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**Working Paper**

## The determinants of excess liquidity in the banking sector of Bosnia and Herzegovina

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**The Determinants of Excess Liquidity in the Banking Sector of  
Bosnia and Herzegovina**

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„The Determinants of Excess Liquidity in the Banking Sector  
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## Abstract

The aim of this research is to identify the determinants of excess liquidity defined as excess reserves in the banking sector in Bosnia and Herzegovina (B&H). The empirical analysis is carried out through the use of the dynamic panel analysis based on the generalized method of moments (GMM) methodology on a dataset of 19 commercial banks operating in B&H in the period from 2006 to 2015. The estimated relationships between excess liquidity and selected variables in models' specifications are as expected. The findings indicate that the size of the bank, non-performing loans and total loans are the key determinants of excess liquidity amongst internal factors. The results also reveal that among the domestic macroeconomic variables CPI is statistically significant indicator of excess liquidity. The commercial banks also rely on foreign markets and the finding arising from this study confirms a significant influence of Eonia on excess liquidity position in B&H. The presented research results and their economic interpretation may have valuable implications on the optimal liquidity management in the commercial banks in B&H and appropriate liquidity supervision. It will also provide beneficial foundation for more thorough liquidity analysis and its possible linkages with other risks within the banking sector.

## 1. Introduction

The aggregate and individual banking sector liquidity in B&H has been evaluated both by the domestic and international authorities. Although the banks are mostly assessed to be very liquid, as well as the system in general, common conclusion is that further liquidity analysis is needed, including introduction of the macroprudential measures and liquidity stress testing<sup>1</sup>.

The consolidated balance sheet of the B&H banking sector suggests that the banks' balances with the CBBH exceed statutory requirements in the considerable amount. The IMF's working paper by Saxegaard (2006) on excess liquidity in Sub-Saharan Africa is one of the most cited papers on this issue. Following Saxegaard's method, we defined the excess liquidity as „commercial banks' holding of cash and deposits at the central bank in excess of statutory requirements“. Although liquidity, in general, is a positive characteristic of an economy, its excess can create problems, especially in the developing economy that requires efficient allocation of funds in order to foster growth. In this spirit, the analysis of the determinants of this excess liquidity should provide clearer picture on the liquidity conditions in the banking sector in B&H and the factors that serve as its main drivers. Among the possible determinants of the excess liquidity provided by the theoretical and empirical literature we consider bank specific variables as well as some external variables.

The remainder of the paper is organized as follows. The section 2 highlights overview of the banking sector in B&H. The section 3 presents previous studies related to the subject matter. The following section describes the data and methodology used in this study. Empirical results are derived and analyzed in chapter five. The last section summarizes the results and offers some concluding remarks.

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<sup>1</sup> Domestic authorities that regularly perform analysis of the banking sector are the Central Bank of Bosnia and Herzegovina (CBBH) and two banking agencies which act as supervisory bodies (Federal Banking Agency and Banking Agency of Republika Srpska) , [www.cbbh.ba](http://www.cbbh.ba); [www.fba.ba](http://www.fba.ba); International Monetary Fund (IMF) and the World Bank (WB) conduct regular and irregular analysis in the form of reviews of state arrangements with the Fund and various technical missions with different purposes including Financial Sector Assessment Program (FSAP); <http://www.imf.org/external/country/bih/> ; <http://www.worldbank.org/en/country/bosniaandherzegovina>

## **2. Overview of the Banking Sector in B&H**

The banking sector in B&H was dependent on inflows from abroad in the late 1990s and during the first decade of 2000s. The foreign liabilities, both in the form of head offices' funding and from supranational institutions, remittances and public foreign debt, fueled accumulation of foreign reserves and credit booming. After the crisis, the global liquidity conditions and risk aversion reduced cross-border bank flows from advanced economies, especially on parent bank funding. Domestic vulnerabilities emerged and the need for more robust financial sector has occurred. At the end of 2015 there were 26 banks operating in Bosnia and Herzegovina. More than a half of total assets belongs to the six biggest banks. Amongst those only one bank is domestically owned.

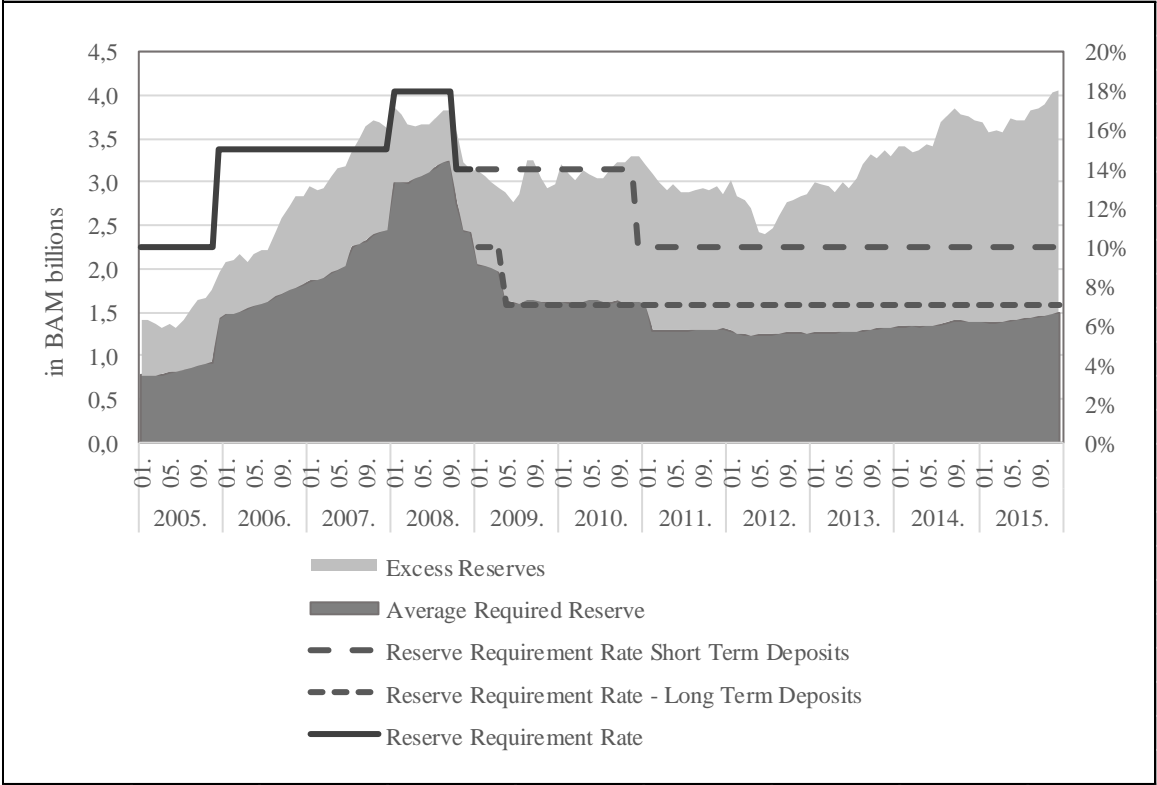
B&H monetary policy is under very rigid Currency Board and the mandatory reserve requirement is the only available instrument of the monetary policy. The CBBH does not have the Lender of Last Resort function. The excess reserves on the account with CBBH have been continuously present in the significant amount. The period before the crisis was marked by huge capital inflow and credit booming, the CBBH was endeavoring to limit excessive credit growth by increasing the mandatory reserve requirement. However, it did not have a significant effect on the credit booming as the banks were continuously increasing both, loan portfolio and holding excess reserves with the CBBH. The initial crisis' hit was recorded in October 2008 when the bank run occurred as well. The CBBH tried to mitigate this effect initially by decreasing the Reserve requirement (RR) rate and at the later stage it had exempted the newly borrowed funds from abroad and government deposits for economic development from the mandatory reserves base. Although these measures helped to sustain more than sufficient liquidity in the system, they did not foster credit growth. The excess liquidity continued to grow, reaching 10.8% of total assets at the end of 2015. Clearly, the RR rate is not the determining factor of this constantly present and growing excess liquidity. The reserves account balance records levels significantly above the required one, reaching even 270% at the end of 2015.

Practical absence of interbank market in B&H, due to strict limit policies from parent banks and specificities of B&H banking sector, can lead to holding excess reserves as safety measure for precautionary purposes. As Table 1 indicates the share of Non-performing loans (NPLs) recorded significant growth in the observed period after the crisis. At the same time

the total loans, after two digit growth rates before the crisis, recorded very modest growth in the recent years. Capital adequacy ratio also declined.

Considering the above mentioned facts, in order to explain the main determinants of the excess liquidity we considered macroeconomic variables and individual factors of the banks operating in the B&H banking sector. We use growth rates of Gross Domestic Product and Consumer Prices Index to capture economic cycle and different individual factors in order to capture specific characteristics of the banks.

Graph 1: Reserves Account Balances and the Reserve Requirement Rate

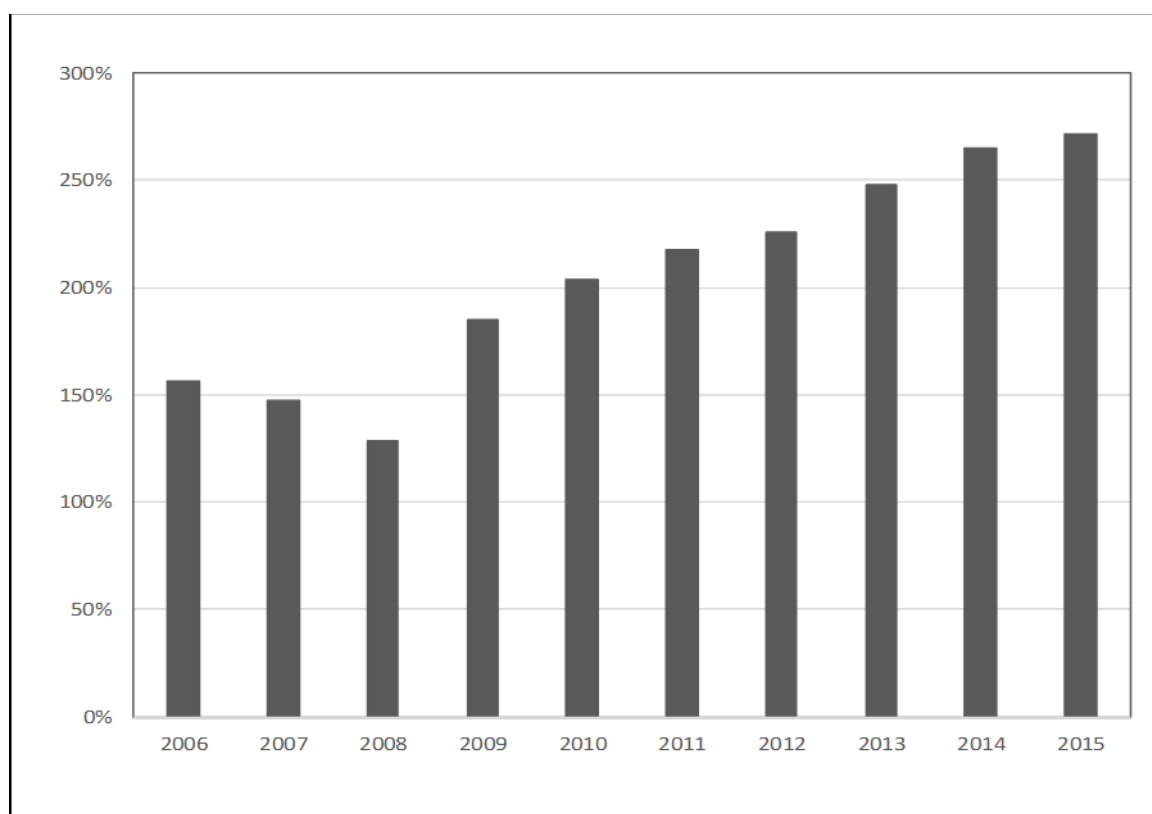




**Table 1: Main indicators of the banking sector in Bosnia and Herzegovina**

|   | 2006   | 2007   | 2008   | 2009   | 2010   | 2011   | 2012   | 2013   | 2014   | 2015   |
|---|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| Number of banks                               | 32     | 32     | 30     | 30     | 29     | 29     | 28     | 27     | 26     | 26     |
| Total assets                                  | 14.683 | 19.570 | 20.813 | 20.608 | 20.416 | 20.995 | 21.186 | 22.023 | 22.766 | 23.737 |
| Total loans                                   | 8.856  | 11.595 | 14.040 | 13.497 | 13.936 | 14.637 | 15.213 | 15.728 | 15.903 | 16.458 |
| Total loans, yoy growth in %                  | 25,54  | 30,93  | 21,08  | -3,87  | 3,25   | 5,03   | 3,94   | 3,38   | 1,11   | 3,49   |
| NPLs in total loans                           | 4,0    | 3,0    | 3,1    | 5,9    | 11,4   | 11,8   | 13,5   | 15,1   | 14,2   | 13,7   |
| Regulatory Capital                            | 1.861  | 2.345  | 2.637  | 2.643  | 2.730  | 2.826  | 2.814  | 2.995  | 2.768  | 2.609  |
| Capital Adequacy Ratio (CAR)                  | 17,7   | 17,1   | 16,2   | 16,1   | 16,2   | 17,1   | 17,0   | 17,8   | 16,3   | 14,9   |
| Reserves Account Balance                      | 2.839  | 3.617  | 3.125  | 2.969  | 3.308  | 2.856  | 2.852  | 3.287  | 3.706  | 4.067  |
| Reserves Account Balance as % of Total Assets | 19,3   | 18,5   | 15,0   | 14,4   | 16,2   | 13,6   | 13,5   | 14,9   | 16,3   | 17,1   |
| out of which                                  |        |        |        |        |        |        |        |        |        |        |
| Mandatory Reserves                            | 1.818  | 2.458  | 2.425  | 1.606  | 1.626  | 1.310  | 1.263  | 1.328  | 1.401  | 1.499  |
| in % of Total Assets                          | 12,4   | 12,6   | 11,7   | 7,8    | 8,0    | 6,2    | 6,0    | 6,0    | 6,2    | 6,3    |
| Excess Reserves                               | 1.021  | 1.160  | 700    | 1.363  | 1.682  | 1.545  | 1.589  | 1.959  | 2.306  | 2.568  |
| in % of Total Assets                          | 7,0    | 5,9    | 3,4    | 6,6    | 8,2    | 7,4    | 7,5    | 8,9    | 10,1   | 10,8   |
| Number of Banks in Foreign Ownership          | 22     | 21     | 21     | 21     | 19     | 19     | 19     | 17     | 16     | 16     |

**Graph 2: Excess Reserves above minimum requirement**



### 3. Literature Review

Holding sufficient liquidity is necessary to ensure against liquidity risk (Diamond and Dybvig, 1983, Diamond and Rajan, 2001). Ruffer and Stracca (2006) in ECB's working paper studied global excess liquidity, providing the evidence that excess liquidity is a useful indicator of inflationary pressure at a global level. They also analyzed the channels through which excess liquidity might be transmitted across borders on the data of three economies (EU, USA and Japan). The aim of the record low interest rates was to boost lending in the EU. Even before the crisis emerged, Wyplosz (2005) in the Briefing Notes to the Committee of Economic and Monetary Affairs, argued that poor growth prospects, resulting in scarce borrowing, lead to building of the liquidity abundance in the euro zone. He clearly differed abundance from the term of excessive liquidity. ECB in Monthly Bulletin (January 2014) points out the relationship between excess liquidity and money market rates, taking into consideration ECB's actions including LTRO's and its effects on improving the market conditions.

Excess reserves were the subject of different studies ever since the banking crisis in 1930s. Frost (1971) in explaining banks' demand for excess reserves concluded that banks find it profitable to hold excess reserves at very low interest rates because the cost of constantly adjusting reserve positions is greater than the interest earned on short-term securities.

The issue of excess liquidity in the developing countries is not so explored. The above mentioned paper by Saxegaard (2006) is very intuitive as it argues that poorly developed interbank market and other impediments of financial market, such as underdeveloped securities market and lack of competition, play an important role in banks' decision on holding excess liquidity. The bond market in B&H has not been enough developed and although the governments were active recently in regard to issuing of treasury bills and government bonds, this market cannot play an effective role in reducing excess liquidity in the banking sector. The banks are almost the only holders of government securities in B&H. Saxegaard (2006) makes a clear difference between precautionary and involuntary liquidity, proving that the banks make liquidity cushions to ensure themselves against shortfalls in liquidity, due to volatility of private sector deposits. The other authors choose different determinants based on the characteristics of the economy. In order to explain the fall in bank

lending in Thailand, Agenor, Aizenman and Hoffmaister (2004) estimated the demand function for excess liquidity and concluded that this fall was actually caused by supply contraction. Thamae (2014) concluded that excess liquidity in the financial sector of Lesotho is driven by undeveloped financial sector and government activities. By identifying this, Thamae (2014) was able to define policy options and decrease vulnerabilities of the economy. Aikaeli (2006) found that rate of required reserves, volatility of cash preference, the bank borrowing rate and variations of loans return or credit risk, defines excess liquidity in the banking sector of Tanzania. Nwakanma and Mgbataogu (2014) in explaining the excess liquidity, based on Nigerian experience, defined the level of money supply, foreign exchange monetization and lagged excess liquidity, as significant factors and pointed out the vulnerability of an open economy to the dynamics of foreign economies.

Fielding and Shortland (2005) examined the determinants of bank liquidity in Egypt, and found out that even after liberalization of foreign exchange and credit market, and elimination of interest rate control, the banks continued to hold huge reserves. This was explained by political factors which forced banks to apply conservative investment policy. Khemraj (2007) expresses the fear of liquidity overhang resulting in macroeconomic instability.

The liquidity is very important for functioning of financial market and banking sector and as shown during financial crisis (Vodova, 2012). Wuryandani (2012) used GMM Model and indicated that credit, saving and deposit affect precautionary liquidity, while financial system and macroeconomic conditions have an effect on involuntary liquidity.

Moussa (2015) studied 18 banks in Tunisia over the period of 10 years (2000-2010), and his finding indicate that financial performance, capital, loans/total assets, operating expenses/total assets, growth rate of GDP, inflation rate, have a significant impact on bank's liquidity. Vodova (2011) also used panel data regression analysis for Check banks, which showed that there is a positive link between bank liquidity and capital adequacy, share of non-performing loans and interest rates on loans, as well as on interbank transaction. The paper found negative influence of inflation rate, business cycle and financial crisis on liquidity. The same author made panel analysis for Slovakia Vodova (2012), Poland Vodova (2012) and Hungary Vodova (2013) with similar results, but taking into consideration specific characteristics of individual markets.

Bosnia and Herzegovina is characterized by underdeveloped financial market, with significant amount of NPLs, no Lender of Last Resort function by the Central Bank, and very poor interbank market. Similar conditions exist in the countries of Central America as well. The

analysis by Delechat, Henao, Muthoora and Vtyurina (2012) concluded that idiosyncratic factors such as a bank size, profitability and efficiency determine liquidity ratios.

This topic has not been explored in B&H so far. Bearing that in mind, the real impact of this paper could be multiple, especially as it will open more questions for the liquidity conditions and appropriate liquidity management.

#### 4. Data, methodology and model development

The data sample includes annual individual data for 19 banks for the period 2006 – 2015 representing the 86% of the total banking sector as of end of 2015. Several outlier banks are exempted from the sample due to bailouts, subsidies by the state and assets sale that occurred in the observed period. The time period is chosen by data availability. The selection of variables was based on the similar studies performed in the other countries, but taking into consideration specific characteristics of the B&H economy. Finally, six specific internal factors, two domestic macroeconomic factors and one foreign were chosen among others to be analyzed. The data source for banks' data is Central Bank of Bosnia and Herzegovina, while data source for macroeconomic indicators is the State Agency for Statistics. The Eonia rates are taken from the official website for Euribor.

The studies that assess determinants of the liquidity of banks are presented by a large array of methodologies. Economic relationships which are included in this paper are dynamic in their nature, and their current behavior depends on their past behavior. Therefore, dynamic panel model was required. The presence of a delayed variable makes the conventional estimation techniques on panel data inappropriate. Thus, the use of panel data with fixed or random effects does not solve econometric problems inherent in dynamic models. The dynamic nature of the model disenable using standard Ordinary Least Squares (OLS) estimators, which might be biased and inconsistent due to the correlation between the unobserved panel-level effects and the lagged dependent variable. In order to overcome a problem of endogeneity that makes biased results and unobserved heterogeneity between banks that cannot be accurately measured, Arellano and Bond (1991) proposed a new GMM estimator for dynamic panel model (Difference GMM). Their proposal was to include additional instruments in the dynamic panel model, and as a name suggests, their proposal was using the difference transformation. Later, Arellano and Bover (1995) and Blundell and Bond (1998) proposed an improvement of the Arellano Bond estimator by imposing additional restrictions to the initial

conditions, which allow the introduction of more instruments in order to improve efficiency. It combines the first difference in equations with equation at the level in which the variables are instrumented by their first differences. It builds a system of two equations (System GMM), the original and transformed one. The above indicates that there are two types of GMM estimators: the difference GMM estimator and system GMM estimator and both are increasingly popular.

Roodman (2006) states that the Difference and System GMM estimators can be seen as part of a broader historical trend in econometric practice toward estimators that make fewer assumptions about underlying data –generating process and use more complex techniques to isolate useful information. They are designed for panel analysis, and embody the following assumption about the data–generating process:

1. There may be arbitrarily distributed fixed individual effects. This argues against cross-section regressions, which must essentially assume fixed effects away, and in favor of a panel set-up, where variation over time can be used to identify parameters.
2. The process may be dynamic, with current realizations of the dependent variable influenced by past ones.
3. Some regressors may be endogenous.
4. The idiosyncratic disturbances (those apart from the fixed effects) may have individual-specific patterns of heteroskedasticity and serial correlation.
5. The idiosyncratic disturbances are uncorrelated across individuals.
6. Some regressors may be predetermined but not strictly exogenous: even if independent of current disturbances, still influenced by past ones. The lagged dependent variable is an example.
7. The number of time periods of available data,  $T$ , may be small. (The panel is “small  $T$ , large  $N$ .”) Finally, since the estimators are designed for general use, they do not assume that good instruments are available outside the immediate data set. In effect, it is assumed that:
8. The only available instruments are “internal”—based on lags of the instrumented variables. However, the estimators do allow inclusion of external instruments.

Sudirman (2014) examined variety of variables that determine the bank liquidity in Indonesia on the data panel of 20 banks over the period 2004-2011, using difference GMM and system

GMM. Dinger (2009) used also the dynamic system GMM methodology when analyzing the impact of transitional banks' activity on the banking system liquidity. Similarly, Delechat, Henao, Muthooru and Vtyurina (2012) considered persistent liquidity ratio in developing model, using GMM developed by Blundell and Bond, in analyzing the determinants of banks' liquidity buffers in Central America. Blundell and Bond (1998) showed with Monte Carlo simulations that the system GMM estimator is more powerful than the first difference but some of the researchers' argued that the system GMM is not appropriate to use with dataset with the small number of N. Therefore, the both estimators are presented in this paper.

Following the previously presented empirical literature and the framework of the presented methodology of the GMM estimators, the incentive for this study, in order to assess determinants of excess liquidity, is to apply the difference GMM and system GMM. The number of lags for the GMM instruments is restricted to 2 (Roodman, 2009).

The value of excess reserves is considered to be the indicator of excess liquidity. The determinants of excess liquidity can be grouped into two categories, internal factors and external factors. Internal factors come from specific banking performance. Therefore, the internal independent variables are previous year excess reserves, non-performing loans, profitability indicator, the share of equity in total assets, total loans, interest rates on loans and size of the bank. The external factors come from the state of macroeconomics, GDP growth rate and CPI, and also Eonia. The Euro Overnight Index Average is a weighted average of all overnight lending transactions between the most active credit institutions in the euro area's money market. It is a globally recognized benchmark for the short-term unsecured money market loans in the euro area and thus it represents the excess liquidity investment option for commercial banks in B&H. The dynamic relations are characterized by the presence of lagged dependent variable among the regressors. The general model to be estimated is of the following linear form:

$$y_{it} = \delta y_{i,t-1} + \sum_{j=1}^j \beta_j x_{it}^j + \sum_{m=1}^m \beta_m x_{it}^m + \mu_{it} + v_{it}$$

$y_{it}$  is bank liquidity of bank  $i$  at time  $t$ , with  $i = 1, \dots, N, t = 1, \dots, T$ .

$x_{it}^j$  is a vector of internal determinants affecting bank liquidity, among others NPLs,

*profitability, equity, loans, deposits, lending interest rates and size of the bank*

*$x_{it}^m$  is a vector of external determinant factor affecting bank liquidity GDP growth,*

*Consumer Prices Index and Eonia*

*$\mu_{it}$  is unobserved bank specific time invaraiant effects*

*$v_{it}$  is a disturbance term which is independednt across banks*

Testing the degrees of correlation between the explanatory variables used in the multivariate regression analysis implies that correlation among the variables do not strongly suggest that there is not any multicollinearity problem. In the Table 2 the expected relationship of internal and external factors on excess liquidity in B&H are presented.

**Table 2. Description of variables**

| Variables                                | Notation                | Expected impact    |
|--|-------------------------|--------------------|
| Lagged value of Excess liquidity         | EX_RES <sub>i,t-1</sub> | Positive           |
| Non performing loans                     | NPL                     | Positive           |
| Profitability                            | ROE                     | Positive/ Negative |
| Equity                                   | EQ_TA                   | Positive/ Negative |
| Loans                                    | LOANS                   | Negative           |
| Lending interest rates                   | L_IR                    | Positive/ Negative |
| Log_total_assets, proxy for size of bank | Log_TA                  | Positive           |
| Growth of Gross Domestic Product         | GDP_GR                  | Negative           |
| Consumer Price Index                     | CPI                     | Negative           |
| Eonia                                    | EONIA                   | Negative           |

## 5. Research results

The results of the application of panel method are presented in this section. Table 3 reports the empirical results of the estimations of fixed effects model and two dynamic models using difference GMM and system GMM. The model estimated by Ordinary Least Squares(OLS) using the Least Squares Dummy Variable approach may produce biased results due to unobserved bank-specific heterogeneity. To address these concerns, the empirical results of two models, difference GMM and system GMM, are interpreted in this study.

The diagnostic tests for two models, difference GMM and system GMM, are satisfied. The Sargan tests show no evidence of over-identifying restrictions. It confirms that there is no correlation among the residuals and used instruments. Therefore, the validity of the instrumental variables set is assessed which indicates that both models are feasible. Besides that, the tests of the first and second order autocorrelations are carried out, m1 and m2 tests. Although, the test m1 suggests that there is the first order of autocorrelation, the test m2 in the first differences is more important because it will detect autocorrelation in levels. According to Arellano and Bond (1991), GMM estimators are consistent, if the second order autocorrelation confirms the absence of these problems at the common level of significance.

The significant coefficient of lagged dependent variable proves the dynamic model. The lag of excess liquidity has a positive impact on the current level of excess liquidity. This is in accordance with the results of Thamae (2014), Saxegaard (2006), Sudirman (2014) and Nwakanma and Mgbataogu (2014), but in contrast with Aikaeli (2006). It is consistent with our expectations as we assumed that banks tend to maintain higher levels of liquidity from the past into forthcoming period.

According to the model results, using the system GMM with lag (2 2), the non-performing loans (NPL) is statistically significant variable and suggests that there is a positive relationship with excess liquidity. It means that a bank with a higher NPLs is more cautious about investing and it rather keeps more funds in the account as the excess liquidity. Vodova (2011) and Vodova (2012) in analyzing the Check and the Polish banks, respectively, came to the same conclusion, proving cautious liquidity risk management.

The empirical analysis of both models in this paper also suggest that total loans are highly significant variable and one of the determinants of the excess liquidity. It has negative relationship with the excess liquidity, indicating that an increase of loans has a negative impact on a bank's liquidity, proving that higher activity will cause lower funds at the commercial banks' accounts with the monetary authority. This finding is in accordance with



Moussa (2015) conclusion for the banks in Tunisia. Further, Aikaeli (2006) found that volatility in loans makes banks cautious and biased to holding excess reserves.

As expected, there is an evidence that the size of a bank is highly significant variable in both models. The logarithm of total assets is taken (LogTA) as a proxy for the size of the bank. The bigger banks keep more excess reserves due to the absence of the Lender of last resort function and poor interbank market. Dinger (2009) states that total assets could affect the availability of liquidity. Vodova (2013) proved for the Hungarian banks that liquidity is decreasing with the size of the bank, while the results for the Check banks were ambiguous (Vodova 2011).

There is no statistically significant relationship between the bank's profit (ROE) and the equity (EQ\_TA) with the excess liquidity in the presented two models. Moussa (2015) proved that equity was significant at 1% level, having negative relationship, but the hypothesis of financial fragility predicted that the increase of capital reduces liquidity creation (Diamond and Rajan, 2001). Sudirman (2014) found positive relationship of capital and profitability on the liquidity of the banks, while Vodova (2012) for the Polish banks concluded that profitability lowers bank's liquidity. The lending rate is not a significant variable in this paper and the same is proved also by Moussa (2015) and Thamae (2014). Vodova (2011) found the evidence of positive relationship between interest rates and liquidity for the Czech Republic.

Many studies assumed and proved a negative link between business cycle and bank liquidity. However, our findings imply that GDP growth (GDP\_GR) is an insignificant variable in both models, proving that other factors dominate in determination of excess liquidity in B&H. These results are consistent with the study of Sudirman (2014) for the banking sector in Indonesia. The inflation (CPI) is one of the important determinants of excess liquidity in B&H, as assumed. Thus, there is negative relationship between the liquidity and inflation since inflation deteriorates an overall macroeconomic environment. The strong interaction between inflation and excess liquidity pointed to the fact that in the case of B&H, it benefits from the relatively stable inflationary environment due to the Currency Board Arrangement where the domestic currency is pegged to EURO. It is consistent with Moussa (2015), Vodova (2011) and Vodova (2012). The results show the negative link between the external variable Eonia (EONIA) and the excess reserves, which corresponds to our expectation. The commercial banks in B&H refer to the European interbank market as an alternative source for

investing excess liquidity. It highlights the fact that the lower interest rates encourage banks to keep the funds rather as excess reserves.

**Table 3. Panel-data estimation, Results**

| Explanatory variables                                  | Fixed Effect model                 | Difference GMM, lag(2,2) | System GMM, lag(2,2)     |
|--|------------------------------------|--------------------------|--------------------------|
| EX_RES <sub>i,t-1</sub>                                |                                    | 0.2170353 **<br>(0.030)  | 0.3644837***<br>(0.000)  |
| NPL  | 1.872647**<br>(0.047)              | 2.291597<br>(0.141)      | 1.900063**<br>(0.020)    |
| ROE  | 0.2676896<br>(0.765)               | 0.8117731<br>(0.542)     | 0.8492085<br>(0.339)     |
| EQ_TA  | 1.461373<br>(0.495)                | 2.286832<br>(0.430)      | -1.230857<br>(0.116)     |
| LOANS  | -1.390977***<br>(0.004)            | -1.917566**<br>(0.010)   | -1.878646 ***<br>(0.000) |
| L_IR   | 4.073287<br>(0.521)                | 10.78252<br>(0.275)      | 6.047318<br>(0.286)      |
| Log_TA   | 2.30751 ***<br>(0.000)             | 3.293983 ***<br>(0.000)  | 2.509586 ***<br>(0.000)  |
| GDP_GR   | -1.126658<br>(0.695)               | -0.2984087<br>(0.910)    | 0.4963183<br>(0.850)     |
| CPI  | -0.0615271*<br>(0.059)             | -0.0720239**<br>(0.036)  | 0.0707672 ***<br>(0.000) |
| EONIA  | -19.60823***<br>(0.007)            | -19.47355***<br>(0.007)  | -26.04293***<br>(0.000)  |
| Number of observation                                  | 171                                | 152                      | 171                      |
| Number of Groups                                       | 19                                 | 19                       | 19                       |
| The F statistics                                       | F(9,143) = 4.19<br>Prob>F = 0.0001 |                          |                          |
| Sargan test of overid. Restrictions, (p -value)        |                                    | 0.128                    | 0.256                    |
| Arellano-Bond test for AR(1) in first differences, m1: |                                    | z = -5.42 Pr > z = 0.000 | z = -5.45 Pr > z = 0.000 |
| Arellano-Bond test for AR(2) in first differences, m2: |                                    | z = -0.89 Pr > z = 0.374 | z = -0.66 Pr > z = 0.511 |

\*\*\* statistically significant at 1% level,

\*\* statistically significant at 5% level,

\*statistically significant at 10% level

## 6. Conclusion

The aim of this research was to analyze the principal determinants of excess liquidity in B&H banking sector, through the estimation of the empirical models. The dynamic panel difference

GMM and system GMM estimators are used due to the fact that single left hand side variable is dynamic, depending on its own past realization. The independent variables are not strictly exogenous, meaning correlated with the past and possibly current realization of the error, fixed individual effect of the bank, and assumed presence of heteroscedasticity and autocorrelation within individuals but not across them. The data sample included in this study is carried out on the data of 19 commercial banks, which refers to about 86% of assets of the overall banking sector. The time framework 2006-2015 is selected by data availability. This study investigates only a short period of data. A further revision could be done as longer data set will be available. B&H monetary policy is under very rigid Currency Board regime and CBBH does not have the Lender of Last Resort function. Interbank market practically does not exist in B&H due to the strict and limited policies from parent banks and specificities of B&H banking sector. It may lead to holding excess reserves as safety measure for precautionary purposes. Therefore, this topic is of particular interest for B&H economy to provide empirical evidence as to what are the main drivers of the excess liquidity.

The selection of variables was based on the similar studies performed in the other countries, but taking into consideration specific characteristics of B&H economy. The two dynamic models are developed using difference GMM and system GMM methodologies. Among the possible determinants, suggested by a theoretical and an empirical literature, six specific internal bank variables, two domestic macroeconomic variables and one foreign variable are considered. For both models, the lagged value of the excess liquidity is highly significant variable, which proves the dynamic model. The other bank-specific variables that affect the excess liquidity are total loans and non-performing loans. The increase of loans has a negative impact on excess liquidity as indicated in most of other studies. Therefore, poor credit growth fueled accumulation of excess liquidity in the post crisis period. The banks with the higher share of non-performing loans are more cautious in investing. The size of the bank is an important factor that affects the excess liquidity, the bigger bank keeps more funds in the form of excess reserves due to the absence of the Lender of last resort function and poor interbank market. Besides that, it is also proved that one of the macroeconomic variables, inflation has significant negative impact on the excess liquidity, while GDP growth proved to be insignificant. Eonia, as an external factor, has expected negative relationship to excess liquidity, proving that European interbank market serves as one of the alternative sources for investing excess liquidity of B&H banks. The presented and interpreted empirical findings of

this research paper are consistent with the expected results and in line with other research papers.

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