Liquidity management strategies in the Czech banking sector

Jana Laštůvková

Citation

Laštůvková, J. (2014). Liquidity management strategies in the Czech banking sector. *MENDELU Working Papers in Business and Economics* 47/2014. Mendel University in Brno. Cited from: http://ideas.repec.org/s/men/wpaper.html

Abstract

Jana Laštůvková: **Liquidity management strategies in the Czech banking sector**

This paper focuses on the evaluation of the liquidity development in the banking sector of the Czech Republic. The evaluation is carried out using specific method of measurement - gross liquidity flows and their overall reallocation. This method allows determining liquidity for the banking sector as well as for the individual groups. The method is also based on liquidity flows, in addition in two forms - positive and negative, is thus the dynamic assessment of the liquidity in a perspective of its creation and outflow. This takes into account current trends in requirements for measuring and monitoring liquidity risk. Evaluation of the flows is supplemented by a correlation analysis to determine the main factors of the liquidity development. The results suggest that the studied groups of banks have different characteristics and are influenced by different factors. Medium-sized group of banks, standing between the two other groups, does not show a clear strategy of its own, but takes elements from the other two groups of banks.

Key words

Contacts

Jana Laštůvková, Department of Finance, Faculty of Business and Economics, Mendel university in Brno, Zemědělská 1, 613 00 Brno, Czech Republic, e-mail: xlastuv1@node.mendelu.cz.

Acknowledgements

Introduction

Due to ongoing changes in society, economy, the development of information technology and overall globalization, it is necessary to constantly vary and improve the methods and procedures of bank risk management. These gradual modifications and trends are also seen in liquidity risk management and should be respected. It is possible to note a shift from static to dynamic methods. It is also advisable to take into account several factors when measuring the risk. Since the recent global crisis, the emphasis on liquidity risk has increased even more. Attention is drawn to the system as a whole, not to the individual banks, because the illiquidity of one entity is not as critical as the illiquidity of the whole system. The Basel Committee, responsible for the Basel business banking regulatory framework, has adapted and updated its concepts. The latest Basel III concept already reflects the liquidity risk in the form of two liquidity ratios. Furthermore, many authors respect the current needs in the construction of their methods of measurement or in their concepts for determining the main factors.

The aim of this paper is to evaluate the development of liquidity in the Czech banking sector while identifying the main factors of this development and on this basis formulate a possible liquidity risk management strategy for the groups of banks. This will be done while respecting the systemic and dynamic view on measuring liquidity risk. The method of Valla et al. (2006) is used, which is based on a dynamic evaluation – the liquidity flows – and a systematic, aggregated view.

1   Literature review

Currently, the most commonly used methods for measuring liquidity risk are various forms of liquidity ratios. E.g. Bunda, Desquilbet (2008) use 5 types of these ratios for their measurement. Selected indicators are used by these authors for further processing in the form of regression to determine the factors of liquidity. Vodová uses very similar liquidity ratios for her measurement. The chosen indicators are evaluated for several banking systems in Central Europe - Czech (2011a), Slovak (2011b), Poland (2012) and Hungary (2013). As well as Bunda, Desquilbet (2008), Vodová (2011a, 2011b, 2012, 2013) subsequently conducts a regression analysis and identifies the determinants of liquidity.

The method of ratios is a static method as well as a method of liquidity gap, which is not as widely used in studies aimed at the measurement and evaluation of liquidity risk. The method of ratios take the values from the bank's balance sheet, which is prepared on a particular date in the past, so a number of authors passes to dynamic methods of measuring liquidity risk, which work with liquidity

flows. Bouwman, Berger (2009) focus on the creation of bank liquidity. They divided balance sheet and off-balance sheet items into different categories according to liquidity and then assigned them different weights. After various combinations they created four different types of liquidity measurement. The Bouwman, Berger (2009) method is used by other authors for evaluating the creation of liquidity or as a base for further processing, such as Pana et al. (2010) or Lakštutiene, Krušinskas (2010) who assessed the Lithuanian banking sector. Horvath et al. (2013) use this liquidity creation method as a starting point to determine the effect of competition in the Czech banking sector on this creation.

In their method, Valla et al. (2006) work only with the active side of the balance sheet, but their measurement is not limited merely to liquidity creation, but it also constructs flow in the form of liquidity outflow. Their method is based on adjusting the value of the liquid assets in the form of nominal and idiosyncratic liquidity flows which are both positive and negative. The authors also determine the overall reallocation and net changes. The method of Valla et al. (2006) is used in this article and applied to the banking sector of the Czech Republic.

These dynamic methods eliminate some of the difficulties of liquidity ratios, but they are still only able to evaluate the previous development, because data are taken from the balance sheets, which are formed to a specific date at the past. The method for measuring liquidity risk in the Basel III concept in the form of two indicators shows other advantages. Construction of these indicators of liquidity - liquidity coverage ratio (LCR) and net stable funding ratio (NSFR) include on the one hand the combination of flow and static variables, allow forward view, and on the other hand make international comparisons possible as indicators will be obligatory for Member States of EU (BIS 2010). There are also authors who work with these indicators in their studies, e.g. Cucinelli (2013) who uses these indicators for subsequent regression.

Each method is an improvement on previous methods, but has a few restrictions itself. Indicators in Basel III do not provide perfect measurement of liquidity risk either. A relatively big disadvantage of these indicators is their flatness. Bank-specific factors are not taken into account, which can lead to distortion or even to undesirable effects, and instead of the targeted optimization, it may lead to a deterioration of the banking situation. So far there has not been any method that would include all aspects needed for adequate liquidity risk measurement.

Many authors use the results of liquidity measurements in comparison with macroeconomic and other variables to obtain the main factors influencing the development of liquidity. A widely used macroeconomic variable is GDP (Valla et al. 2006; Bunda, Desquilbet 2008; Vodová 2011a) mostly

with a defined negative influence, i.e., that the banks behave cyclically in relation to the overall economic development. Valla et al. (2006), who construct both positive and negative liquidity flows, indicate that both flows behave cyclically and, therefore, whether the liquidity will decrease or increase in economic growth depends on the very structure of the examined bank sector and individual banks. Besides the development of GDP, other macroeconomic variables are often inflation (Bunda, Desquilbet 2008; Vodová 2011a) and unemployment (Hackethal et al. 2010; Vodová 2011a) with an expected positive impact for inflation and a negative one for unemployment.

Another set of variables is at market level - for instance, the presence of bank regulations (Bunda, Desquilbet 2008) and interest rates - both the interest rates of the interbank market with a positive influence (Moore 2010; Vodová 2011a) and the rate of lending, again with a positive impact on liquidity (Bunda, Desquilbet 2008; Vodová 2011a).

The last set of variables is at the level of individual banks: the microeconomic level. A lot of authors use variables as the value of total assets (Bunda, Desquilbet 2008; Vodová 2011b), which refers to the size of the bank. It is assumed to be a negative influence between the size of banks and the value of liquidity. Some authors classify and examine specific variables affecting the liquidity of the banks. Bunda, Desquilbet (2008) determined the relationship between a regime of exchange rates and the banks' liquidity. The role and influence of central banks (Aspachs et al. 2005), the impact of mergers (Pana et al. 2010) or competition (Horvath et al. 2013) on liquidity creation is classified in these respective analyses.

Lately there have also been studies regarding the impact of the crisis and, respectively, the progress of liquidity before, after and during the crisis (Bunda, Desquilbet 2008; Moore 2010). The authors agree that the crisis has reduced the value of liquidity.

On the basis of all these studies, macroeconomic variables with a potential impact on the liquidity of the Czech banking sector are included and observed in this article.

2   Methodology and the description of the sample

To obtain and evaluate liquidity flows the method of the authors Valla et al. (2006) is used, which is called gross liquidity flows. This method is based on the liquid assets of the banks for the period. For the construction of the final flows, the following process in the adjustment of the value of liquid assets is observed:

1. Determining the annual changes in liquid assets

$$\Delta I_{it} = I_{it} + I_{it-1} \tag{1}$$

where I_{it} is the value of the bank's liquidity i at time t, I_{it-1} is the value of the bank's liquidity i at time t-1.

2. Determining the net growth rate g_{it}

$$g_{it} = \frac{\Delta I_{it}}{(I_{it-1} + I_{it})/2} \tag{2}$$

3. Determining nominal liquidity flows

By aggregating the values obtained from Equation 2, either positive (where git ≥ 0) or negative (where 0 ≤ git) nominal flows are gained.

$$POS_t^{nom} = \sum_{i|g_{it\geq 0}}^{N} g_{it}\left(\frac{(I_{it-1} + I_{it})/2}{\sum_{i=1}^{N} I_{it-1}}\right) \qquad NEG_t^{nom} = \sum_{i|g_{it\leq 0}}^{N} |g_{it}|\left(\frac{(I_{it-1} + I_{it})/2}{\sum_{i=1}^{N} I_{it-1}}\right) \tag{3}$$

4. Determining idiosyncratic liquidity flows

The values for each bank i in year t from Equation 2 are adjusted by the trend component as follows:

$$g_{it}^{id} = g_{it} - g_t^{tr} \tag{4}$$

where:

g_{it}^{id} – idiosyncratic growth rate,

g_t^{tr} – aggregate growth rate adjusted by Hodrick-Prescott filter, which is defined as:

$$min_T = \left(\sum_{t=1}^{T}(y_t - \tau_t)^2 + \lambda \sum_{t=1}^{T}\left[(\tau_{t+1} - \tau_t) - (\tau_t - \tau_{t-1})\right]^2\right) \tag{5}$$

By aggregating the values of Equation 4 positive and negative idiosyncratic flows are obtained.

$$POS_t^{id} = \sum_{i|g_{it}^{id}\geq 0}^{N} g_{it}^{id}\left(\frac{(I_{it-1} + I_{it})/2}{\sum_{i=1}^{N} I_{it-1}}\right) \qquad NEG_t^{id} = \sum_{i|g_{it}^{id}\leq 0}^{N} |g_{it}^{id}|\left(\frac{(I_{it-1} + I_{it})/2}{\sum_{i=1}^{N} I_{it-1}}\right) \tag{6}$$

5. Calculation of net changes for nominal and idiosyncratic flows

$$NET_t^{nom} = POS_t^{nom} - NEG_t^{nom} \qquad\qquad NET_t^{id} = POS_t^{id} - NEG_t^{id} \tag{7}$$

6. Determining the total reallocation for nominal and idiosyncratic flows

$$\text{TOT}_t^{\text{nom}} = \text{POS}_t^{\text{nom}} + \text{NEG}_t^{\text{nom}} - |\text{NET}_t^{\text{nom}}| \qquad\qquad TOT_t^{id} = POS_t^{id} + NEG_t^{id} \qquad (8)$$

The construction of nominal and idiosyncratic flows are covered both effects for liquidity risk management - external and internal. Both flows are additionally designed as positive, as a creation of liquidity, as well as negative, in the case of its outflow.

The correlation coefficients - Pearson's correlation coefficient – will be used for evaluating the relationship between the obtained flows and major macroeconomic variables (GDP, inflation, unemployment). For the evaluation of the possible internal relations and strategies there will also be established correlations between items of the bank financial statement – the relationship between total and liquid assets.

The observed sample will be the banking sector of the Czech Republic and on the one hand its sub-groups (small, medium, large groups of banks and building societies) according to the CNB methodology (CNB 2003–2014), as well as the sector as a whole (excluding foreign branches). The development will be evaluated from the period 2001-2012. The liquid assets and total assets are annual values taken from the Bankscope database.

With regards to the macroeconomic variables, GDP is the percentage change in constant 2005 prices, inflation is the percentage change in the average price level and the overall rate of unemployment is yearly reporting periods. All of these variables are taken from the Czech Statistical Office.

3   Results

Based on the evaluation of nominal flows of liquidity for all sub-groups and the overall sector, it is evident that virtually all of the evaluated period is the determining factor in the development of liquidity the group of large banks. This is logical because, despite the small number of banks in this group (a total of 4 banks), they have by far the highest absolute value in terms of liquid assets. However, in times of crisis and just after it, the overall development of liquidity in the sector differs from the development of liquidity in the group of large banks. This fact is illustrated in Figure 1. Positive liquidity flows are in this part of period mainly driven up by a group of medium-sized banks and building societies.
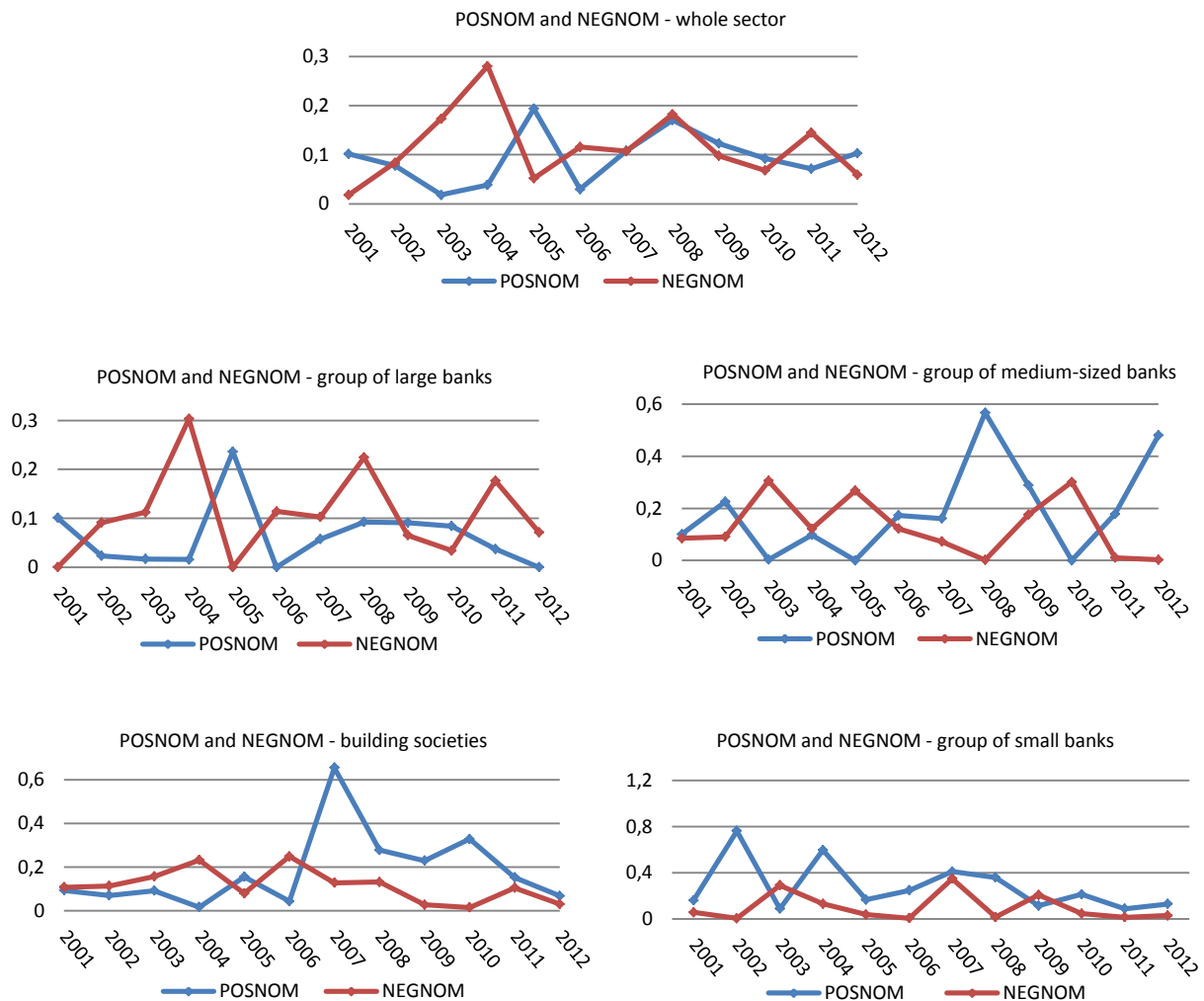
Figure 1: Nominal liquidity flows for the whole sector and the each group of banks

A group of large banks represented the smallest relative liquidity creation in this part of the observed period. This fact could be explained by the reliance of this group on the interbank market and obtaining liquidity from it. As illustrated e.g. Bunda, Desquilbet (2008), large banks often hold smaller amounts of liquidity in contrast to the group of small banks and rely on the rule of "too big to fail". Despite the fact that a large group of the Czech banks are in comparison with the world's large banks' minor bodies, in the Czech banking sector they are dominant. Smaller holdings of liquid assets to total assets value is demonstrated by a negative correlation between these two variables. (corr -0.667**), see Figure 2.
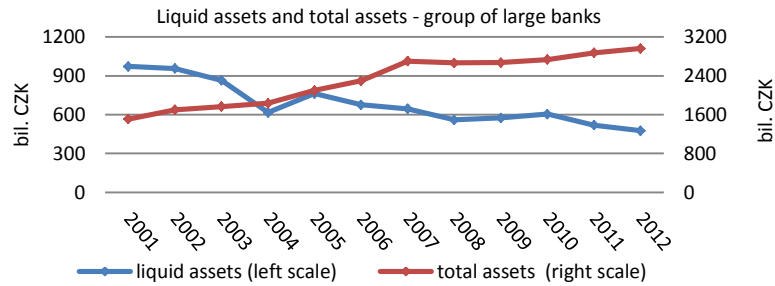
Figure 2: Liquid assets and total assets – group of large banks

Thus, the value of total assets is basically the size of the banks, the higher it was the less liquid assets the banks held. For this reason, a group of large banks created the smallest relative value of liquid assets, because most relied on obtaining funds from financial markets, which, however, showed low market liquidity indicators during the period of crisis, as documented by CNB Report (2008/2009). A group of large banks showed the lowest average positive nominal flows throughout the period.

The group of small banks had quite the opposite relationship between liquid assets and total assets, see Figure 3.
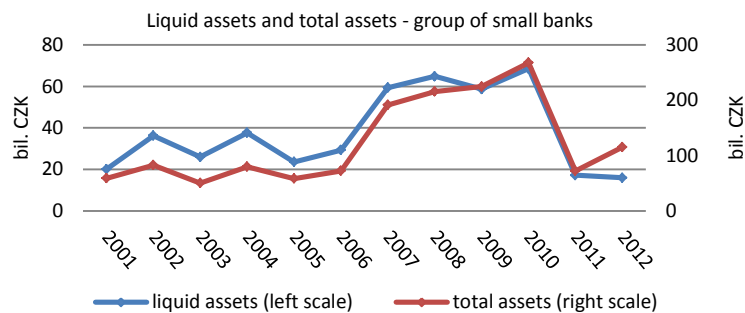

Figure 3: Liquid assets and total assets – group of small banks

It showed an almost identical process for both variables (corr 0.959***). Banks in the small group maintain a certain ratio of liquid assets to total assets. Holding of this liquidity rely more on themselves than on obtaining liquidity from the interbank market. During the financial crisis, a group of small banks was the most active group in increasing the total assets and, logically, they also increased the value of the liquid assets. A group of small banks reported the highest average positive flows and the lowest average negative flows during the reported period. It is evident that this group creates and holds the liquidity.

Based on these results it can be concluded that the strategy of a large group of banks in managing liquidity risk is to raise funds from interbank and financial markets, since the holdings of liquid assets

brings almost no income, the bank of its size in the examined sector may also rely on possible assistance and loans from the central bank, as the major banks know that their collapse could lead to systemic risk. In contrast, small banks are aware that they do not form the core of the system and their possible illiquidity or insolvency would most likely not be supported by the central bank as a lender of last resort and must therefore rely more on themselves and on their holdings of these liquid assets. Looking at the medium-sized group of banks and its relationship between liquid and total assets in the Figure 4, no clear link is seen (corr 0.298).
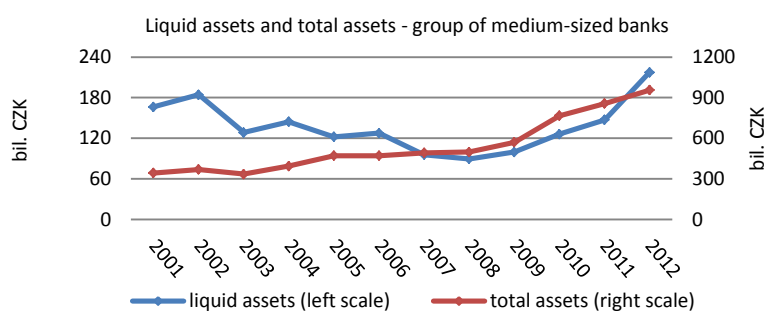

Figure 4: Liquid assets and total assets – group of medium-sized banks

The medium-sized group of banks is not clearly focused on raising funds from financial markets or, conversely, for holding liquidity in their portfolios, but adapts its strategy according to economic conditions. Up to 2007 a negative correlation prevails (corr -0.707*) between the studied variables, whereas since 2007, in the time of crisis, there is a positive correlation (corr 0.923**).

This would suggest that the medium-sized group of banks chooses its approach to the management of liquid assets according to the conditions in the economy. This assumption of behavior of this group is confirmed by the correlation coefficients reported in the case of nominal liquidity flows and macroeconomic variables. The medium-sized group is the only one among the other groups (the large and small groups and the building societies) which showed a clear correlation with these variables. The Table 1 shows the correlation coefficients of this group of banks with selected macroeconomic variables.

Table 1: Correlation coefficients of medium-sized group of banks with macroeconomic variables

flow	GDP	inflation	unemployment
POSNOM	-0,6212 ** (t+1)	0,6100 ** (t)	-0,6767 ** (t)
NEGNOM	0,5159 * (t+1)	-0,6672 ** (t)	0,4995 * (t)
NETNOM	-0,6189 ** (t+1)	0,6727 ** (t)	-0,6491 ** (t)

Note: *, ** and *** denote significance at the 10, 5 and 1% level

The relationship between nominal flows and GDP is delayed by one period and shows a negative influence. The negative relationship also determines Valla et al. (2006); Bunda, Desquilbet (2008); Vodová (2011a). Thus, the higher the GDP is, the lower the liquidity creation and conversely the higher the outflow. One of the reasons may be the fact that banks in times of economic growth invest more liquid assets and do not keep them, because it's easy to get them in times of need for a reasonable price, as well as the fact that during economic growth there is higher demand for loans, which means a higher outflow of liquidity.

The correlations show a positive relation between net nominal flow and inflation at time t, as well as studies Bunda, Desquilbet (2008); Vodová (2011a). This can be explained by an automatic increase in the nominal value of the liquid assets at the time of rising inflation and its decline in the event of it decreasing.

Conversely, a negative relationship is confirmed by unemployment consistent with Hackethala et al. (2010); Vodová (2011a). The reason could be the fact that during higher unemployment people are less likely to pay off their loans and banks are forced to use liquid assets to cover these shortages (positive relationship with NEGNOM). In addition, at higher levels of employment and, respectively, lower unemployment, banks can expect a higher demand for credit and banks show a growth of liquid assets (negative relationship with POSNOM).

The correlation for the other groups of banks (the groups of small and large banks) showed statistically insignificant values and variables were independent of each other. The only exception was the relationship of nominal flows with inflation - both small and large groups of banks showed a statistically significant correlation at 10%, but with a lag of one period. In the group of large banks there was only a negative correlation with NEGNOM flows, indicating a reduced outflow of the funds at higher inflation. At higher inflation, interest rates on loans increase and banks are less willing to lend a possible liquidity, so there is no a large outflow of the remaining reserves. In the case of the group of small banks, a positive relationship with inflation is demonstrated at this time by NEGNOM flows. This relationship could again come from the strategy of holding liquid assets in this group of banks, because their nominal value increases, banks can "release" more liquidity without this being reflected in total stock.

The group of building societies also showed some specifics. In the correlation analysis, the same relationship with unemployment and GDP were displayed as well as with medium-sized banks. However, unlike all the other groups the correlation between inflation and nominal flows is not evaluated, which could suggest the fact that building societies often work with a fixed interest rate.

Both the group of medium-sized banks and building societies reported high average nominal flows, there were on average the most active groups in sector regarded creation and outflow of liquidity.

A closer look at the development of liquidity in the sector in Figure 1 indicates two larger deviations in negative flows - in 2004 and 2008 - as well as two larger positive deviations - in 2005 and again in 2008. In 2004, when the Czech Republic entered the EU, the single license principle came into force, but in terms of reporting and liquidity management for banks it did not have much effect, unlike other regulatory changes, and that the mortgage loan has not been more limited by purpose. This has led to a rapid increase in mortgage loans (with and without state support) this year, especially in the category of the large group of banks and building societies (CNB, 2004). This increase is thus definitely reflected in the higher negative flow in 2004. On the negative flow of 2008, there was a decline in indicators of market liquidity as mentioned above, and the banks of the large group were forced to use their reserves. Conversely, a positive liquidity flow in 2008 was driven by medium-sized banks and building societies, which is why the positive flow of the whole sector differed from the positive flow of the group of large banks in this period of crisis. The second significant year in positive flows is 2005. Here several factors played a role. On the one hand there was the implementation of international standards, where the most influenced statement items were customer loans and securities (CNB, 2005). This had a direct impact on liquidity, as well as the fact that loans were repaid without any problems thus leading to the creation of liquidity. This year is again typical for the increase in mortgage loans - this one was the most productive medium-sized group of banks, however, it was not significant enough to be reflected in the overall development of liquidity. The development of liquidity by building societies may also have been effected by frequent amendments to the Act on Construction Savings in individual years.

In assessing the overall reallocation of nominal flow for the entire sector, it is clearly evident that the highest activity took place during the crisis, see Figure 5, left chart. This time was characterized by significant liquidity creation as well as its substantial outflow, since banks on the one hand wanted to obtain sufficient liquidity cushions and were also forced to use them. The most active groups in the time of crisis were particularly the small and medium-sized group of banks. However, the group of large banks also showed higher activity. The year 2002 also indicated a relatively high market activity. The explanation may be the adoption of a new methodology for the management of liquidity risk by the CNB.
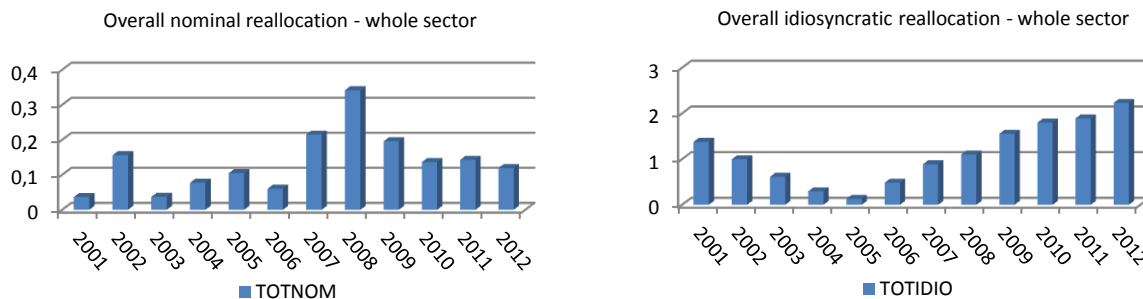
Figure 5: Overall reallocation of nominal (left chart) and idiosyncratic (right chart) flows

The total reallocation of the entire banking sector for idiosyncratic flows is shown in the right chart in Figure 5. It is clear that in the beginning of the period, with substantial economic growth, there were also significant idiosyncratic flows, when the economic growth gradually decreased, heterogeneity reduced, and banks showed values closer to trend. With the emerging crisis, banks again increased their activities and deviation from the trend.

In the analysis of idiosyncratic flows which represent differences in development from the trend, e.g. specific strategies, changes in the internal structure were an apparent heterogeneity. The growth in nominal liquidity flows is often accompanied by the growth in idiosyncratic liquidity flows. Banks showed higher growth than the trend. Also, pronounced liquidity outflows in nominal flows were equally pronounced in idiosyncratic flows. It is evident from the Figure 5 that banks reflect economic developments and try to, with their own activity, either support it or, in the event of adverse developments, reduce the negative consequences. In the group of large banks a relatively large increase in positive idiosyncratic flows is reflected during the crisis, which could indicate the efforts of individual banks to resist the unfavorable development, which is usually accompanied by a significant outflow of liquidity.

Specific idiosyncratic flows were shown by a group of building societies where negative idiosyncratic flows prevailed almost throughout the period, given by the individual requirements of clients about building savings loans. The idiosyncratic flows could also have been influenced by mergers, which were relatively abundant in the reference period.

Conclusions

From the results we can see that both positive and negative liquid flows coexist simultaneously. Larger fluctuations in these flows usually alternate with each other. Nominal flow itself not only

reflects macroeconomic development, but equally the behavior of individual banks, which was supported by substantial idiosyncratic flows. Total reallocation pointed out that banks are highly active in times of crisis. Bunda, Desquilbet (2008), Moore (2010) present that the crisis generally lower the value of the liquidity, it was confirmed only by the group of large banks, on the other hand, the group of small banks was able to create high positive flow of liquidity and also to increase the value of total and liquid assets. It might mean that the crisis lower the liquidity in that case that banks in the sector rely and gain the liquidity mainly from interbank markets, which are during this period in problems.

All of the observed groups in the Czech banking sector are influenced by different factors and diverse drivers but all observe and react to the overall economic development. A group of large banks, even with the smallest number of units in the group, gives the character of development of the whole sector. The only exception is during the period of crisis. This group seems to gain its liquidity through financial interbank markets, which showed lower liquidity in a crisis. On the contrary, the group of small banks relied more on themselves in liquidity management and held liquid assets in their portfolios. Medium-sized banks, standing between the two groups, showed differing characteristics during the period. By positive economic development at the beginning of the period, the group had a negative relationship between the value of total and liquid assets. Under the effect of the crisis, this relationship changed to positive. This is confirmation that this group reflects economic development the most, and on this basis changes its strategy, as evidenced are the relatively strong correlations of the nominal flows with macroeconomic variables. It may be noted that the medium-sized group of banks behaved more like a group of large banks during good economic development, while in times of crisis it behaved like a group of small banks. In here is also important to mention that medium-sized group of banks have the largest fluctuations, so there are stable big banks and also banks which regularly switch between this and small group of banks and are rather small. By their behavior, the building societies stood completely sideways to the other groups due to their specific activity.

The strategies of each group played a significant role in the development of liquidity in this period. The strategies were derived especially from the size of the bank, where it was assigned a negative relationship to the value of liquid assets, as well as it determined Bunda, Desquilbet (2008). When determining the correlation of macroeconomic variables and nominal flow values, only by the group of medium-sized banks were statistically significant, so it is not possible to generalize for the entire banking sector of the Czech Republic. This is different from the results of other authors, e.g. Vodová (2011a), who examined also the Czech banking sector concluded that there are significant relations between macroeconomic variables and the liquidity of the whole sector, the same results but in

different banking systems have also Bunda, Desquilbet (2008). Dissimilar results could be caused by the different method for measurement liquidity. Bunda, Desquilbet (2008) and Vodová (2011a) used liquidity ratios, this article worked with liquidity flows. Despite this fact, the signs of the relations are the same as the signs of the relations for the group of medium-sized banks, it means positive influence with inflation, and negative with GDP and unemployment.

The strategy plays the crucial role of the banks behavior, it is determined by the size of the bank. This particular strategy leads to the different characteristics and the behavior of each group of banks in the sector. And this different behavior and characteristics are a sign that it is not always possible to set regulatory measures uniformly across the sector.

References

Aspachs, O., Nier, E., Tiesset, M. (2005). Liquidity, banking regulation and the macroeconomy. Evidence on bank liquidity holdings from a panel of UK-resident banks. BIS papers.

Berger, A. N., Bouwman, C. H. S. (2008). Financial Crises and Bank Liquidity Creation. Federal Reserve Bank of Cleveland.

BIS. 2010. Basel III: International framework for liquidity risk measurement, standard and monitoring. Basel: Bank for International Settlements.

Bunda, I., Desquilbet, J. B. (2008). The bank liquidity smile across exchange rate regimes. *International Economic Journal*, vol. 22, no. 3, 361–386.

CNB. (2004). Financial Market Supervision Reports 2004. Prague: Czech national bank.

CNB. (2005). Financial Market Supervision Reports 2005. Prague: Czech national bank.

CNB. (2008/2009). Financial Stability Report 2008/2009. Prague: Czech national bank.

CNB. (2003–2014). Financial Market Supervision Reports. Prague: Czech national bank. Available at: http://www.cnb.cz/en/supervision_financial_market/aggregate_information_financial_sector/financial_market_supervision_reports/index.html

Cucinelli, D. (2013). The Determinants of Bank Liquidity Risk within the Context of Euro Area. *Interdisciplinary Journal of Research in Business*, vol. 2, Issue. 10, 51- 64.

Hackethal, A., Rauch, C., Steffen, S., Tyrell, M. (2010). Determinants of Bank Liquidity Creation. *Social Science Research Network*.

Horvath, R., Seidler, J., Weill, L. (2013). How bank competition influence liquidity creation. *BOFIT Discussion Papers*, Issue 15/16, 4-23.

Lakštutiene, A., Krušinskas, R. (2010). Lithuanian banks liquidity creation in 2000 –2008. *Economics & Management,* 986-991.

Moore, W. (2010). How do financial crises affect commercial bank liquidity? Evidence from Latin America and the Caribbean*. MPRA Paper*, no. 21473, Munich Personal RePEc Archive.

Pana, E., Park, J., Query, T. (2010). The impact of bank mergers on liquidity creation. Journal of Risk Management in Financial Institutions, vol. 4, Issue 1, 74-96.

Valla, N., Saes-Escorbiac, B., Tiesset, M. (2006). Bank liquidity and financial stability. *Financial Stability Review,* no. 9, 89–104.

Vodová, P. (2011a). Liquidity of Czech Commercial Banks and its Determinants. *International Journal of mathematical models and methods in applied sciences,* vol. 5, no. 6, 1060–1067.

Vodová, P. (2011b). Determinants of commercial banks´ liquidity in Slovakia. *Lessons Learned from the Financial Crisis*. Proceedings of 13th International Conference on Finance and Banking.

Vodová, P. (2012). Determinants of commercial banks´ liquidity in Poland. In RAMÍK, J. and STAVÁREK, D. (eds.) *Proceedings of 30th International Conference Mathematical Methods in Economics.* Karviná: Silesian University, School of Business Administration, 962-967.

Vodová, P. (2013). Determinants of commercial banks´ liquidity in Hungary. Available at: <http://www.slu.cz/opf/cz/informace/acta-academica-karviniensia/casopisy-aak/aak-rocnik-2013/docs-1-2013/Vodova.pdf>.