Banking sector and bank liquidity – key actors within financial crises?

Dan Costin NIȚESCU
Bucharest University of Economic Studies, Romania
dan.nitescu@fin.ase.ro
Florin Alexandru DUNĂ
Bucharest University of Economic Studies, Romania
alexandruflorin.duna@gmail.com
Adriana Daniela CIUREL
Bucharest University of Economic Studies, Romania
adriana_daniela_ciurel@yahoo.com

Abstract. *The paper emphasizes the context of financial crisis and the influence of a selection of indicators on bank liquidity, for a period longer than 50 years. The first part represent the introduction on the topic of the study, followed by the presentation of the related literature. The third part reflects the methodology used within the empirical study, analyzing complex correlations between the bank liquidity and two categories of indicators, macro and bank related indicators, for the countries included nowadays within the Euro Area. The paper links, within the fourth part, the qualitative input from other relevant studies with the empirical evidence and findings of our quantitative analysis, based on data collected for the period between 1960 and 2017. Bank liquidity has received special attention, given its strong association with financial crisis events and periods of macroeconomic instability. The final part reflects our conclusions.*

Keywords: bank liquidity, regulatory framework, financial markets, financial stability, deposits to GDP.

JEL Classification: D53, E44, E58, F61, F62, G21.

1. Introduction

Banking sector support in financing the real economy, mainly via lending activities and securing deposits, represent a catalyzer for growth. The 2008 financial crisis reflected the important role of liquidity creation of the banking sector.

Our paper, providing an analysis over a period of 57 years (between 1960 and 2017), takes into consideration both a traditional approach on liquidity risk, via bank runs, when customer withdraw their money but also a recent approach on liquidity risk, linked with bank exposures to other financial partners, based on interbank financial arrangements. When a shock appears, via losing access to withdraw from undrawn financing facilities, the shock is exacerbated, generating instability on asset side liquidity.

Liquidity creation, liquidity exposure, liquidity risk are concepts very much linked with the most recent financial crisis. Although relevant research was performed, a complete and documented answer to a major question is still missing: "the 2008 financial crisis has started as a liquidity or a solvency crisis"?

In a holistic manner, financial crises are linked with politics, economics, communication, sentiments, expectations, behavior of all the relevant actors. The actions and reactions of authorities, bank customers, financial partners with no access to undrawn loan commitments, influences the crisis context and management, both at the macroeconomic and microeconomic level. At the policy level, there are cross over effects, instruments calibrated for one policy may significantly influence on the objectives of other policy and vice versa.

In Europe, the cultural approach reflects the prevalence for bank financing[1], banking channel being of highly importance in funding the European economy. Thus, bank liquidity has a critical function, being an important pillar for supporting economic activities, representing as well a potential vulnerability in a crisis context. Bank are transforming the risks in their balance sheets and are creating liquidity. Our research analyze, based on a selection of relevant indicators, both at the macroeconomic level and at bank's level, the influence on bank liquidity, in a long-term context.

Other arguments considered for the topic of our research are included within the results and discussions section. They approach aspects such as: the behavioral aspects of liquidity, contagion effects and quick propagation in the market of a liquidity problem for a bank, the connection between liquidity risk and solvency risk, the importance of intraday liquidity management, the impact of maturity transformation, both within the bank's balance sheet but also related to the other banks.

Our qualitative analysis reflects mainly the 2008 financial crisis context, adding value to our empirical study. Within the 57 years analyzed period of the study, lessons have been forgotten regarding aspects such as: sovereign debt, fixed or flexible interest rates, savings, loans, liquidity risk, insolvent banks, junk bonds, currency fluctuations, maturity transformation, irrational exuberance in the market, overheating in different sectors of the economy. As consequences, various crises[2] appeared. The causes of the crises are numerous. Even crises that started from a specific sector of the economy have transformed into financial crises, involving, among the main actors, the banking system.

Historically, and especially since the 1970s, numerous crises in the financial system have affected banking entities in different countries, with consequences such as the generation of high financial and fiscal costs for these countries.

The causes of banking crises are both from the macroeconomic and microeconomic perspectives. Among the macroeconomic factors are, on the one hand, shocks that affect the quality of banking assets, the excessive expansion of monetary aggregates, the funding of resources and credit dynamics and, on the other hand, also influence expectations and external and internal volatility (Hausmann and Rojas-Suárez, 1996). With respect to microeconomic causes, these are mainly characterized by weakness in banking regulation and supervision, precipitation in financial liberalization schemes, inadequate accounting aspects, the increase in financial intermediation margins and in the past due portfolio, the State ownership and participation in banks, the granting of credits to related parties and asymmetric information problems.

The measures adopted within crises context, were focused on preventing the spread of crises, restoring the confidence of depositors, protecting the payment system and promoting the restructuring and recapitalization of viable banks. In most of the cases, the intervention of the government and/or the Central Bank was fundamental to provide liquidity and maintain the integrity of the banking systems. The measures implemented in several countries represented assistance to banks, assistance to debtors and reforms to the legal framework.

The structure and the strategies in managing crisis have evolved and changed, but lessons learned from the crisis times must be analyzed and reflected. In this regard, bank liquidity has to be considered as an all-in-all driver, shadow and mirror of what a bank, in terms of stability, predictability and transparency should look like.

One of the main pillars of banking business has to be considered the management of bank liquidity, especially in a cross-border banking and international context. Financial stability, prudence, financial sustainability represent relevant concepts within the post 2008 financial crisis environment.

As Jorda et al. (2011) reflect in a research study, realized for a selection of fourteen advanced countries analyzed between 1870 to 2008, recessions may be divided into financial recessions and normal recessions. The study presented how GDP recovery varied in severity, according to credit outstanding relative to GDP in the preceding boom. Their conclusions were strongly confirmed, revealing that not only financial recessions are deeper and slower in recovery than in normal recessions, but slower the recovery the greater the credit-to-GDP ratio[3] is.

Accommodating their findings to the 2008 crisis, the answer may be formulated upon the measurement methods of the credit outstanding. With bank loans to the private sector as the measure of credit, the US recovery is about 1% of GDP better than mean recovery for financial recessions. When, in addition, the measure of credit also includes credit granted by the shadow banking system, the results are about 4% better than the median recovery in financial recessions.

The financial crisis of 2008, which has led to the most severe economic crisis worldwide, since the Great Depression of 1930, has called into question, for the first time, the banking business models. A model "originate to maintain" (BIS, 2008, Buiter, 2007, Gorton, 2008, Hellwing, 2008), based on financing through deposits, providing loans to customers, with special attention to the reserves in the long term, based on deposit guarantee systems and the role of central banks as lenders, should be reevaluated and changed.

A new regulatory framework emerged, special provision for liquidity, solvability, supervision and resolution on banking organizations were drafted and implemented. Bail-in and bailout schemes to support authorities, banks and the economy where developed in order to rebalance and recreate a sustainable environment for growth.

Our paper adds value to existing research by analysing data over a 57 years period of time, combining a macroeconomic and a microeconomic approach, via studying the correlations between bank liquidity and a selection of relevant indicators. The focus of our paper is on the countries that are part nowadays from the Euro area, due also to the available data for analysis.

As for the future policies, our research may offer input in designing a new framework for sustainable growth, while building resilience and addressing adequately risks.

2. Literature review

Before the 1960s, bankers considered liquidity almost exclusively in the balance sheet assets and since then, they began to include it in the liabilities side as well. John M. Keynes (1883-1946) adheres to the theory of preference for liquidity to interpret the interest, monetary theory, explaining the phenomenon in terms of money. From that point of view, the interest rate is functionally related to the amount of cash that the public wants to retain, by lowering the interest rates as the supposed cash balances rise. The preference for liquidity function reflects the various reasons for holding cash, such as speculation motives to prefer cash to securities based on expectations that prices will fall. The monetary authorities, by providing the public with greater cash balances, can cause the interest rate to fall, thereby stimulating a greater volume of investment.

The liquidity trap puts a limit on this opportunity because once the interest rate has reached a very low level, the subsequent increase in cash balances will no longer be able to continue to lower it. At this lower level, the holders of securities will believe that the only thing that can be expected is an increase in interest rates or a decrease in the prices of the securities, and will therefore be willing to sell securities to the monetary authorities at prices reigning, in order to maintain the interest rate as it is. Therefore, the pretense of facing a depression through a purely monetary policy can be a failure and should resort to fiscal policy: public works or tax reductions.

The theory of Diamond and Dybvig (1983) applies in "closed" economies. The alteration of the confidence of the depositors in the domestic banking system can cause the economy to move from a "good" equilibrium (without banking crises) to a "bad" equilibrium (with banking crises).

In 1997, Goldfajn and Valdés discovered that the origin of crises is the volatility of international capital flows and the work of financial intermediaries. On the other hand, the theories of Allen and Gale (1998) and Buch and Heinrich (1999) show that banking crises occur when depositors perceive that a deterioration of fundamentals will eventually affect the net value of banking institutions.

According to Adam Smith, banking practices deviate from the idea that they should lend short as they borrow short. There is a lag between the maturities of assets and liabilities on the balance sheet. It is presumed that the interbank business has ceased to function as the entities no longer lend to each other, which has led them to a problematic situation. With the arrival of the credit crisis and the uncertainty about whether another bank may present solvency problems, the interbank credit has been closed. It is considered that this liquidity crisis represents mainly a crisis of confidence. The collapse of subprime mortgages has led to the collapse of large mortgage and financial institutions, which altered the perception of risk among investors.

Also another important role in the history of financial markets and banking systems, were the so-called "panic crisis", led into the commercial banking systems by different endogene and exogene factors. These panic crisis occurred frequently in Europe and the United Stated, were central banks held a leading role in reassuring stability. In this respect, one of the first central banks that took this role was the Central Bank of Sweden, established over 300 years ago (Allen and Gale, 1998).

Relevant studies, mainly performed after the 2008 financial crisis, indicated the importance of global liquidity conditions on financial stability and local macroeconomic performance. Rey (2013) identified the existence of a global financial cycle that transmits the financial conditions of the United States (USA) to the rest of the world.

Similarly, Bruno and Shin (2015) pointed out the importance of global interbank credit as a mechanism for transmitting these conditions to macroeconomic and financial variables at the local level. Given the relevance of credit cycles and the potential effects they may have on financial and macroeconomic stability, they explore the existence of a potential synchronization between these cycles for different countries and monetary regime factors, in the behavior of the credit cycle. In addition, it seeks to identify the effect that global liquidity shocks may have on the behavior of common factors.

Blanchard et al (2010) reflects that, markets are segmented but interlinked. When investors leave one market, the effect on prices may be very large. Considering that, the demand for liquidity extends the banking system, the financial regulation and supervision should consider financial intermediation as a macroeconomic feature.

Regarding post crisis years of observation, for the Euro area particularly, banks are directing their interest policy strategies towards increasing the margins in the retail banking sector, with the economical proof that profitability of banks can improve from their leverage and reduce reliance in wholesale funding (Constâncio, 2016).

In post crisis times, reaching high profitability levels and complying with capital, solvency and liquidity requirements represent challenging tasks for any bank. Profit margin

decreased in the Euro area within the 2008 financial crisis environment, due also to the low interest rates and difficulties for the banks in increasing revenues in a low nominal growth. Some of the tools for the near future are the increase in the credit volumes (based upon adequate liquidity levels), lower impairment costs, capital and investment gains through the stock exchange markets, local and global.[4]

The 2008 financial crisis renewed the interest in the relationships between the real economy and financial sector, with a special emphasis on financial stability, as the axis for the design and implementation of macroeconomic policy (Agénor and Pereira da Silva, 2012).

Ceccheti and Kharroubi (2012, 2015) warned of possible harmful effects of financial sector growth on total factor productivity, thus adding a new line of research to recent literature. This also led to a transformation in the conception of the role played by the financial sector in the economic fluctuations, going from a perspective where it can only amplify the fluctuations generated in the real sector of the economy, to another, in which it can also be a generator of these fluctuations (Helbling, Raju Huidrom, Kose and Otrok, 2011)[5].

Because of the complexity and importance of liquidity, in direct correlation with the solvency ratios of a bank and of a banking system, one of the main challenges, both at the bank's and systemic level, is the management of liquidity risk.

Around the interest on the implications of global financial conditions, the concept of liquidity has been consolidated as one of the relevant factors for the understanding of the gestation and transmission of financial shocks. Borio (2008) identifies liquidity as one of the relevant factors in the consolidation of financial imbalances in the pre-crisis period.

Likewise, Cesa-Bianchi, Céspedes and Rebucci (2015) identify the impact of global liquidity shocks on consumption and housing prices for a sample of advanced countries and emerging economies, concluding that the latter are more sensitive to these shocks, with large impacts on consumption and housing prices.

In addition to the indicators and instruments mentioned in our study, in order to support the operational flows within a bank, the context for demand and supply of liquidity, should be diligently understood.

Thus, a balanced and proper explanation of the creation of demand and supply of liquidity, within the Euro 19 countries banking system may be explained by the interaction of macroeconomic strategies, monetary policies, regulatory framework, implemented by credit institutions, resulting solvency, capital and profitability consolidation.

The indicator of liquidity, represented under the current account holdings, is highly influenced by relevant factors, including monetary policy instruments. Other instruments and tools maybe considered net foreign assets, banknotes in circulation, Government deposits, generally autonomous factors that are in some particular situations generated by/via the regulatory framework, as reflected in Figure 1.

Figure 1. *Simplified Balance Sheet – of the Eurozone (example model)*

Assets		Liabilities	
Autonomous liquidity factors		**Autonomous liquidity factors**	
Net foreign assets (A1+A2+A3-L7-L8-L9)	387.1	Banknotes in circulation (L1)	285.8
		Government deposits (L5.1)	57.2
		Other autonomous factors (net)	92.1
			435.1
		Current account holdings – covering the minimum reserve system (L2.1)	134.9
Monetary policy instruments		**Monetary policy instruments**	
Main refinancing operations (A5.1)	123.0		
Longer-term refinancing operations (A5.2)	60.0		
Marginal Lending facility (A5.5)	0.0	Deposit facility (L2.2)	0.1
	570.1		**570.1**

Source: ECB, "The liquidity management of ECB", Monthly Bulletin.

In addition, regarding the management of bank liquidity, it is also important to emphasize the mechanism of minimum reserve requirements (named in the following MRR). This instrument support commercial banks access to liquidity, when needed, but also reflect a prudent strategy, when buffers/stocks of capital are imposed or required (by regulatory institutions or by central banks). For instance, regarding the European Central Bank, this component is important in managing the volatile nature of liquidity.[6]

Research and studies on liquidity reflect different opinions related to the regulatory framework, best practice in various financial markets, benchmark indicators, factors that influence liquidity, perceptions on adequate liquidity management, lessons from the previous crisis. Those aspects are relevant, both for policy and bank's individual level, liquidity representing one of the most important indicator for banking activity. Within the post crisis environment, due to the financial macro stability approach, liquidity, under all its "interpretations" [7], becomes a critical systemic indicator.

The concept of global liquidity has taken on great strength over the post 2008 crisis period, given its strong association with the global financial cycle.

3. Methodology and database

Our empirical analysis was conducted in order to identify and emphasize correlations between the bank liquidity (endogenous variable) and two categories of selected indicators (as exogenous variables): macroeconomic indicators (Central bank assets to GDP/CBGDP, Deposit money bank assets to deposit money bank assets and central bank assets/DMBA, Financial system deposits to GDP/FSDGDP) and bank related indicators (Bank credit to bank deposit/BCD, Domestic credit to private sector/DCPS).

In order to analyse the correlations between the indicators defined above and to answer the central question of the research: "Is the bank liquidity influenced significantly by macroeconomic indicators or bank related indicators?", the following working hypotheses are formulated:

Hypothesis 1 (I_1): Financial system deposits, as a share of GDP, positively influences bank liquidity.

Hypothesis 2 (I_2): Central bank assets, as a share of GDP, positively influences bank liquidity.

Hypothesis 3 (I_3): Domestic credit to private sector influences bank liquidity.

The methodology used to verify these hypotheses includes the collection of 342 observations and is based on econometric modelling using EViews. The data series included in the regression model have an annual frequency, being based on a data panel from 1960 to 2017, extracted from the Eurostat Date Base Warehouse[8], for 19 countries/economies/financial systems, included nowadays within the Euro area: Austria, Belgium, Cyprus, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Portugal, Slovakia, Slovenia, Spain.

We apply the methodology, following the next four steps:
1. Test the stationarity, using the Augmented Dickey Fuler test.
2. Determine if the errors are from a normal distribution, using the Jarque-Bera test.
3. Test first-order autocorrelation, using the Durbin-Watson test, and for the 2nd order autocorrelation using the Breusch-Godfrey test.
4. Correct the hypothesis of heteroscedasticity, estimating in E-Views a new model (Arch test).

The results of our study are relevant for policy actions, reflected as well via the long timeframe selected and analysed (1960-2017).

The methodology enables to perform relevant tests and to analyze, based upon the hypothesis, direct and indirect correlations, to verify if the link between the independent and the dependent variables is significant (test relevance) or not.

In our econometrical approach, we have used "A Least Squares Regression Line model", as our data shows that there is a linear relationship between the variables, but also to quantify the influence, if there are any correlations between independent and the dependent variables.

To estimate the dependence of the selected variables we have used the multiple regression model, generically expressed by the formula:

$$Y = f(\alpha + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_n X_n) + \varepsilon$$

Where:
Y – the dependent variable (resultative, random) = bank liquidity;
X1, ..., X_n – independent (factorial) variables, non-aliasing;
ε – random variable or residual variable.

In order to realize link correlations between the Y determinant dependent variable – bank liquidity[9] and X independent variables, the panel model included the whole group of countries (19 countries), the timeframe of fifty-seven years and the two categories of indicators (test performed for both macroeconomic and bank related indicators).

For the first group of macroeconomic indicators and correlations, the formula of the regression line model can be transcript, as follows:

$$L = f\left(\alpha + \beta_1\, CBGDP + \beta_2 DMBA + \beta_3 FSDGDP\right) + \varepsilon$$

The abbreviations used in the empirical study are:
L – liquidity;
CBGDP – central bank assets to GDP;
DMBA – deposit money bank assets to deposit money bank assets and central bank assets;
FSDGDP – financial system deposits to GDP.

For the second group of bank related indicators and correlations, the formula of the regression line model can be transcript, as follows:

$$L = f\left(\alpha + \beta_1\, BCD + \beta_2 DCPS\right) + \varepsilon$$

The abbreviations used in the empirical study are:
L – liquidity;
BCD – bank credit to bank deposit;
DCPS – domestic credit to private sector.

Concerning the variables mentioned above, we have tested the significance of the following macroeconomic and bank related indicators, in regard to the bank liquidity levels. The abbreviations and units used within the model are described as follows.

I. Macroeconomic indicators, in accordance with the definitions provided by The European Central Bank, Eurostat and The World Bank:
1) **CBGDP** – Central bank assets to GDP: Ratio of central bank assets to GDP. Central bank assets are claims on domestic real nonfinancial sector by the Central Bank.
2) **DMBA** – Deposit money bank assets to deposit money bank assets and central bank assets: Total assets held by deposit money banks as a share of sum of deposit money bank and Central Bank claims on domestic nonfinancial real sector. Assets include claims on domestic real nonfinancial sector which includes central, state and local governments, nonfinancial public enterprises and private sector. Deposit money banks comprise commercial banks and other financial institutions that accept transferable deposits, such as demand deposits.
3) **FSDGDP** – Financial system deposits to GDP: Demand, time and saving deposits in deposit money banks and other financial institutions, as a share of GDP.

II. Bank related indicators, in accordance with the definitions provided by The European Central Bank, Eurostat and The World Bank:
1) **BCD** – Bank credit to bank deposit: The financial resources provided to the private sector by domestic money banks as a share of total deposits. Domestic money banks comprise commercial banks and other financial institutions that accept transferable deposits, such as demand deposits. Total deposits include demand, time and saving deposits in deposit money banks.
2) **DCPS** – Domestic credit to private sector: refers to financial resources provided to the private sector.

The methodology used for both macroeconomic indicators and bank related indicators, were analyzed by performing mathematical/econometrical testing using a Linear Regression Model.

In the study, we have argued to use the interpretation of liquidity[10] from an empirical approach and practicality reasons.

The data for the Y dependent variable bank liquidity has been interpreted and analyzed from Eurostat Date Base Warehouse[11].

The related X independent variables, for the macroeconomic related indicators, were analyzed, transcript, used and implemented within the model, being collected from the European Central Bank and Eurostat Data Base, for 57 consecutive years' timeframe (1960-2017).

4. Results and discussions

Within this part of the research, we present the results of the empirical study and add extra qualitative input, related to financial crisis and banking activities.

As a first step, we have applied the Augmented Dickey Fuller statistic test to see if our dependent variable, the Liquid liabilities to GDP, is stationary. In order to do so, we have applied unit route testing that generated the following results:

Table 1. *Augmented Dickey-Fuller test statistic*

Null Hypothesis: LIQUIDITY has a unit root				
Exogenous: Constant				
Lag Length: 0 (Automatic – based on SIC, maxlag =10)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-1.302338	0.6227
Test critical values:	1% level		-3.550396	
	5% level		-2.913549	
	10% level		-2.594521	
*MacKinnon (1996) one-sided p-values.				
Augmented Dickey-Fuller Test Equation				
Dependent Variable: D(LIQUIDITY)				
Method: Least Squares				
Date: 09/09/18 Time: 14:20				
Sample (adjusted): 1961 2017				
Included observations: 57 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LIQUIDITY (-1)	-0.052988	0.040687	-1.302338	0.1982
C	4.347365	2.758149	1.576189	0.1207
R-squared	0.029915	Mean dependent var		0.832280
Adjusted R-squared	0.012277	S.D. dependent var		4.313850
S.E. of regression	4.287287	Akaike info criterion		5.783643
Sum squared reside	1010.946	Schwarz criterion		5.855329
Log likelihood	-162.8338	Hannan-Quinn critter.		5.811502
F-statistic	1.696083	Durbin-Watson stat		2.324033
Prob(F-statistic)	0.198228			

Source: Authors own processing, based on data provided by Eurostat Data Base Warehouse.

Unit route shows that the liquidity is non-stationary, but this hypothesis cannot be rejected because the probability is quite high, more than 60%.

As non-stationary series cannot be forecasted, we created stationaries to our variables and the equations obtained reflect that only the variable Financial system deposits to GDP has a higher influence on liquidity, as its probability is 0%. This variable influences the liquidity with 83%, which means that if the Deposits to GDP increases, also the Liquidity will increase, reflecting that Hypothesis 1 is valid.

The other variables have an insignificant effect on bank liquidity, because their probability is more than 5%.

We observed that the variable Central bank assets to GDP has a negative impact on the Banking liquidity, but this is not significant if we look at its probability which is not less than 5%.

The model chosen headlines that these five variables jointly can influence our dependent variable, as the probability for F-statistics is significant.

Table 2. *Linear Regression model to test bank liquidity interdependency with the selected 5 indicators*

Dependent Variable: DLIQUIDITY				
Method: Least Squares				
Sample (adjusted): 1960 2017				
Included observations: 342 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
DBANK_ASSETS	-0.220155	0.430955	-0.510854	0.6117
DCREDIT_TO_DEPOSITS	0.030616	0.074026	0.413588	0.6809
DCREDITTOPRIVATE_SECTOR	0.052315	0.053622	0.975617	0.3339
DDEPOSITS_TO_GDP	0.832826	0.069852	11.92275	0.0000
DASSETS	0.694464	0.828337	0.838383	0.4057
C	0.169747	0.284248	0.597181	0.5530
R-squared	0.787951	Mean dependent var		0.832280
Adjusted R-squared	0.767162	S.D. dependent var		4.313850
S.E. of regression	2.081576	Akaike info criterion		4.403428
Sum squared reside	220.9808	Schwarz criterion		4.618486
Log likelihood	-119.4977	Hannan-Quinn critter.		4.487007
F-statistic	37.90207	Durbin-Watson stat		2.216770
Prob(F-statistic)	0.000000			

Source: Authors own processing, based on data provided by Eurostat Data Base Warehouse.

The linear regression model no.1, present in Table 2, has tested the nature of correlations of the "y" dependent variable (bank liquidity) with the "x" independent variables (macroeconomic and bank related indicators presented above). Our first regression panel model consists of 342 observations (using 6 indicators for 57 years of time). Considering the validity of the regression, some of the variables are relevant for our analysis.

Regarding the model used to determine the inter-correlations between bank liquidity and Bank credit to bank deposit, Central bank assets to GDP, Deposit money bank assets to deposit money bank assets and central bank assets, Domestic credit to private sector, Financial system deposits to GDP, the valid values reflect the following interpretations.

The results for the R Square, considered as the determination coefficient, shows that 78.7% from liquidity variation is explained by the following variables: Bank credit to bank deposit, Central bank assets to GDP, Deposit money bank assets to deposit money bank assets and central bank assets, Domestic credit to private sector, Financial system deposits to GDP.

Regarding the interpretation for the Adjusted R Square, the results reflect 76.7%, which in our case is significant. The value of R Square can increase as the numbers of variables increase, so it is very important to take into consideration the value of Adjusted R Square. As significance F is 0%, which is less than 5%, it indicates that the test is significant because it has a grade of confidence more than 95%.

Regarding the following tested indicators: Bank credit to bank deposit, Central bank assets to GDP, Deposit money bank assets to deposit money bank assets and central bank assets, Domestic credit to private sector, in direct correlation with "y" variable, "t stat" values are not relevant, being out of the specific interval; this means that there is no direct inter-dependency between the bank liquidity and the indicators mentioned previously, when it had significant fluctuations (out of the interval).

The only indicator (bank related indicator) that influences the bank liquidity rate is the Financial system deposits to GDP. The determination coefficient shows that even a small percentage as per "t stat" value, equal to 11.92275, which is in the interval, express the influence upon the "y" dependent variable. The liquidity variability is explained by this indicator.

In order to answer the hypothesis of our empirical study, analyzing the regression results, we could observe that it also persists an inverse relationship between the bank liquidity and the Bank credit to bank deposit, Central bank assets to GDP, Deposit money bank assets to deposit money bank assets and central bank assets, Domestic credit to private sector, indicators.

The mathematical and statistical interpretation:

β_0 = intercept parameter

$\beta_1, \beta_2, \beta_3$ = partial regression coefficients or slope coefficients.

$\hat{\beta}_0$ = **-0,220155** shows that if the five explanatory variables X1, X2, X3, X4 and X5 are 0, the average value of "Liquid assets to deposits and short-term funding" is estimated to be around -0,22%.

$\hat{\beta}_1$ = **0.030616** shows that, while maintaining the other constant variables, when "Bank credit to bank deposit" (X1) increases by 1%, the liquidity ratio increases on average by 0.03%.

$\hat{\beta}_2$ = **0.052315** shows that, while maintaining the other constant variables, when "Domestic credit to private sector" (X2) increase by 1%, the liquidity ratio increases on average by 0.05%.

$\hat{\beta}_3$ = **0.832826** shows that, while maintaining the other constant variables, when "Financial system deposits to GDP" (X3) increases by 1%, the liquidity ratio decreases on average by 0.83%.

$\widehat{\beta}_4$ = **0.694464** shows that, while maintaining the other constant variables, when "Deposit money bank assets to deposit money bank assets and central bank assets" (X4) increase by 1%, the liquidity ratio increases on average by 0.69%.

$\widehat{\beta}_5$ = **0.169747** shows that, while maintaining the other constant variables, when "Central bank assets to GDP" (X5) increases by 1%, the liquidity ratio decreases on average by 0.16%.

Note: These interpretations may change as a result of verification of residue assumptions.

As reflected in the graphs below (Figure 2), all the variables chosen have an influence on bank liquidity, but closer to our dependent variable is the variable Deposits to GDP. Other results confirm that Central bank assets, as a share of GDP, are in an indirect relationship with bank liquidity, in this respect Hypothesis number 2 is not valid.

Figure 2. *Detailed graphical representation of the 5 selected indicators that impact bank liquidity*

Gradients of the Objective Function
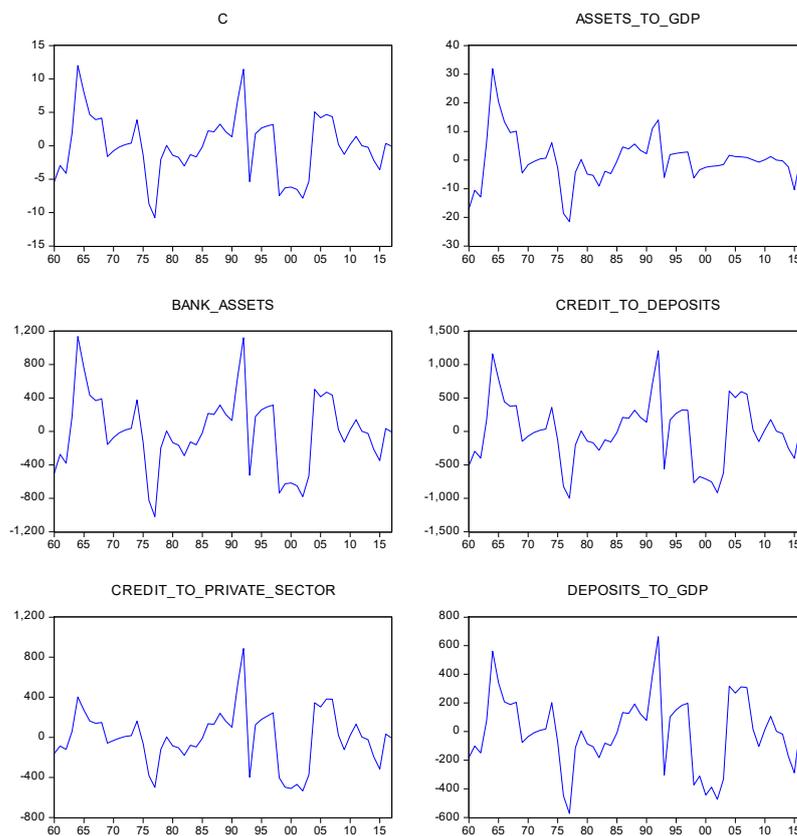
Source: Authors own processing, based on data provided by Eurostat Data Base Warehouse.

Taking into consideration these results, we wanted to estimate the equation, using only the variable Deposits to GDP, and we obtained the following results:

Table 3. *Linear Regression (detailed of model no. 1) to test bank liquidity interdependency with the most relevant of the selected indicators – Deposits to GDP*

Dependent Variable: DLIQUIDITY				
Method: Least Squares				
Date: 09/18/18 Time: 20:13				
Sample (adjusted): 1961 2017				
Included observations: 57 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
DDEPOSITS_TO_GDP	0.867225	0.063041	13.75649	0.0000
C	0.163024	0.277889	0.586650	0.5598
R-squared	0.774813	Mean dependent var		0.832280
Adjusted R-squared	0.770718	S.D. dependent var		4.313850
S.E. of regression	2.065617	Akaike info criterion		4.323192
Sum squared reside	234.6725	Schwarz criterion		4.394878
Log likelihood	-121.2110	Hannan-Quinn critter.		4.351052
F-statistic	189.2411	Durbin-Watson stat		2.200620
Prob(F-statistic)	0.000000			

Source: Authors own processing, based on data provided by Eurostat Data Base Warehouse.

Our results are in line with the macroeconomic theory, a shock on deposits generating a decrease of the bank liquidity and vice versa.
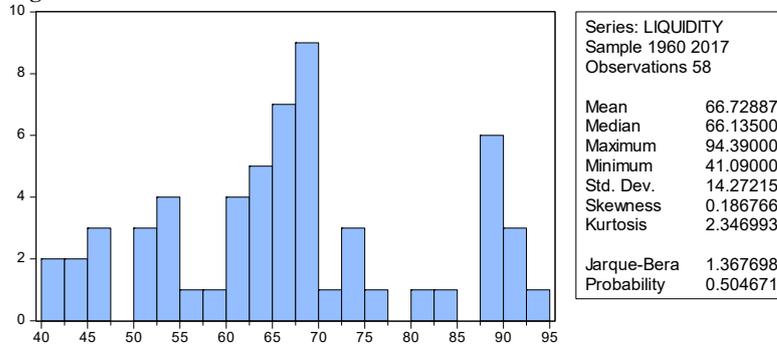
Figure 3. *Detailed graphical representation of interdependency between bank liquidity and deposits to GDP indicator*
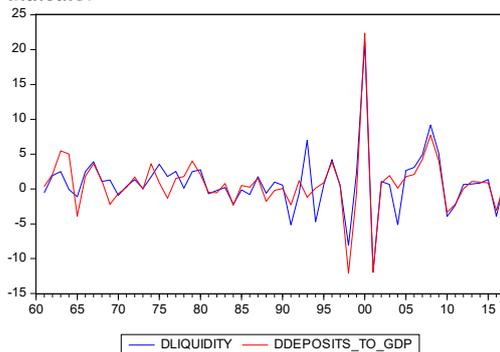
Source: Authors own processing, based on data provided by Eurostat Data Base Warehouse.

To determine if the errors are from a normal distribution, we used the Jarque-Bera test, and we have obtained the following results:

Figure 4

Source: Authors own processing, based on data provided by Eurostat Data Base Warehouse.

According to this test, Jarque-Bera statistics is 1.367698, and the corresponding probability is 50.46%, which is more than 5%. That means, we cannot reject null hypothesis, because, as we can see in the graph, our dependent variable has normal distribution.

For this model, firstly we want to determine the autocorrelation, by using Durbin-Watson test, and secondly we use the Breusch-Pagan-Godfrey test to check whether the residuals have heteroskedasticity.

Table 5. *Breusch-Pagan-Godfrey test whether the residuals have heteroskedasticity*

F-statistic	1.200396	Prob. F (6,51)		0.3213
Obs*R-squared	7.177332	Prob. Chi-Square (6)		0.3048
Scaled explained SS	0.300153	Prob. Chi-Square (6)		0.9995
Test Equation:				
Dependent Variable: WGT_RESID^2				
Method: Least Squares				
Date: 09/22/18 Time: 15:40				
Sample: 1960 2017				
Included observations: 58				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	57.99369	45.73542	1.268026	0.2105
LIQUIDITY	-0.053282	0.101314	-0.525911	0.6012
ASSETS_TO_GDP	-1.432174	0.880016	-1.627441	0.1098
BANK_ASSETS	-0.547885	0.459942	-1.191203	0.2391
CREDIT_TO_DEPOSITS	-0.003454	0.038962	-0.088646	0.9297
CREDIT_TO_PRIVATE_SECTOR	-0.014665	0.037466	-0.391419	0.6971
DEPOSITS_TO_GDP	0.056967	0.105647	0.539219	0.5921
R-squared	0.123747	Mean dependent var		0.913949
Adjusted R-squared	0.020659	S.D. dependent var		1.765096
S.E. of regression	1.746769	Akaike info criterion		4.066174
Sum squared reside	155.6113	Schwarz criterion		4.314849
Log likelihood	-110.9191	Hannan-Quinn critter.		4.163038
F-statistic	1.200396	Durbin-Watson stat		1.919447
Prob(F-statistic)	0.321301			

Source: Authors own processing, based on data provided by Eurostat Data Base Warehouse.

Within the below table, we have used Durbin-Watson test to determine autocorrelation in our econometrical model, where:
No   – No positive autocorrelation;
Na – No negative autocorrelation;
$n = 58$ – Number of observations;
$k = 6$ – Number of explanatory variables.

Their values are between 0 and 4, and some levels that will allow us to delimit the areas of non-autocorrelation. These levels are (lower limit) and du (upper limit), the critical values for our equation, which we found in the table Durbin-Watson.

From these levels, we find 2 zones of indecision, one zone of positive autocorrelation, one zone of negative autocorrelation and one zone where autocorrelation does not exist. As Durbin Watson result is very close to the number 2, between du and 4-du, we can accept the null hypothesis of no autocorrelation.

Then the null hypothesis of this test reflects there is no positive autocorrelation and the alternate hypothesis reflects there is no negative autocorrelation. To use the Durbin Watson

table, the first thing we consider is n, which is the number of observations and k is the number of explanatory variables.

Figure 5

positive autocorrelation	indecision	there is no autocorrelation	indecision	negative autocorrelation
Refuse No		Accept No		Refuse No
0	dl=1,3576 du=1,8101	2	4-du=2,1899 4-dl=2,6424	4

Source: Authors own processing, based on data provided by Eurostat Data Base Warehouse.

Within our model, which has 57 observations and 6 explanatory variables, we used a table with 5% significant points, and we found the values for dl = 1.3576 and du = 1.8101. We calculated also the values for 4-du and 4-dl, and the next step was to locate in which area we can find the value of Darvin-Watson for our model. When reviewing the results of the regression, we find that the statistic value of 1.919447 is between du and 4-du, as reflected in the equation, which means that we can accept the null hypothesis.

Du < Darvin-Waton < 4-Du, indicates that we can accept the null hypothesis, and there is no autocorrelation.

By using the Breusch-Pagan-Godfrey test, we found out that the probability is 30.48%, which is more than 5%, meaning that we can accept null hypothesis, because residuals are homoscedastic, which is desirable for the model implemented.

We used also the Autoregressive conditional heteroskedasticity Model (ARCH) in order to find out the relationships between the selected variables.

Table 4. *Autoregressive conditional heteroskedasticity Model (ARCH)*

Dependent Variable: LIQUIDITY				
Method: M -ARCH (Marquardt) – Normal distribution				
Date: 09/22/18 Time: 13:52				
Sample: 1960 2017				
Included observations: 58				
Failure to improve Likelihood after 39 iterations				
Pre-sample variance: back cast (parameter = 0.7)				
GARCH = C (7) + C (8) *RESID (-1) ^2 + C (9) *GARCH (-1)				
Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	-46.24979	41.14882	-1.123964	0.2610
DEPOSITS_TO_GDP	0.906192	0.060682	14.93340	0.0000
CREDIT_TO_PRIVATE_SECTOR	0.129757	0.042474	3.054990	0.0023
CREDIT_TO_DEPOSITS	0.059007	0.052010	1.134549	0.2566
BANK_ASSETS	0.443695	0.408434	1.086332	0.2773
ASSETS_TO_GDP	1.240880	0.922364	1.345326	0.1785
	Variance Equation			
C	3.343993	2.004940	1.667877	0.0953
RESID (-1) ^2	0.650419	0.505869	1.285747	0.1985
GARCH (-1)	-0.199839	0.425354	-0.469819	0.6385
R-squared	0.972902	Mean dependent var		66.72887
Adjusted R-squared	0.970296	S.D. dependent var		14.27215
S.E. of regression	2.459764	Akaike info criterion		4.507246
Sum squared reside	314.6227	Schwarz criterion		4.826970
Log likelihood	-121.7101	Hannan-Quinn critter.		4.631785
Durbin-Watson stat	0.835521			

Source: Authors own processing, based on data provided by Eurostat Data Base Warehouse.

The results are quite similar to the regression model, because the variable which has a strong impact on bank liquidity is also Deposits to GDP, which influences with 90.61% the liquidity. Another valid variable in this model is Credit to private sector, influencing less the bank liquidity, with 12.97%. In this respect, the Hypothesis no. 3 is valid.

Our findings are in line with the macroeconomic theory, as credits and deposits are the indicators that influence mostly on bank liquidity.

Regarding other relevant discussions, related to the correlation between the crisis context, banking activity and bank liquidity, the 2008 crisis emphasized the need for new tools, mechanisms, instruments and policies.

Regulatory response for the 2008 crisis was very important, including a new approach, based on the need to insure high quality liquid assets, diversification, control of stock and management of liquidity.

A key concern supported strongly within the regulatory framework, emphasize on the correlation between liquidity risk and outflows, in crisis times. Via specific indicators[12], the regulations impose limits on short-term market funding, this aspect being one of the key elements[13] in the 2008 financial crisis.

The behavioral aspects of liquidity are very important for banking business, for the banking sector but also for the economy. Based on rumors, real or not real, depositors, other banks may withdraw funds, block access to funds, generating panic and bank run. From this point, the amplification may directly transform a liquidity crisis into a solvency crisis, for a bank or for a banking system.

Although the banks are well capitalized, specific concerns for: intraday liquidity management, strong communication policies in place, specially drafted for a crisis context, disclosure and market discipline, legal and operational arrangements with other banks/financial partners, should be carefully considered.

Due to the fact that banks are attracting short term deposits and funds from the interbank market and provide long term lending, this activity of maturity transformation implies risks and vulnerabilities. A problem from a bank balance sheet may be translated to a systemic level, being linked with the asset prices, collateral valuation changes, cash flows and short-term obligations of interconnected counterparties.

New capital requirements, with a good quality structure of cash, reflected the importance banking activity for insuring sustainable long periods of economic growth and stability[14]. The new approach in handling the new global vs. local context required technical and tactical systemic risk management, leading into creating a non-volatile cash cycle and a more long-term cost-efficient quality of the investments portfolios in the banking sector.

Those strategic correlations reflect the key roles played by the banking sector and the key influential role of bank liquidity in crisis times, from economic and financial stability point of view.

Liquidity is included, together with capital, credit constraints among the instruments used both for macro prudential and micro prudential actions. The crisis reflected that micro prudential policy is not enough; soundness of each bank and of the system should be

insured, based on a mix of policies. Capital and liquidity requirements, on and off-site inspections, licensing new actors in the market, contribute significantly to the supervision of the banking sector, based on risk mitigation policies. In order to positively impact on banking activity, it requires rigorous evaluations and policy implementation, supervision and communication.

Under sophisticated umbrella concepts, such as macro stability, macro financial stability, financial sustainability, there are relevant functionalities, of highly importance in every crisis context. As reflected by our study and by the economic realities, key aspects that link micro and macro in a sustainable manner include: deposits in banks and the need to create confidence to secure long term savings, interbank funding based on knowing/trusting your partners, traditional banking activities based on lending and attracting deposits, credits towards real economy, tools to manage exposure to counterparties, when funding is channeled into the banking system and from the banking system to the real economy. Bank liquidity tend to occupy a central pillar of importance for the sustainability of the banking business, both at bank level and systemic level.

Not only from a traditional perspective over the indicators measuring liquidity, but also from market perspectives, indicators such as Loan-to-deposit ratio, Liquidity Coverage Ratio, Global Liquidity Index, together with new instruments, such as Available Stable Funding (ASF), within the existing related specific literature, reflect in a consistent manner, the evolution and signaling policy of bank liquidity.

In a global context, a new paradigm occurred in the form of transferring strategical policies, from global to local markets. For instance, the funding and fund-raising mechanism enabled that the banking system in one country, may affect and be affected by financial covenants from another country. That is why this type of pioneer activities in Europe (and in other continents as well), after the 2008 global financial crisis are in the umbrella of a predictable evolution about future, more consolidated financial structures[15].

Relevant literature reflects that major changes and developments, concerning the banking and financial sector, have roots within financial crises.

Financial crises have affected not only the balance sheets of the banks, but throughout the entire financial ecosystem, financial markets and society. Empiric evidence reveals that after the 2008 financial crisis, the effects of bank liquidity should be adequately monitored, understood and considered, within a new regulatory framework, both at the bank's and banking system level. Sustainable banking business should include a diversified mix of funding, specific tools for managing bank liquidity and adequate calibration with the other relevant bank indicators.

5. Concluding remarks

The financial crises are caused by various catalyzers, such as housing market overheating, inadequate liquidity monitoring and supervision, "unknown" exposures transferring risks into the banking sectors, currency "wars", insolvency for large financial institutions, inadequate regulation of a highly integrated international financial system.

The 2008 financial crisis reflected the difficulty of coordination, in a multipolar economic world but also the strong effects that illiquidity may affect the banking sectors and real economies. The lessons of previous crises have allowed the authorities to react with a certain speed but important challenges persist, looking for more fundamental solutions rather than particular interventions.

Our empirical study includes the analysis of five selected macroeconomic and bank related variables: Bank credit to bank deposit, Central bank assets to GDP, Deposit money bank assets to deposit money bank assets and central bank assets, Domestic credit to private sector, Financial system deposits to GDP. The study uses regression models, based on data collected for a period of 57 years (between 1960 to 2017) for 19 countries, representing nowadays the Euro area.

The results confirm that deposits are linked and influence, in a significant manner the bank liquidity, compared with other selected variables. Credits have also influence on bank liquidity.

The fundamental aspects of the banking business, deposits and credits are impacting on bank liquidity. Considering the role of bank liquidity, both at banks and system level, and the effects within a crisis context, liquidity management becomes a major concern for bank stability and sustainability.

The long period of time considered for the analysis, methods and tools selected, the large number of observations included, may offer support for a future mix of policies, appropriate to current realities and challenges.

The study helps to explain some of the continuous economic stages and developments in banking systems, to identify factors that influence the determinant indicators, directly proportional to the evolution of bank liquidity. The findings emphasize that shocks to global liquidity have an effect on the common component of the credit and deposit cycle. Shocks generated in international financial markets have significant effects on the financial stability and the macroeconomic financial stability of the euro area.

The study also reflects, contrary to some public studies/perceptions, that some bank related indicators do not directly and significantly influence on bank liquidity.

It is also important to highlight that, given the great heterogeneity of countries/specific developments during the analyzed period, further research may explore the transmission mechanisms of the global liquidity shocks for the different countries of the euro area.

Due to the important role of the banking sector within every economy and to the cross effects/interdependencies of bank liquidity, banking sector and bank liquidity represent key actors within crises. If understood, the impact/effects of bank liquidity and its amplification power, risks may be highly mitigated.

The management of bank liquidity, at the banking organization level, add new priorities, in terms of: diversification of funding sources/currencies, short-term focus and long-term sustainability, correlation with capital requirements/other banking business relevant indicators, developing internal capacities for crisis situations and partnering with other financial institutions.

The management of bank liquidity, at the systemic level, should prioritize: coordination between different policies, calibration of macro prudential instruments, assessment of their impact over the banking sector and real economy, monitoring the liaison between liquidity risks and solvability risks, supervisory reviews and assessments for liquidity, liquidity stress testing, analyze the spillover effects of liquidity, strategic communication policies and protocols.

Mixing macro and micro prudential and supervisory tools, in a harmonized manner, add value to the management of liquidity, both at banks and systemic level. The stability of the banking sector on the long run and the mitigation of risks will contribute to sustainable economic growth.

Notes

[1]   The indicator Domestic credit to private sector (reflected as % of GDP), for the Euro area, in 2017, registered 88,23 and 96,39 for the European Union, in accordance to International Monetary Fund, International Financial Statistics and data files, World Bank and OECD GDP estimates.

[2]   For example, mentioning the beginning of the crises: energy crisis (1970), Savings and loans crisis (1980s), Stock market crush (1987), Junk bond crush (1989), Asia crisis (1997), Dotcom bubble (2000), global financial crisis (2008), European Sovereign debt crisis (2009), Greek government-debt crisis (2009), Portuguese financial crisis (2014).

[3]   In accordance with OECD, GDP reflects "an aggregate measure of production equal to the sum of the gross value added of all resident and institutional units engaged in production (plus any taxes and minus any subsidies, on products not included in the value of their outputs"; another generally accepted and used definition: GDP (Gross Domestic Product) reflects the sum of the market value of all goods and services destined for final consumption produced in all branches of the economy within a country within one year.

[4]   ECB, Challenges for the European banking industry, Madrid, July 2016.

[5]   As indicated by the Bank of International Settlements (BIS) (2011), the literature has identified three channels through which the transmission of the shocks originating in the financial sector of the economy to the real sector takes place, and in turn the retransmission through the financial sector of shocks originated in the real sector; These three channels are: 1) the balance sheet of the borrowers, 2) the balance sheet of the banks and 3) the liquidity. The first two are known as the financial accelerator.

[6]   ECB, "The liquidity management of ECB", Monthly Bulletin, as per definition: Reserve requirements are a standard monetary policy tool in central banking.

[7]   May be considered, *inter alia:* bank liquidity, global liquidity, official liquidity, private liquidity.

[8]   As provided on the site of the entity: http://ec.europa.eu/eurostat), for the timeline of fifty-seven years (1960-2017).

[9]   Defined for banks in EU 19 countries, as "liquid assets to deposits and short-term funding" (%), in accordance to the methodology used from definition variable, presented at Eurostat Data Base Warehouse.

[10] Reflected as "the banks capacity to meet its deposits withdrawals"; within the regression model, bank liquidity ratio reflected is Loans/Total Deposits (in percentage %).

[11] As provided on the site of the entity: http://ec.europa.eu/eurostat), for the timeline of fifty seven years (1960-2017).

[12] Such as Net Stable Funding Ratio.

[13] In case of Lehman Brothers, the bank could not roll over its short-term wholesale funding.

[14] Therese Grace, Niamh Hallissey and Maria Woods, The Instruments of Macro-Prudential Policy, Quarterly Bulletin 01/January 15.

[15] Jaime Caruana (GM, Bank for International Settlements), Global Liquidity: Where it stands, and why it matters, Frankfurt, 5 March 2014.

References

Adrian, T., Fleming, M., and Vogt, E., 2016. Market liquidity after the Financial Crisis, *Federal Reserve Bank of New York Staff Reports*, No. 796.

Agénor P.R., Alper, K. and Luiz Awazu Pereira da Silva, 2012. Capital requirements and business cycles with credit market imperfections, *Journal of Macroeconomics*, Vol. 34, Issue 3, pp. 687-705.

Allen, F. and Gale, D., 1998. Optimal Financial Crises, *The Journal of Finance*, Vol. 53, No. 4, Papers and Proceedings of the Fifty-Eighth Annual Meeting of the American Finance Association, Chicago, Illinois, January 3-5, pp. 1245-1284.

Basel Committee on Banking Supervision, 2013. Basel III: The Liquidity Coverage Ratio and Liquidity Risk Monitoring Tools, *Bank for International Settlements*.

Borio, C., 2008. The financial turmoil of 2007? A preliminary assessment and some policy considerations, *Monetary and Economic Department,* March 2008, BIS Working Papers No. 251.

Blanchard, O., Dell'Ariccia G., Mauro, P., 2010. Rethinking macroeconomic policy, <https://www.imf.org/external/pubs/ft/spn/2010/spn1003.pdf> International Monetary Fund, Staff Position Note.

Bruno, V. and Shin, H.S., 2015. Cross-border banking and global liquidity, *Review of Economic Studies*, 82(2), pp. 535-564.

Buch, C.M. and Heinrich, R.P., 1999. Twin crises and the intermediary role of banks, *International Journal of Finance & Economics*, Vol. 4, Issue 4, October, pp. 313-323.

Buiter, W.H., 2007. Lessons from the 2007 Financial Crisis, CEPR Discussion Paper No. DP6596.

Caruana, J., 2014. GM, Bank for International Settlements, Global Liquidity: Where it stands and why it matters.

Cesa-Bianchi, A., Cespedes, L.F. and Rebucci, A., 2015. Global Liquidity, House Prices, and the Macroeconomy: Evidence from Advanced and Emerging Economies, *Journal of Money, Credit and Banking*, Vol. 47, Issue S1, March/April, pp. 301-335.

Cecchetti, S.G. and Kharroubi, E., 2012. Reassessing the impact of finance on growth, Monetary and Economic Department, BIS Working Papers No. 381.

Cecchetti, S.G. and Kharroubi, E., 2015. Why does financial sector growth crowd out real economic growth?, *Monetary and Economic Department,* February, BIS Working Papers No. 490.

Charles, W., Calomirisy, F. and Heiderz, M.H., 2015. A Theory of Bank Liquidity Requirements.

Chun, K., Lee, J., Koukoianova, E., Park, H. and Shin, H., 2014. Global liquidity through the lens of monetary aggregates, Working Paper WP/14/9, Washington: IMF.

Diamond, D.W. and Dybvig, P.H., 1983. Bank Runs, Deposit Insurance, and Liquidity, *The Journal of Political Economy*, Vol. 91, No. 3, pp. 401-419.

ECB – European Central Bank (Monthly Bulletin), The liquidity management of ECB.

ECB – European Central Bank, 2016, Challenges for the European banking industry.

ECB – European Central Bank, Carlo Altavilla, Miguel Boucinha, José-Luis Peydró, 2017. Monthly Bulletin, Monetary policy and bank profitability in a low interest rate environment.

Eurostat, 2018. Data base. [online] Available at: <https://ec.europa.eu/eurostat/data/database> [Accessed on June-July 2018].

Eickmeier, S., Gambacorta, L. and Hofmann, B., 2013. Understanding global liquidity, Working Papers 402, Basel: BIS.

Goldfajn, I. and Valdes, R.O., Capital Flows and the Twin Crises: The Role of Liquidity, IMF Working Paper No. 97/87.

Gorton, G.B., 2008. The Subprime Panic, NBER Working Paper No. 14358.

Grace, T., Hallissey, N. and Woods, M., 2015. The Instruments of Macro-Prudential Policy, Quarterly Bulletin.

Hausmann, R. and Rojas-Suárez, L., 1996. Banking Crises in Latin America, Banco Interamericano de Desarrollo, IDB, Business & Economics.

Helbling, T., Huidrom, R., Kose, A. and Otrok, C., 2011. Do credit shocks matter? A global perspective, European Economic Review, vol. 55, Issue 3, pp. 340-353.

Hellwig, M., 2008. Systemic Risk in the Financial Sector: An Analysis of the Subprime-Mortgage Financial Crisis, *Max Planck Institute for Research on Collective Goods*, Kurt-Schumacher-Street, Bonn.

Niţescu, D.C. and Duna, F.A., 2018. A multifactorial analysis on bank liquidity in the Euro Area, *Romanian Journal of Economic Forecasting*, Vol. 21, Issue 3, pp. 153-167; <http://www.ipe.ro/rjef/rjef3_18/rjef3_2018.pdf>, pp. 153-167.

Oscar, J., Schularick, M. and Taylor, A.M., 2011. Financial Crises, Credit Booms, and External Imbalances: 140 Years of Lessons – *IMF Economic Review*, Vol. 59, Issue 2, pp. 340-378.

Rey, H., 2013. Dilemma not Trilemma: The Global Financial Cycle and Monetary Policy Independence, Federal Reserve Bank of Kansas City Economic Policy Symposium.

The Bank for International Settlements, 2018. Data base. [online] Available at: <https://www.bis.org> [Accessed on June-July 2018].

The European Central Bank, 2018. Data base. [online] Available at: <https://www.ecb.europa.eu> [Accessed on June-July 2018].

The International Monetary Fund, 2018. Data base. [online] Available at: <www.imf.org> [Accessed on June-July 2018].

The Word Bank, 2018. Data base. [online] Available at: https://datacatalog.worldbank.org/, <http://databank.worldbank.org/data/reports.aspx?source=wdi-databasearchives-%28beta%29> [Accessed on June-July 2018].

Valentina, B. and Shin Hyun Song, 2015. Capital flows and the risk-taking channel of monetary policy, *Journal of Monetary Economics*, Elsevier, vol. 71(C), pp. 119-132.