	***
MB__mil__USD_	0,108484	0,0489609	2,2157	0,02970	**

Statistics based on the rho-differenced data:

Mean dependent var	1839015	S.D. dependent var	389688,9
Sum squared resid	7,28e+10	S.E. of regression	30942,51
R-squared	0,993944	Adjusted R-squared	0,993864
F(1, 76)	4,909434	P-value(F)	0,029704
rho	-0,083107	Durbin-Watson	2,154236

(model with the best predictible ability is model, where the dependent variable is the monetary aggregate M1 and the explanatory variable is MB – both in millions USD.- this model explains up to 99.39% of change in the dependent variable with the confidence interval at 0.05. F value of the model is high, the p-value is less than 0.05, therefore our model seems to be correct. After adjustment of model for elements of autocorrelation by Cochran-Orcutt method and by Ramsey LM test, it was confirmed that the model is correctly defined.)

In case of evaluating the effectiveness of monetary policy, we concluded that the funds poured into the financial sector have not been transformed into the real economy. Because of that we decided to analyze the impact of growth of M1 to U.S. GDP in this period.

Model 2: OLS, using observations 2007:2-2012:4 (T = 23)
Dependent variable: deltaGDP

	Coefficient	*Std. Error*	*t-ratio*	*p-value*	
const	0,00383585	0,00202375	1,8954	0,07189	*
deltaM1	-0,0698234	0,0457859	-1,5250	0,14218	

Mean dependent var	0,001959	S.D. dependent var	0,007932
Sum squared resid	0,001246	S.E. of regression	0,007704

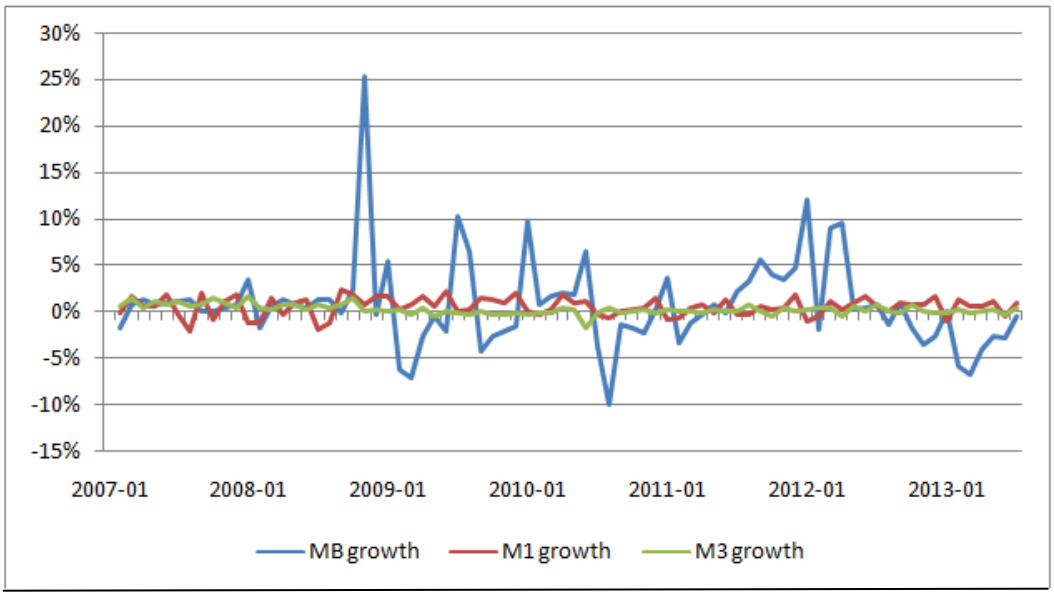
R-squared	0,099702	Adjusted R-squared	0,056831
F(1, 21)	2,325612	P-value(F)	0,142180
Log-likelihood	80,33007	Akaike criterion	-156,6601
Schwarz criterion	-154,3891	Hannan-Quinn	-156,0890
rho	0,540321	Durbin-Watson	0,901043

Theoretical assumptions about the impact of M1 to GDP was not confirmed.

4.2 Eurozone

The situation in this case for the development of monetary aggregates in the euro area was very similar to that in the USA. The most significant increase in the monetary base can be seen in the second half of 2008, but the increase of monetary aggregates M1 and M3 was much lower than the increase in the value of the monetary base provided by the ECB. This fact is clearly evident in Figure 5.

Figure 5: growth of the monetary base and M1, M3 monetary aggregates

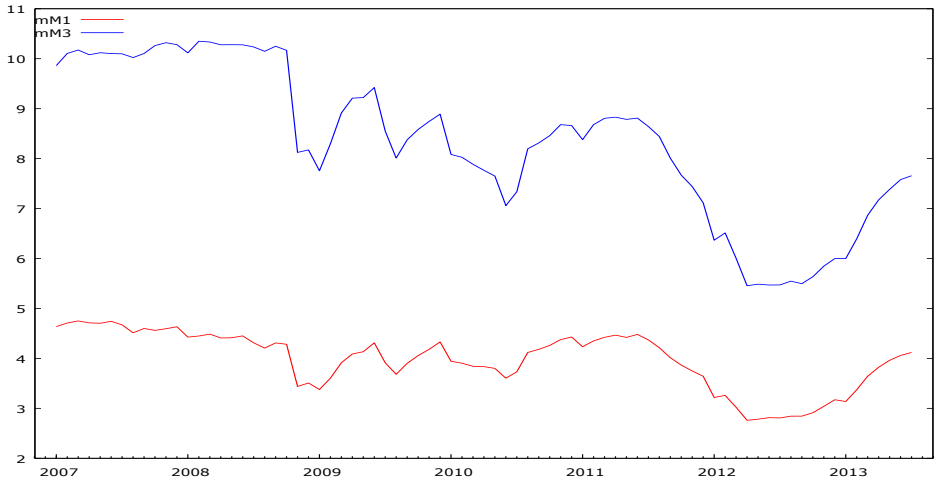


source: www.ecb.int

Equally paradoxically, with the largest volume of pouring liquidity into the financial sector decreased the value of multipliers, thus slowing down the process of multiplication compared with the period before the start of unconventional measures. This decline can be seen on Figure 6. The line of drop is slightly more significant in the case of multiplier M3. This decline is directly related to decline in transactional and speculative demand, which is recorded in the same period of sharp decline due to increasing uncertainty in the markets.

The difference with the U.S. lies mainly in the fact that the value of the multiplier in the eurozone didn't remain on the lowered values, but several times were increasing and decreasing again. While in the USA we have reported stable levels, without significant changes in these days, the multiplication process in the euro area slowed down again since the second half of 2012.

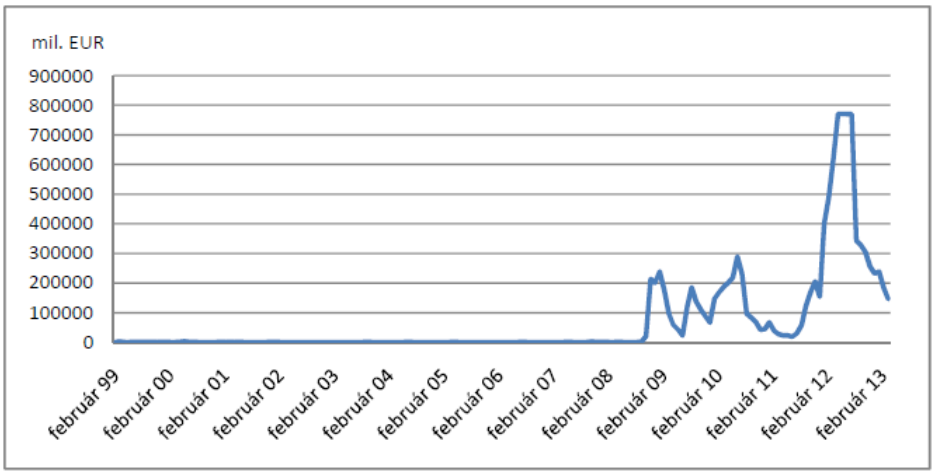
Figure 6: evolution of the M1 multiplier and M3 multiplier



source: www.ecb.int

Uncertainty in the financial markets and the already mentioned unwillingness between interbank lending partners led to the fact that the banking entities in the euro area have begun to rely on the use of the deposit facility. This form is required as their overnight liquidity which is securely placed. Safety is in this case sufficiently compensated by getting lower interest rates offered by ECB.

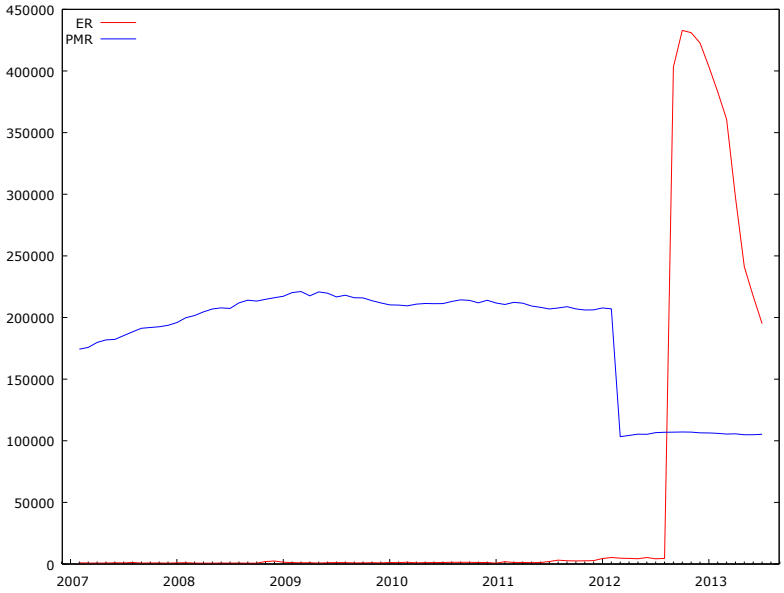
Figure 7: deposit facility



source: www.ecb.int

Excess reserves grew strongly in the second half of 2011, which corresponds to a decreasing line of both declining multipliers. See Figure 8

Figure 8: required reserves and excess reserves in eurozone



source: www.ecb.int

The ECB decided to reduce the interest rate on holdings of required reserves. This was reflected as a reduction of the total volume of holdings of required reserves from January 2012. The aim was to retain such funds in an economy where was liquidity needed instead of holding funds in the accounts at the ECB. After this reduction, however, in the second half of 2012 sharply increased the amount of excess reserves, the ECB responded by lowering the deposit rate to zero. This was due to unwanted accumulation of liquidity on the accounts at the ECB, which, like in the U.S. means that money is not getting to the real economy and there are liquidity lacks on the interbank market, which should then be distributed by depository institutions.

In the case of a simple regression model we chose as dependent variable M1 and exogenous explanatory variable MB, same as in the US. We chose to define the model in absolute terms, but after the recovery of model from autocorrelation we come across to paradoxical phenomenon. In the period from 2007 to the present we can not confirm direct statistical relationship between M1 and MB.

Model 3: Cochrane-Orcutt, using observations 2007:03-2013:07 (T = 77)
Dependent variable: M1
rho = 0,987361

	Coefficient	*Std. Error*	*t-ratio*	*p-value*	
const	6,23307e+06	412230	15,1204	<0,00001	***
MB	-0,0620788	0,0866465	-0,7165	0,47593	

Statistics based on the rho-differenced data:

Mean dependent var	4478605	S.D. dependent var	480216,3
Sum squared resid	1,37e+11	S.E. of regression	42757,34
R-squared	0,992282	Adjusted R-squared	0,992179
F(1, 75)	0,513315	P-value(F)	0,475932
rho	-0,038761	Durbin-Watson	2,060595

For comparison, the same analysis was carried out in the euro area in the previous period, ie from 1999 to 2006. Before the crisis of 2007, was this the relationship between these variables evident and quite significant. Model for this period is as follows:

$$M1 = -190745 + 5{,}10916\ MB + e$$

In the case of change of MB 1000000 EUR, M1 changes on 5109 160 EUR, ie an increase of the monetary aggregate as compared with MB is more than 5 – times bigger, what is suggesting a very strong multiplication. Based on these findings it can be said that a direct relationship between MB and M1 in the euro area was evident in the pre-crisis period, but its disruption occurred just in the emergence of the financial crisis and its consequences.

As in the U.S., we decided to examine the statistical dependence between variables ΔM1 and ΔHDP in the period from 2007 to the present. Even in this case we have not confirmed the relation between the increase of these parameters.

Model 4: Cochrane-Orcutt, using observations 1999:3-2006:4 (T = 30)
Dependent variable: Δ_GDP
rho = 0,649217

	Coefficient	*Std. Error*	*t-ratio*	*p-value*	
const	0,0055007	0,00161827	3,3991	0,00205	***
Δ_M1	0,0127245	0,013832	0,9199	0,36546	

Statistics based on the rho-differenced data:

Mean dependent var	0,005559	S.D. dependent var	0,003865
Sum squared resid	0,000260	S.E. of regression	0,003046
R-squared	0,400298	Adjusted R-squared	0,378880
F(1, 28)	0,846281	P-value(F)	0,365465
rho	-0,014383	Durbin-Watson	1,871041

5. Conclusion

Due to pouring liquidity into the financial sector, assets in balance sheets of central banks had highly increased, which can be proved with the enormous quantity of monetary base supplied especially in 2008. Balance sheet amounts of Fed and ECB compared to pre-crisis levels due to unconventional policy tripled. Despite the huge sums flowing into the economy, the increase in the money supply, both in the U.S. than in the euro area, were several times lower, for most of the period it was minimal. These conclusions were confirmed by both regression models.

In the U.S., we concluded that, compared with the increase in the monetary base is an increase in the money supply measured by M1 only of 10%. In the euro area models didn't confirmed direct statistical dependence between the development of these variables. This paradoxical effect can be explained by two phenomena.

The first is the sharp reduction in the money multiplier and the second is holding high volumes of excess reserves by economic entities on the accounts in central banks. Instead of operating with excess liquidity, subjects on the banking market interrupted with this process the multiplication process.

Declining of multipliers show that instead of lending to economic entities remained this resources in banks. This findings indicate that help which was directed through the supply of liquidity to the financial sector for further support of stabilization and recovery of the real economy stopped here. In some cases became unconventional measures even ineffective.

Acknowledgement

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