Determinants of Commercial Banks' Liquidity in the Czech Republic

PAVLA VODOVÁ
Department of Finance
Silesian University in Opava, School of Business Administration in Karviná
Univerzitní nám. 1934/3, 733 40 Karviná
CZECH REPUBLIC
vodova@opf.slu.cz http://www.opf.slu.cz/kfi/eng/lide/vodova/vodova.htm

Abstract: This paper aims to identify determinants of liquidity of commercial banks in the Czech Republic. We consider bank specific and macroeconomic data over the period from 2001 to 2009 and analyze them with panel data regression analysis. We have found that bank liquidity is positively related to capital adequacy, interest rates on loans, share of non-performing loans and interest rate on interbank transaction and negatively related to inflation rate, business cycle and financial crisis. The influence of banks size is ambiguous.

Key-Words: Commercial banks, determinants of liquidity, liquidity ratios, panel data regression analysis, Czech Republic

1 Introduction

Many banks struggled to maintain adequate liquidity during global financial crisis [1]. Unprecedented levels of liquidity support were required from central banks in order to sustain the financial system. Even with such extensive support, a number of banks failed, were forced into mergers or required resolution. The crisis showed the importance of adequate liquidity risk measurement and management. Commercial banks were heavily exposed to maturity mismatch both through their balance sheet and off-balance sheet vehicles and through their increased reliance on repo financing [2]. A reduction in funding liquidity then caused significant distress. In response to the freezing up of the interbank market, the European Central Bank and U.S. Federal Reserve injected billions in overnight credit into the interbank market. Some banks needed extra liquidity supports [3].

It is evident that liquidity and liquidity risk is very up-to-date and important topic. The aim of this paper is therefore to identify determinants of liquidity of commercial banks in the Czech Republic.

2 Bank Liquidity and its Measuring

Bank for International Settlements [4] defines liquidity as the ability of bank to fund increases in assets and meet obligations as they come due, without incurring unacceptable losses. Liquidity risk arises from the fundamental role of banks in the maturity transformation of short-term deposits into long-term loans.

The term liquidity risk includes two types of risk: funding liquidity risk and market liquidity risk. Funding liquidity risk is the risk that the bank will not be able to meet efficiently both expected and unexpected current and future cash flow and collateral needs without affecting either daily operations or the financial condition of the firm. Market liquidity risk is the risk that a bank cannot easily offset or eliminate a position at the market price because of inadequate market depth or market disruption.

Liquidity risk can be measured by two main methods: liquidity gap and liquidity ratios. The liquidity gap is the difference between assets and liabilities at both present and future dates. At any date, a positive gap between assets and liabilities is equivalent to a deficit [5].

Liquidity ratios are various balance sheet ratios which should identify main liquidity trends. These ratios reflect the fact that bank should be sure that appropriate, low-cost funding is available in a short time. This might involve holding a portfolio of assets than can be easily sold (cash reserves, minimum required reserves or

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government securities), holding significant volumes of stable liabilities (especially deposits from retail depositors) or maintaining credit lines with other financial institutions. Various authors like [6], [7] or [8] provide various liquidity ratios. For the purpose of this research we will use for evaluation of liquidity positions of commercial banks in the Czech Republic following four different liquidity ratios (1) – (4):

\[ L_1 = \frac{\text{liquid assets}}{\text{total assets}} \]

The liquidity ratio \( L_1 \) should give us information about the general liquidity shock absorption capacity of a bank. As a general rule, the higher the share of liquid assets in total assets, the higher the capacity to absorb liquidity shock, given that market liquidity is the same for all banks in the sample. Nevertheless, high value of this ratio may be also interpreted as inefficiency, since liquid assets yield lower income liquidity bears high opportunity costs for the bank. Thus it is necessary to optimize the relation between liquidity and profitability.

\[ L_2 = \frac{\text{liquid assets}}{\text{deposits + short term borrowing}} \]

The liquidity ratio \( L_2 \) is more focused on the bank’s sensitivity to selected types of funding (we included deposits of households, enterprises and other financial institutions). The ratio \( L_2 \) should therefore capture the bank’s vulnerability related to these funding sources. The bank is able to meet its obligations in terms of funding (the volume of liquid assets is high enough to cover volatile funding) if the value of this ratio is 100 % or more. Lower value indicates a bank’s increased sensitivity related to deposit withdrawals.

\[ L_3 = \frac{\text{loans}}{\text{total assets}} \]

The ratio \( L_3 \) measures the share of loans in total assets. It indicates what percentage of the assets of the bank is tied up in illiquid loans. Therefore the higher this ratio the less liquid the bank is.

\[ L_4 = \frac{\text{loans}}{\text{deposits + short term financing}} \]

The last liquidity ratio \( L_4 \) relates illiquid assets with liquid liabilities. Its interpretation is the same as in case of ratio \( L_3 \): the higher this ratio the less liquid the bank is.

3 Determinants of Bank Liquidity

Although liquidity problems of some banks during global financial crisis re-emphasized the fact that liquidity is very important for functioning of financial markets and the banking sector, an important gap still exists in the empirical literature about liquidity and its measuring. Only few studies aim to identify determinants of liquidity.

Bank-specific and macroeconomic determinants of liquidity of English banks studies [9]. They assumed that the liquidity ratio as a measure of the liquidity should be dependent on following factors (estimated influence on bank liquidity in parenthesis): Probability of obtaining the support from lender of last resort, which should lower the incentive for holding liquid assets (-), interest margin as a measure of opportunity costs of holding liquid assets (-), bank profitability, which is according to finance theory negatively correlated with liquidity (-), loan growth, where higher loan growth signals increase in illiquid assets (-), size of the bank (?), gross domestic product growth as an indicator of business cycle (-), and short term interest rate, which should capture the monetary policy effect (-).

Determinants of liquidity risk of banks from emerging economies with panel data regression analysis are analysed by [10]. The liquidity ratio as a measure of bank’s liquidity assumed to be dependent on individual behaviour of banks, their market and macroeconomic environment and the exchange rate regime, i.e. on following factors: total assets as a measure of the size of the bank (-), the ratio of equity to assets as a measure of capital adequacy (+), the presence of prudential regulation, which means the obligation for banks to be liquid...
enough (+), the lending interest rate as a measure of lending profitability (-), the share of public expenditures on
gross domestic product as a measure of supply of relatively liquid assets (+), the rate of inflation, which
increases the vulnerability of banks to nominal values of loans provided to customers (+), the realization of a
financial crisis, which could be caused by poor bank liquidity (-), and the exchange rate regime, where banks in
countries with extreme regimes (the independently floating exchange rate regime and hard pegs) were more
liquid than in countries with intermediate regimes.

The empirical analysis of the hypothesis that interest rates affect banks’ risk taking and the decision to hold
liquidity across European countries provides [11]. The liquidity measured by different liquidity ratios should be
influenced by: behaviour of the bank on the interbank market – the more liquid the bank is the more it lends in
the interbank market (+), interbank rate as a measure of incentives of banks to hold liquidity (+), monetary
policy interest rate as a measure of banks ability to provide loans to customers (-), share of loans on total assets
and share of loan loss provisions on net interest revenues, both as a measure of risk-taking behavior of the
bank, where liquid banks should reduce the risk-taking behavior (-), and bank size measured by logarithm of
total bank assets (+).

The effects of the financial crisis on the liquidity of commercial banks in Latin America and Caribbean
countries investigated [6]. Liquidity should depend on: cash requirements of customers, captured by
fluctuations in the cash-to-deposit ratio (-), current macroeconomic situation, where a cyclical downturn should
lower banks’ expected transactions demand for money and therefore lead to decreased liquidity (+), and money
market interest rate as a measure of opportunity costs of holding liquidity (-).

Liquidity created by Germany’s state-owned savings banks and its determinants has been analyzed by [12].
According to this study, following factors can determine bank liquidity: monetary policy interest rate, where
tightening monetary policy reduces bank liquidity (-), level of unemployment, which is connected with demand
for loans (-), savings quota (+), level of liquidity in previous period (+), size of the bank measured by total
number of bank customers (-), and bank profitability (-).

Entirely unique is the approach of [13]. They considered these determinants of liquidity: level of economic
output (+), discount rate (+), reserve requirements (?), cash-to-deposit ratio (-), rate of depreciation of the black
market exchange rate (+), impact of economic reform (-), and violent political incidence (+).

Studies cited above suggest that commercial banks’ liquidity is determined both by bank specific factors
(such as size of the bank, profitability, capital adequacy and factors describing risk position of the bank) as well
as macroeconomic factors (such as different types of interest rates, interest margin or indicators of economic
environment). It can be useful to take into account some other influences, such as the realization of financial
crisis, changes in regulation or political incidents.

4 Methodology and Data
In order to identify determinants of liquidity of Czech commercial banks, the panel data regression analysis is
used. For each liquidity ratio, we estimate following equation:

\[ L_{it} = \alpha + \beta' X_{it} + \delta_i + \epsilon_{it} \]

where \( L_{it} \) is one of four liquidity ratios\(^2\) for bank \( i \) in time \( t \), \( X_{it} \) is a vector of explanatory variables for bank \( i \) in
time \( t \), \( \alpha \) is constant, \( \beta' \) are coefficient which represents the slope of variables, \( \delta_i \) denotes fixed effects in bank
\( i \) and \( \epsilon_{it} \) is the error term.

It is evident that the most important task is to choose the appropriate explanatory variables. The selection of
variables was based on previous relevant studies. We considered whether the use of the particular variable
makes economical sense in Czech conditions. For this reason, we excluded from the analysis variables such as
political incidents, impact of economic reforms or the exchange rate regime. We also considered which other
factors could influence the liquidity of banks in the Czech Republic. The limiting factor then was the
availability of some data. Table 1 shows a list of variables which we have used in regression analysis.

\(^2\) Liquidity ratios \( L_1 - L_4 \) were calculated according to (1) – (4).
We consider four bank specific factors and eight macroeconomic factors. As it can be seen from Table 1, we expect that three factors could have positive impact on bank liquidity, the rest of factors are expected to have negative impact on bank liquidity. Macroeconomic data were provided by International Financial Statistics of International Monetary Fund (IMF). Bank specific data were obtained from annual reports of Czech banks. We used unconsolidated balance sheet and profit and loss data over the period from 2001 to 2009. The panel is unbalanced as some of the banks do not report over the whole period of time.

Table 2 shows more details about the sample. As it includes most of the Czech banking sector (not only by the number of banks, but also by their share on total banking assets), we used fixed effects regression.

### 5 Results

We use an econometric package EViews 7. After tests of stationarity, we proceed with regression estimation. We estimate (5) separately for each of four defined liquidity ratios. We gradually change the content of the vector of explanatory variables \( X_t \). The aim is to find a model which has a high adjusted coefficient of determination and simultaneously the variables used are statistically significant. As it can be seen from following tables, results of the analysis suggest that each liquidity ratio is determined by different factors.

If we measure liquidity with ratio \( L_1 \), we find determinants of liquidity in Table 3. The explanatory power of this model is very high; however, signs of coefficients mostly do not correspond with our expectations. The positive influence of the share of capital on total assets is consistent with the assumption that bank with sufficient capital adequacy should be liquid, too. The negative impact of financial crisis has been mentioned above. However, influence of other factors is opposite than we expected. Inflation rate has negative impact on bank liquidity. It seems that inflation deteriorates overall macroeconomic environment and thus lowers bank...
liquidity. Positive effect of interest rate on loans can be quite surprising. It highlights the fact that higher lending rates do not encourage banks to lend more. This is consistent with the problem of credit crunch and credit rationing, whose presence in the Czech banking sector has been proved in [14]. Although we estimated negative influence of non-performing loans, results of the analysis show the opposite effect. This could be a sign of prudent policy of banks: they offset the higher credit risk with cautious liquidity risk management.

Table 3: Determinants of liquidity measured by L1 and L2

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. deviation</th>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>-32.22911**</td>
<td>14.30259</td>
<td>C</td>
<td>-8785.403*</td>
<td>1826.702</td>
</tr>
<tr>
<td>CAP</td>
<td>0.394122*</td>
<td>0.111375</td>
<td>CAP</td>
<td>24.23011*</td>
<td>6.648880</td>
</tr>
<tr>
<td>FIC</td>
<td>-12.18207*</td>
<td>3.457011</td>
<td>INF</td>
<td>-62.56230**</td>
<td>28.13294</td>
</tr>
<tr>
<td>INF</td>
<td>-2.422175*</td>
<td>0.648306</td>
<td>IRL</td>
<td>355.5998*</td>
<td>115.6788</td>
</tr>
<tr>
<td>IRL</td>
<td>10.46715*</td>
<td>2.525620</td>
<td>TOA</td>
<td>605.0599*</td>
<td>118.2894</td>
</tr>
<tr>
<td>NPL</td>
<td>0.544098**</td>
<td>0.217598</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Adjusted $R^2$: 0.750647
Total obs.: 135

Table 4: Determinants of liquidity measured by L3 and L4

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. deviation</th>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>60.22954*</td>
<td>3.819548</td>
<td>C</td>
<td>-26529.85*</td>
<td>5521.369</td>
</tr>
<tr>
<td>CAP</td>
<td>-0.260495**</td>
<td>0.108074</td>
<td>CAP</td>
<td>-72.94792*</td>
<td>20.23211</td>
</tr>
<tr>
<td>GDP(-3)</td>
<td>1.988391*</td>
<td>0.642655</td>
<td>IRB</td>
<td>-417.6170**</td>
<td>169.2004</td>
</tr>
<tr>
<td>NPL</td>
<td>-1.237575*</td>
<td>0.319411</td>
<td>IRL</td>
<td>-1055.056*</td>
<td>387.8583</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>TOA</td>
<td>1977.643*</td>
<td>367.3569</td>
</tr>
</tbody>
</table>
| Adjusted $R^2$: 0.848969
Total obs.: 87

Determinants of liquidity measured by the ratio $L_3$ are presented in Table 4. As high value of this ratio means low liquidity, these results have to be interpreted in reverse: positive sign of the coefficient means negative impact on liquidity and conversely. Explanatory power of the model is again very high. The results of the analysis show that only three factors influence the share of illiquid loans in total assets. As in case of previous ratios, the capital adequacy and the share of non-performing loans show positive relations with bank liquidity. Growth rate of gross domestic product is statistically significant with three years lag. In the context of the ratio $L_3$, this lag is in accordance with the philosophy that companies must make a profit first to have sufficient creditworthiness and to be able to get a loan. The positive coefficient on GDP growth rate signals that according to our expectations, liquidity tends to be inversely related to the business cycle. Most borrowers want to take a loan during expansion when they have valuable investments projects. Banks which would like to satisfy the growing demand for loans would face lower liquidity. During economic downturn, lending opportunities are not so good so banks hold higher share of liquid assets.

3 The starred coefficient estimates are significant at the 1 % (*) or 5 % (**) level.
Table 4 shows also determinants of liquidity measured by the last liquidity ratio $L_4$. The last model has a high explanatory power. Capital adequacy and interest rate on loans have the same impact on bank liquidity as in case of ratio $L_1$. In accordance with our expectation, interest rate on interbank transaction is positively related with bank liquidity. Higher interbank interest rate encourages banks to invest money on the interbank market and balances with other banks are a part of liquid bank assets. So far, effects of individual factors have been entirely consistent. However, the relation between the size of the bank and its liquidity in this model completely differs from that described in Table 3. The results of this last model suggest that small banks are more liquid than big banks. This finding fully corresponds to the well known “too big to fail” hypothesis. If big banks are seeing themselves as “too big to fail”, their motivation to hold liquid assets is limited. In case of a liquidity shortage, they rely on a liquidity assistance of Lender of Last Resort.

6 Conclusion
The aim of this paper was to identify determinants of liquidity of commercial banks in the Czech Republic. We have used the panel data regression analysis for four liquidity ratios. The results of models enable us to make following conclusions. Bank liquidity increases with higher capital adequacy, higher interest rates on loans, higher share of non-performing loans and higher interest rate on interbank transaction. In contrast, financial crisis, higher inflation rate and growth rate of gross domestic product have negative impact on bank liquidity. The relation between the size of the bank and its liquidity is ambiguous. It could be useful to divide banks into groups according to their size and to estimate determinants of liquidity separately for small, medium-sized and large banks. We also found that unemployment, interest margin, bank profitability and monetary policy interest rate have no statistically significant effect on the liquidity of Czech commercial banks.

References: