

A Service of



Leibniz-Informationszentrum Wirtschaft Leibniz Information Centre for Economics

Horvath, Roman; Seidler, Jakub; Weill, Laurent

### Working Paper How bank competition influence liquidity creation

BOFIT Discussion Papers, No. 16/2013

**Provided in Cooperation with:** Bank of Finland, Helsinki

*Suggested Citation:* Horvath, Roman; Seidler, Jakub; Weill, Laurent (2013) : How bank competition influence liquidity creation, BOFIT Discussion Papers, No. 16/2013, ISBN 978-952-6699-19-6, Bank of Finland, Institute for Economies in Transition (BOFIT), Helsinki, https://nbn-resolving.de/urn:nbn:fi:bof-201408072068

This Version is available at: https://hdl.handle.net/10419/212771

#### Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

#### Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.



## WWW.ECONSTOR.EU

BOFIT Discussion Papers 16 • 2013

Roman Horvath, Jakub Seidler and Laurent Weill

How bank competition influence liquidity creation



EUROJÄRJESTELMÄ EUROSYSTEMET Bank of Finland, BOFIT Institute for Economies in Transition BOFIT Discussion Papers Editor-in-Chief Laura Solanko

BOFIT Discussion Papers 16/2013 19.6.2013

Roman Horvath, Jakub Seidler and Laurent Weill: How bank competition influence liquidity creation

ISBN 978-952-6699-19-6 ISSN 1456-5889 (online)

This paper can be downloaded without charge from http://www.bof.fi/bofit.

Suomen Pankki Helsinki 2013

# Contents

| Abs | stract |   | 4  |
|-----|--------|---|----|
| 1   | Introd | luction   | 5  |
| 2   | Metho  | odology   | 7  |
|     | 2.1    | Data  | 7  |
|     | 2.2    | Lerner indices  | 7  |
|     | 2.3    | Measures of banks' liquidity creation                   | 9  |
|     | 2.4    | The relation between competition and liquidity creation | 10 |
| 3   | Resul  | ts  | 12 |
| 4   | Concl  | luding remarks  | 13 |
| Ref | erence | s   | 15 |
| Tab | les    |   | 17 |

### Roman Horvath, Jakub Seidler and Laurent Weill

### How bank competition influence liquidity creation

### Abstract

This paper evaluates the effect of bank competition on liquidity creation by banks. Thus, we contribute to the literature on both bank competition and the determinants of liquidity creation by banks. To explore this relationship, we conduct dynamic GMM panel estimations on a dataset of Czech banks from 2002 to 2010. We find that enhanced competition reduces liquidity creation, a finding we observe under different specifications, including alternative measures of liquidity creation. We explain this finding in terms of the impact of increased bank competition on the financial fragility of banks, which leads banks to reduce their lending and deposit activities. The evidence suggests that pro-competitive policies in the banking industry can reduce liquidity provision by banks.

JEL Codes: G21.

Keywords: bank competition, liquidity creation.

Roman Horvath, Charles University, Prague, and IOS Regensburg. Email: roman.horvath@gmail.com Jakub Seidler, Czech National Bank and Charles University, Prague. Email: jakub.seidler@cnb.cz

**Laurent Weill**, EM Strasbourg Business School, University of Strasbourg. Corresponding author. Address : Institut d'Etudes Politiques, Université de Strasbourg, 47 avenue de la Forêt Noire, 67082 Strasbourg Cedex. Phone : 33–3–68–85–81–38. Fax : 33–3–68–85–86–15. Email: laurent.weill@unistra.fr

We acknowledge the support from the Grant Agency of the Czech Republic P402/12/G097.

## 1 Introduction

The increasing globalization of banking activities has brought to the foreground a debate about the role of competition in the banking industry. The effects of bank competition on access to credit (e.g., Beck, Demirgüc-Kunt and Maksimovic, 2004), financial stability (e.g., Berger, Klapper and Turk-Ariss, 2009; Beck, De Jonghe and Schepens, 2013; Fungacova and Weill, 2013) and economic growth (e.g., Cetorelli and Gambera, 2001; Claessens and Laeven, 2005) have now been extensively studied.

However, the burgeoning literature on bank competition has not, to our knowledge, examined the impact of bank competition on liquidity provision by banks. Apart from risk transformation, the central function of banks is to supply liquidity to the economy. Banks create liquidity by financing relatively illiquid assets with relatively liquid liabilities, i.e., by using short-term liquid deposits to finance long-term illiquid lending. In doing so, they contribute to financing economic activity and facilitate transactions among economic agents. For many years, this role of banks has largely been ignored in the empirical literature, in contrast to their role in risk transformation. However, a seminal paper by Berger and Bouwman (2009) proposes a novel approach to the measurement of bank liquidity creation, an approach that has led to an emerging strand of literature devoted to the measurement, causes and consequences of liquidity creation by banks.<sup>1</sup>

The aim of this paper is to investigate how bank competition influences liquidity creation by banks. We thus contribute to both recent strands of the literature focused on bank competition and on bank liquidity creation.

Two opposing hypotheses can be suggested regarding the impact of bank competition on liquidity creation. The first is that increased competition increases the fragility of banks by reducing bank profits, which normally act as a "buffer" against adverse shocks. As a consequence, banks are incentivized to reduce liquidity creation by limiting both the volume of loans granted and the volume of deposits accepted to reduce the threat of bank runs. Thus, according to this "fragility channel" view, bank competition should lead to a reduction in liquidity creation. The fragility channel view is reinforced by Petersen and Rajan (1995), who argue that increased competition reduces credit supply, as banks are less likely to grant credit to clients that are not locked in. The idea is that decreased market

<sup>&</sup>lt;sup>1</sup> Among others, Berger and Bouwman (2011) examine the role of liquidity creation in financial crises, while Berger and Bouwman (2009), Distinguin, Roulet and Tarazi (2013) and Horvath, Seidler and Weill (2013) investigate the relationship between capital and liquidity creation.

power reduces incentives for banks to establish long-term relationships with new borrowers, relationships that could create future surpluses to be shared.

The second hypothesis regarding the effect of back competition on liquidity creation is that increased competition influences banking pricing policies – specifically, leading to diminished loan rates and increased deposit rates. As a consequence, demand for both loans and deposits rises. Several studies provide empirical support for a link between competition and low lending rates (e.g. Carbo-Valverde, Rodriguez Fernandez and Udell, 2009; Love and Martinez Peria, 2012). Enhanced competition stimulates demand for loans by alleviating financing obstacles. Beck, Demirgüc-Kunt and Maksimovic (2004) provide empirical support for this argument in their finding that increased bank concentration increases financing obstacles in general, while Hainz, Weill and Godlewski (2013) show that increased concentration is associated with higher collateral requirements. Thus, the "price channel" view suggests a positive link between competition and liquidity creation.

We analyze the relationship between bank competition and liquidity creation, using an exhaustive dataset of Czech banks, from 2002 to 2010, provided by the Czech National Bank. We restrict our study to a single country, as the measurement of liquidity creation, following Berger and Bouwman's (2009) methodology, requires very detailed banklevel data, including off-balance sheet items. As a consequence, cross-country databases, such as Bankscope, would not be suitable, as they do not provide bank-level information at a sufficient level of disaggregation.<sup>2</sup> The quarterly frequency of the data allows for the use of dynamic GMM estimation, enabling us to avoid endogeneity problems. In addition, the use of an exhaustive dataset of banks reduces the possibility of selection bias.

We measure bank competition using the Lerner index, which is an individual measure of competition commonly used in recent studies (Turk-Ariss, 2010; Fungacova and Weill, 2013). In comparison with concentration indices, the Lerner index has the major advantage of capturing the effective behavior of banks rather than assuming that concentration is negatively correlated with competition. In addition, the Lerner index enables us to exploit bank-level variations in market power in our estimations.

The Czech banking industry is an interesting case for our study. The Czech Republic has been an EU member since 2004, yet possesses certain key characteristics of an emerging country, such as a dominant role for the banking system in the financing of the

 $<sup>^{2}</sup>$  For instance, the disaggregation of loans by category or by maturity, which is required in the computation of liquidity creation measures, is not provided in the Bankscope database for most banks.

economy and a high market share of foreign-owned banks. According to the figures from Czech National Bank, the depth of financial intermediation (measured as the ratio of total financial sector assets to GDP) reached 156%, while the ratio of banking sector assets to GDP was nearly 115% at the end of 2010. About 97% of banking assets are owned by foreign capital.

The impact of bank competition on liquidity creation is of great interest because of its implications for policy. While regulators may be incentivized to favor bank competition to increase the welfare of bank consumers, any result suggesting a liquidity-destroying role of bank competition would indicate the existence of a policy trade-off. Thus, in this study, we seek to improve our understanding of the determinants of liquidity creation and the consequences of bank competition.

The remainder of this paper is structured as follows. Section 2 explains the methodology. Empirical results are presented in Section 3. Section 4 concludes.

## 2 Methodology

### 2.1 Data

We use quarterly data, from the Czech National Bank, for all Czech banks operating during the 2002–2010 period. All data are from balance sheets reported by banks to the Banking Supervision of the central bank. We do not include branches of foreign banks but only Czech legal entities. Branches of foreign banks are typically very small and only represent about 10% of total assets of the Czech banking industry. We thus have a sample of 31 banks. Descriptive statistics of the main variables used to compute Lerner indices and liquidity creation measures are presented in Table 1.

### 2.2 Lerner indices

Tools used to measure bank competition can be divided into the traditional IO and the new empirical IO approaches. The traditional IO approach proposes tests of market structure to assess bank competition based on the Structure Conduct Performance (SCP) model. The SCP hypothesis states that increased concentration causes less competitive behavior among banks and leads to higher bank profitability. Competition can then be measured by concen-

tration indices such as the market share of the largest banks or by the Herfindahl-Hirschman index. However, concentration has been shown to be a poor measure of bank competition (e.g., Bikker, Shaffer and Spierdijk, 2012). The new empirical IO approach provides non-structural tests to circumvent the problems associated with the competition measures based on the traditional IO approach. Non-structural measures do not infer the competitive conduct of banks from an analysis of market structure but rather measure bank behavior directly.

In line with this approach, we compute the Lerner index, an individual measure of competition for each bank and each period, commonly used in recent studies of bank competition (e.g., Fang, Hasan, and Marton, 2011; Fungacova and Weill, 2013). Alternative non-structural measures include the H-statistic and the Boone indicator. These, however, provide aggregate measures of competition that are not suitable to our bank-level investigation of the relationship between competition and liquidity creation.

The Lerner index is defined as the difference between price and marginal cost, divided by price, i.e., it measures the market power of a bank to set a price above marginal cost. Thus, high values of the Lerner index are associated with significant market power. Price here is the average price of bank output (proxied by total assets). Specifically, it is the ratio of total revenues to total assets, following, e.g., Carbo et al. (2009). Marginal cost is estimated using a translog cost function with one output (total assets) and three input prices (price of labor, price of physical capital, and price of borrowed funds). Turk-Ariss (2010) applies this specification of inputs when calculating the Lerner index to banks in developing countries. We estimate a cost function, in which we include bank fixed effects, for all periods. Symmetry and linear homogeneity restrictions on input prices are imposed. The cost function is specified as follows:

$$\ln TC = \alpha_0 + \alpha_1 \ln y + \frac{1}{2} \alpha_2 (\ln y)^2 + \sum_{j=1}^3 \beta_j \ln w_j + \sum_{j=1}^3 \sum_{k=1}^3 \beta_{jk} \ln w_j \ln w_k + \sum_{j=1}^3 \gamma_j \ln y \ln w_j + \varepsilon \quad (1)$$

where *TC* denotes total cost, *y* is total assets,  $w_1$  is the price of labor (the ratio of staff expenses to the number of employees),  $w_2$  the price of physical capital (the ratio of the sum of general and administrative expenses, depreciation and other operating expenses, divided by fixed assets),  $w_3$  is the price of borrowed funds (the ratio of the costs of borrowed funds to borrowed funds). Thus, total cost is the sum of staff expenses, general and administrative expenses, and costs of borrowed funds. The

indices for each bank have been excluded from the presentation for the sake of simplicity. The estimated coefficients of the cost function are then used to compute the marginal cost (MC):

$$MC = \frac{TC}{y} \left( \alpha_1 + \alpha_2 \ln y + \sum_{j=1}^{3} \gamma_j \ln w_j \right)$$
(2)

Once marginal cost is estimated and the price of output computed, we can calculate the Lerner index for each bank and each period, thus obtaining the direct measure of bank competition used in the estimations. Lerner indices for each year are presented in Table 2.

Two main findings emerge from the analysis of these measures. First, the values of Lerner indices are high in comparison to what is observed for other countries, suggesting a low degree of competition in the Czech banking industry. Carbo et al. (2009) observe mean Lerner indices at the country level ranging from 11% to 22% for EU countries. However, Fungacova, Pessarossi and Weill (2012) find a mean Lerner index among Chinese banks of 37.8%. In their analysis of the link between competition and cost efficiency in the Czech banking industry, Pruteanu-Podpiera, Weill and Schobert (2008) measure bank competition in the 1994–2005 period, using Lerner indices. For the latter years of their study, they obtain average Lerner indices of around 43%, which accord with the high values that we find.

Second, the evolution of the mean Lerner index shows a stable level of bank competition over the sample period, with yearly means ranging from 49% to 55%. This suggests that no big changes have occurred in the market structure of the Czech banking industry during the period of our study. This finding is in line with the observation that large Czech banks were privatized before the beginning of our study period.

### 2.3 Measures of banks' liquidity creation

We follow Berger and Bouwman's (2009) methodology in classifying balance sheet items as liquid, semi-liquid, or illiquid. Once all of the balance-sheet items are classified, we assign them weights according to Berger and Bouwman's (2009) four measures of liquidity creation and calculate the measures by summing all weighed items. Their specifications classify all items, except loans, by combining information on both product category and

maturity, while loans are classified based purely on category or maturity ("cat" or "mat" measures). In addition, off-balance-sheet items are either included or excluded ("fat" or "nonfat" measures).

Following Horvath, Seidler and Weill (2013), we classify items based only on maturity, as our data set provides detailed information that allows us to consider on- and offbalance-sheet items by maturity, not by category. Hence, in Berger and Bouwman's (2009) terminology, we consider the "mat fat" and the "mat nonfat" liquidity creation measures. It should be stressed that we expand upon their classification, as they classify only loans by maturity, while we classify all balance sheet items by their remaining maturity.

For the purposes of our analysis, we label these measures broad and narrow liquidity creation, respectively. The broad measure of liquidity creation is our preferred measure because it accounts for off-balance-sheet items that can also provide liquidity. We nonetheless also consider the narrow measure of liquidity creation in our analysis, as it provides a relevant means of testing the robustness of our conclusions. Table 3 provides a detailed description of the classifications, while Table 4 presents the means of the liquidity creation measures by year.

We observe a strong rise in liquidity creation using both measures. The mean ratio of liquidity creation to assets has increased between 2002 and 2010 from 7% to 28% under the broad measure and from 9% to 32% under the narrow measure. A detailed analysis of the path of liquidity creation shows a strong expansion between 2002 and 2008 followed by stabilization between 2008 and 2010. The financial crisis has not caused a reduction in liquidity creation among Czech banks, but it does appear to have occasioned a halt in the growth of liquidity creation. Broadly, this accords with the fact that Czech banks remained largely stable during the financial crisis, requiring no government support and exhibiting high levels of profitability and liquidity (Czech National Bank, 2012), unlike many other European banks.

### 2.4 The relation between competition and liquidity creation

To analyze the relationship between competition and liquidity creation, we estimate the following equation:

$$LiquidityCreation_{i,t} = f(Lerner Index_{i,lag}, LiquidityCreation_{i,lag}, Z_{i,t}) + e_{i,t}$$
(3)

where the subscript *i* denotes bank *i*, *t* denotes the time dimension, *Z* represents the control variables, and  $e_{i,t}$  is an error term. *LiquidityCreation* is the ratio of liquidity creation to assets. We use the broad and narrow measures of liquidity creation to test the robustness of our results. The *Lerner Index* is our measure of bank market power.

We estimate this equation using GMM estimators, so that we can take into account potential issues of endogeneity and omitted variables, following Arellano and Bover (1995) and Blundell and Bond (1998). Horvath, Seidler and Weill (2013) proceed in the same manner in their analysis of the relationship between capital and liquidity creation among Czech banks. This approach has also been applied by Fiordelisi, Marques-Ibanez and Molyneux (2011) to analyze risk in the European banking industry. We consider four lags to be reasonable, given the quarterly frequency of our data.

We consider several control variables in our estimations, where the selection of these variables is based on Berger and Bouwman (2009) and Horvath, Seidler and Weill (2013), who measure liquidity creation by US banks and Czech banks, respectively.

A first group of control variables consists of bank-level variables. Specifically, we take different dimensions of risk into account using four variables: *Earnings Volatility*, defined as the standard deviation of a bank's monthly returns on assets measured over the previous six months; *Credit Risk*, measured as the ratio of risk-weighted assets and off-balance-sheet activities, divided by assets; *Z-Score*, measured by the return on assets plus the ratio of equity to total assets, divided by *Earnings Volatility; NPL*, defined as the ratio of non-performing loans to total loans. We also include *Capital*, defined as the ratio of equity to total assets, as there is evidence, noted above, for a role of this variable in banks' liquidity creation. We do not use size or market share as control variables, as they are obviously strongly related to our proxy variable for competition.

A second group of control variables consists of macroeconomic variables. Specifically, we use *Inflation* (the year-on-year change in consumer prices) and *Unemployment* (the unemployment rate) to control for the macroeconomic environment. Data for these variables come from the Czech Statistical Office.

11

## 3 Results

We present our estimations on both the broad and narrow measures of liquidity creation in Table 5. As noted above, the broad measure of liquidity creation is our preferred one, as it is the most comprehensive measure. However, we use the narrow measure to check the robustness of our regression results. In addition, we test two alternative sets of control variables by including or excluding the macroeconomic control variables *Inflation* and *Unemployment*, so that we can examine their potential influence on the findings.

The major finding is the positive and significant coefficient for the Lerner index. We obtain this result with both sets of control variables and both measures of liquidity creation. We thus observe that greater market power enhances liquidity creation. As a consequence, our estimations clearly support the prediction that bank competition reduces liquidity creation.

This result accords with the hypothesis that competition undermines liquidity creation by increasing the fragility of banks. In particular, increased competition diminishes profits and thus weakens banks' protections against negative shocks. Given reduced profitability, banks have lower incentives to create liquidity, as a higher volume of loans increases potential loan losses and a higher volume of deposits increases sensitivity to bank runs. Thus, we provide evidence that increased bank competition can have detrimental economic effects by reducing liquidity creation of banks.

Regarding the control variables, we observe that *Credit Risk* and *Z-score*, with negative and positive coefficients, respectively, are the only bank-level variables that are significant in both estimations. These findings accord with the view that reduced risk enhances liquidity creation.

We now turn to additional estimations, also displayed in Table 5, using the narrow measure of liquidity creation. Under this specification, we again find a positive and significant influence of the Lerner index on liquidity creation, a result observed both with the macroeconomic control variables both included and excluded. Thus, our main conclusion, that market power of banks favors liquidity creation, is not influenced by inclusion or exclusion of off-balance sheet items in the liquidity creation measure.

We check the robustness of our results in two ways. The results of the robustness tests are displayed in Table 6.

12

As the number of lags can influence the results, we try an alternative specification, using six lags of the Lerner index instead of four. Under the alternative specification, we again observe a positive and significant effect of the Lerner index on liquidity creation for both measures of liquidity creation. Hence, these results corroborate those obtained with four lags.

Second, as financial crises can influence the relationship between competition and liquidity creation through its effects on the latter, we restrict our sample data to 2000–2007, thereby excluding the period of the financial crisis from the analysis. Again, we find that the Lerner index exerts a positive effect on liquidity creation, suggesting that increased bank competition is likely to lead to less liquidity creation.

Our main result is thus confirmed by robustness tests, supporting the view of the liquidity-destroying effect of bank competition.<sup>3</sup>

## 4 Concluding remarks

This paper examines the relationship between bank competition and liquidity creation by banks. We find that increased bank competition reduces liquidity creation. We interpret this result in terms of the effect of competition in increasing bank fragility, which reduces banks' incentives to create liquidity.

Our results, which shed light on the debate over the economic effects of bank competition, send two important messages to policymakers. First, bank competition can have detrimental economic effects. In other words, there is a trade-off between the positive effects of competition on consumer welfare, stemming from lower margins, and the negative effects of competition on liquidity creation. Second, regulation of bank competition cannot be considered independently of monetary policy. In particular, if bank competition plays a role in liquidity creation, authorities in charge of policies that influence the financing of the economy cannot ignore the impact of market structure on banking activities.

Our investigation represents, of course, a first analysis of the relationship between competition and liquidity creation. Thus, our results are not generalizable in all respects, as we focus on just one country. But the need to use detailed data in this analysis and the ab-

<sup>&</sup>lt;sup>3</sup> We also estimated simple correlation coefficients between the Lerner index and our measures of liquidity creation for all banks as well as separately for large and small banks. The correlation coefficients were always positive and statistically significant at the 5% level and varied between 0.1 and 0.45, depending on the measure of liquidity creation, the number of lags of the Lerner index and size of the bank.

sence of previous studies of this issue make our results relevant to an understanding of the effects liquidity-creating effects of bank competition. We hope that further research in other fields of investigation will deepen our understanding of this issue.

## References

- Arellano, M. and O. Bover, 1995. Another Look at the Instrumental-Variable Estimation of Error-Components. Journal of Econometrics 68, 29–52.
- Beck, T., De Jonghe, O. and G. Schepens, 2013. Bank Competition and Stability: Cross-Country Heterogeneity. Journal of Financial Intermediation 22, 218–244.
- Beck, T., Demirgüc-Kunt A. and V. Maksimovic, 2004. Bank Competition and Access to Finance: International Evidence. Journal of Money, Credit and Banking 36, 3, 627–654.
- Berger, A., and C. Bouwman, 2009. Bank Liquidity Creation. Review of Financial Studies 22, 3779–3837.
- Berger, A. and C. Bouwman, 2011. Bank Liquidity Creation, Monetary Policy, and Financial Crises. Working Paper, Wharton Financial Institutions Center.
- Berger, A., Klapper, L. and R. Turk-Ariss, 2009. Bank Competition and Financial Stability. Journal of Financial Services Research 21, 849–870.
- Bikker, J., Shaffer, S. and L. Spierdijk, 2012. Assessing Competition with the Panzar-Rosse Model: The Role of Scale, Costs, and Equilibrium. Review of Economics and Statistics, 94, 4, 1025–1044.
- Blundell, R. and S. Bond, 1998. Initial Conditions and Moment Restrictions in Dynamic Panel Data Models. Journal of Econometrics 87, 115–143.
- Carbo, S., Humphrey, D., Maudos, J. and P. Molyneux, 2009. Cross-Country Comparisons of Competition and Pricing Power in European Banking. Journal of International Money and Finance 28, 115–134.
- Carbo-Valverde, S., Rodriguez Fernandez, F. and G. Udell, 2009. Bank Market Power and SME Financing Constraints. Review of Finance 13, 309–340.
- Cetorelli, N. and M. Gambera, 2001. Banking Market Structure, Financial Dependence, and Growth: International Evidence from Industry Data. Journal of Finance 56, 2, 617–648.
- Claessens, S. and L. Laeven, 2005. Financial Dependence, Banking Sector Competition and Economic Growth. Journal of the European Economic Association 3, 1, 179– 207.
- Czech National Bank, 2012. Financial Stability Report.
- Distinguin, I., Roulet, C. and A. Tarazi, 2013. Bank Regulatory Capital and Liquidity: Evidence from US and European Publicly Traded Banks. Journal of Banking and Finance (forthcoming).
- Fang, Y., Hasan, I. and K. Marton, 2011. Bank Efficiency in South-Eastern Europe. Economics of Transition 19, 3, 495–520.
- Fiordelisi F., Marques-Ibanez D. and P. Molyneux, 2011. Efficiency and Risk in European Banking. Journal of Banking and Finance, 35, 1315–1326.

- Fungacova, Z., Pessarossi, P. and L. Weill, 2012. Is Bank Competition Detrimental to Efficiency? Evidence from China. BOFIT Discussion Paper n°31/2012, Bank of Finland.
- Fungacova, Z., and L. Weill, 2013. How Market Power Influences Bank Failures. Economics of Transition 21, 2, 301–322.
- Hainz, C., Weill, L. and C. Godlewski, 2013. Bank Competition and Collateral: Theory and Evidence. Journal of Financial Services Research (forthcoming).
- Horvath, R., Seidler, J. and L. Weill, 2013. Bank Capital and Liquidity Creation: Granger-Causality Evidence. Journal of Financial Services Research (forthcoming).
- Love, I. and M. Martinez Peria, 2012. How Bank Competition Affects Firms'Access to Finance. World Bank Policy Research Working Paper 6163.
- Petersen, M. and R. Rajan, 1995. The Effect of Credit Market Competition on Lending Relations. Quarterly Journal of Economics 110, 2, 407–443.
- Pruteanu-Podpiera, A., Schobert, F. and L. Weill, 2008. Banking Competition and Cost Efficiency: A Micro-Data Analysis on the Czech Banking Industry. Comparative Economic Studies 50, 2, 253–273.
- Turk-Ariss, R., 2010. On the Implications of Market Power in Banking: Evidence from Developing Countries. Journal of Banking and Finance 34, 4, 765–775.
- Windmeijer, F., 2005. A finite sample correction for the variance of linear efficient twostep GMM estimators. Journal of Econometrics 126, 25–51.

## Tables

Table 1Descriptive statistics

| Variable                  | Mean  | Std. Dev. |
|---------------------------|-------|-----------|
| Assets                    | 102   | 173       |
| Loans                     | 42.5  | 69.5      |
| NPL                       | 5.83  | 7.97      |
| Credit risk               | 41.24 | 43.56     |
| Capital                   | 0.08  | 0.11      |
| Earnings volatility       | 0.34  | 0.91      |
| Z-score                   | 11.18 | 16.87     |
| Price                     | 0.05  | 0.02      |
| Marginal cost             | 0.03  | 0.01      |
| Unemployment              | 7.19  | 1.28      |
| Inflation                 | 2.68  | 1.94      |
| Price of labour           | 910   | 489       |
| Price of physical capital | 6.45  | 12.18     |
| Price of borrowed funds   | 0.025 | 0.012     |
| Total cost                | 4 096 | 6 577     |
| Revenues                  | 6.056 | 10.6      |

This table displays the mean and the standard deviation for all variables used to compute the Lerner indices or as control variables in the estimations. Assets, Loans, Total cost, and Revenues are in billion CZK. Price is the ratio of revenues to assets. Marginal cost is estimated using a translog cost function with one output (assets) and three input prices (price of labor, price of physical capital, and price of borrowed funds). Price of labor is the ratio of staff expenses to number of employees. Price of physical capital is the ratio of the sum of general and administrative expenses, depreciation and other operating expenses, divided by fixed assets. Price of borrowed funds is the ratio of expenses for borrowed funds to borrowed funds. Total cost is the sum of staff expenses, general and administrative expenses, depreciation, other operating expenses, and expenses for borrowed funds. Earnings Volatility is the standard deviation of a bank's monthly return on assets measured over the previous six months. Credit Risk is the ratio of risk-weighted assets and off-balance-sheet activities divided by assets. Z-Score is the return on assets plus the ratio of equity to total assets divided by Earnings Volatility. NPL is the ratio of nonperforming loans to loans. Capital is the ratio of equity to total assets.

#### Table 2 Lerner indices

| Year | Mean | Std. Dev. |
|------|------|-----------|
| 2002 | 0.49 | 0.11      |
| 2003 | 0.52 | 0.12      |
| 2004 | 0.51 | 0.11      |
| 2005 | 0.51 | 0.13      |
| 2006 | 0.51 | 0.13      |
| 2007 | 0.51 | 0.12      |
| 2008 | 0.49 | 0.12      |
| 2009 | 0.51 | 0.14      |
| 2010 | 0.55 | 0.10      |

This table shows the mean and the standard deviation of the Lerner indices computed for each year.

| Table 3 | Description of | of classification | for liquid  | ity creation   |
|---------|----------------|-------------------|-------------|----------------|
|         | Dosonption     | n olassinoation   | ior inquiru | ity of outform |

| Assets                                 |  |                                      |  |  |  |
|--|--|--------------------------------------|--|--|--|
| Illiquid assets (weight 1/2)           | Semi-liquid assets (weight 0)            | Liquid assets (weight -1/2)          |  |  |  |
| Financial assets held for trading with | Financial assets held for trading with   | Financial assets held for trading    |  |  |  |
| maturity greater than one year         | maturity between three months and        | with maturity less than three        |  |  |  |
|  | one year                                 | months                               |  |  |  |
| Financial assets designated at fair    | Financial assets designated at fair val- | Financial assets designated at fair  |  |  |  |
| value through profit or loss with      | ue through profit or loss with maturity  | value through profit or loss with    |  |  |  |
| maturity greater than one year         | between three months and one year        | maturity less than three months      |  |  |  |
| Available-for-sale financial assets    | Available-for-sale financial assets with | Available-for-sale financial assets  |  |  |  |
| with maturity greater than one year    | maturity between three months and        | with maturity less than three        |  |  |  |
|  | one year                                 | months                               |  |  |  |
| Loans and receivables with maturity    | Loans and receivables with maturity      | Loans and receivables with maturi-   |  |  |  |
| greater than one year                  | between three months and one year        | ty less than three months            |  |  |  |
| Held to maturity investments with      | Held to maturity investments with        | Held to maturity investments with    |  |  |  |
| maturity greater than one year         | maturity between three months and        | maturity less than three months      |  |  |  |
|  | one year                                 |                                      |  |  |  |
| Derivative-hedge accounting (posi-     | Derivative-hedge accounting (positive    | Derivative-hedge accounting (posi-   |  |  |  |
| tive fair value) with maturity greater | fair value) with maturity between three  | tive fair value) with maturity less  |  |  |  |
| than one year                          | months and one year                      | than three months                    |  |  |  |
| Other assets with maturity greater     | Other assets with maturity between       | Other assets with maturity less than |  |  |  |
| than one year                          | three months and one year                | three months                         |  |  |  |
|  |  | Cash and cash balances with central  |  |  |  |
|  |  | banks                                |  |  |  |

#### Liabilities

| Illiquid liabilities (weight - <sup>1</sup> / <sub>2</sub> ) | Semi-liquid liabilities (weight 0)       | Liquid liabilities (weight ½)          |
|--|--|--|
| Financial liabilities held for trading                       | Financial liabilities held for trading   | Financial liabilities held for trading |
| with maturity greater than one year                          | with maturity between three months       | with maturity less than three          |
|  | and one year                             | months                                 |
| Financial liabilities designated at fair                     | Financial liabilities designated at fair | Financial liabilities designated at    |
| value through profit or loss with                            | value through profit or loss with ma-    | fair value through profit or loss      |
| maturity greater than one year                               | turity between three months and one      | with maturity less than three          |
|  | year                                     | months                                 |
| Financial liabilities measured at                            | Financial liabilities measured at amor-  | Financial liabilities measured at      |
| amortized cost with maturity greater                         | tized cost with maturity between three   | amortized cost with maturity less      |
| than one year  | months and one year                      | than three months                      |
| Derivative-hedge accounting (nega-                           | Derivative-hedge accounting (negative    | Derivative-hedge accounting (nega-     |
| tive fair value) with maturity greater                       | fair value) with maturity between three  | tive fair value) with maturity less    |
| than one year  | months and one year                      | than three months                      |
| Other liabilities with maturity great-                       | Other liabilities with maturity between  | Other liabilities with maturity less   |
| er than one year   | three months and one year                | than three months                      |
|  |  | Deposits, loans and other financial    |
|  |  | liabilities vis-à-vis central banks    |

#### **Off-balance-sheet items**

| Illiquid items (weight <sup>1</sup> / <sub>2</sub> ) | Semi-liquid items (weight 0)        | Liquid items (weight - <sup>1</sup> / <sub>2</sub> ) |
|--|-------------------------------------|--|
| Commitments and guarantees given                     | Commitments and guarantees given    | Commitments and guarantees given                     |
| with maturity greater than one year                  | with maturity between three months  | with maturity less than three                        |
|  | and one year                        | months   |
| Commitments and guarantees re-                       | Commitments and guarantees received | Commitments and guarantees re-                       |
| ceived with maturity greater than                    | with maturity between three months  | ceived with maturity less than three                 |
| one year   | and one year                        | months   |

This table classifies balance sheet items in terms of their liquidity, which is the basis for calculation of the liquidity creation measures. We take off-balance sheet items into account for the broad measure of liquidity creation but not the narrow measure.

|      | Liquidity creation –<br>broad measure |      | Liquidity creation –<br>narrow measure |           |
|------|---------------------------------------|------|--|-----------|
| Year | Mean Std. Dev.                        |      | Mean                                   | Std. Dev. |
| 2002 | 0.07                                  | 0.23 | 0.09                                   | 0.15      |
| 2003 | 0.09                                  | 0.27 | 0.12                                   | 0.17      |
| 2004 | 0.13                                  | 0.26 | 0.16                                   | 0.17      |
| 2005 | 0.15                                  | 0.26 | 0.18                                   | 0.17      |
| 2006 | 0.20                                  | 0.27 | 0.22                                   | 0.18      |
| 2007 | 0.24                                  | 0.27 | 0.26                                   | 0.19      |
| 2008 | 0.27                                  | 0.26 | 0.31                                   | 0.20      |
| 2009 | 0.29                                  | 0.27 | 0.32                                   | 0.20      |
| 2010 | 0.28                                  | 0.26 | 0.32                                   | 0.18      |

#### Table 4Liquidity creation measures

This table shows the mean and standard deviation for the liquidity creation measures adopted in the estimations. These measures are ratios of liquidity creation (both the broad measure and the narrow measure of liquidity creation) to total assets.

#### Table 5Main estimations

|                                  | Explained variable:<br>Liquidity creation – broad measure |           | Explained variable:<br>Liquidity creation – narrow measure |           |
|----------------------------------|---|-----------|--|-----------|
|                                  | (1)   | (2)       | (3)  | (4)       |
| LiquidityCreation <sub>t-1</sub> | 0.18*   | 0.07      | 0.30***  | 0.24*     |
| 1 2 11                           | (0.10)  | (0.14)    | (0.11)   | (0.13)    |
| LiquidityCreation <sub>t-2</sub> | -0.06   | -0.06     | 0.13**   | 0.05      |
| 1 2 22                           | (0.09)  | (0.13)    | (0.06)   | (0.08)    |
| LiquidityCreation <sub>t-3</sub> | 0.06  | 0.01      | 0.03   | 0.03      |
|                                  | (0.06)  | (0.11)    | (0.07)   | (0.09)    |
| LiquidityCreation <sub>t-4</sub> | -0.07   | -0.02     | 0.19   | 0.21**    |
|                                  | (0.07)  | (0.12)    | (0.08)   | (0.09)    |
| <i>Lerner</i> <sub>t-1</sub>     | 0.24***   | 0.18**    | 0.04   | 0.03      |
|                                  | (0.09)  | (0.08)    | (0.04)   | (0.04)    |
| Lerner <sub>t-2</sub>            | 0.64***   | 0.51***   | 0.17***  | 0.15*     |
|                                  | (0.18)  | (0.18)    | (0.06)   | (0.08)    |
| <i>Lerner</i> <sub>t-3</sub>     | 0.15**  | 0.11*     | 0.01   | 0.03      |
|                                  | (0.06)  | (0.06)    | (0.04)   | (0.04)    |
| Lerner <sub>t-4</sub>            | 0.06***   | 0.05      | 0.07***  | 0.04*     |
|                                  | (0.03)  | (0.04)    | (0.03)   | (0.02)    |
| Lerner <sub>total</sub>          | 1.09***   | 0.85***   | 0.29***  | 0.25*     |
|                                  | (0.00)  | (0.01)    | (0.01)   | (0.07)    |
| Capital                          | 1.36***   | -0.08     | -0.17  | 0.16      |
|                                  | (0.52)  | (0.66)    | (0.55)   | (0.57)    |
| NPL                              | -0.002  | -0.001    | $-0.01^{***}$  | -0.01***  |
|                                  | (0.001)   | (0.001)   | (0.002)  | (0.001)   |
| Credit risk                      | 1.2E-05   | 5.5E-05   | 2.2E-05  | 0.9E-05   |
|                                  | (0.00001)   | (0.00001) | (0.00001)  | (0.00001) |
| Z-score                          | -0.0003***  | -0.0003** | -0.0001  | -0.0001   |
|                                  | (0.0001)  | (0.0001)  | (0.0001)   | (0.0001)  |
| Earnings volatility              | -0.02   | -0.01     | 0.02**   | 0.02*     |
|                                  | (0.01)  | (0.01)    | (0.01)   | (0.01)    |
| Unemployment                     |   | 0.003     |  | -0.003*   |
|                                  |   | (0.004)   |  | (0.002)   |
| Inflation                        |   | 0.004**   |  | 0.001     |
|                                  |   | (0.002)   |  | (0.001)   |
| Observations                     | 869   | 869       | 869  | 869       |
| Sargan test                      | 13.29   | 9.98      | 22.83  | 23.51     |
| AB test AR(1)                    | -1.89*  | -1.66*    | -2.84***   | -2.39***  |
| AB test $AR(2)$                  | 0.42  | 0.48      | -0.32  | 0.53      |

We use the two-step system GMM estimator with Windmeijer's (2005) corrected standard errors (reported in brackets). \*\*\*, \*\*, and \* indicate that p is less than 0.01, 0.05, and 0.1, respectively. The Sargan/Hansen test of the overidentifying restrictions for the GMM estimators is the null hypothesis that instruments used are not correlated with the residuals, and hence the overidentifying restrictions are valid. The Arellano–Bond (AB) test for serial correlation concerns the first differenced residuals. The null hypothesis is that errors in the first difference regression do not exhibit second-order serial correlation. The variable *Lerner*<sub>total</sub> is the estimated coefficient for the test that the sum of lagged terms is not different from zero (*p*-values are reported in brackets). Constant not reported.

#### Table 6 Robustness checks

|                         | Explained variable:<br>Liquidity creation – broad measure |                      | Explained variable:<br>Liquidity creation – narrow meas |          |
|-------------------------|---|----------------------|---|----------|
|                         | (1)   | (2)                  | (3)   | (4)      |
|                         | More lags of L  | erner index include  | d (6 lags)  |          |
| Lerner <sub>total</sub> | 0.59**  | 1.27***              | 0.19**  | 0.08***  |
|                         | (0.02)  | (0.00)               | (0.04)  | (0.00)   |
| Bank controls           | Yes   | Yes                  | Yes   | Yes      |
| Macro controls          | No  | Yes                  | No  | Yes      |
| Observations            | 807   | 807                  | 807   | 807      |
| Sargan test             | 17.65   | 7.71                 | 17.16   | 7.14     |
| AB test $AR(1)$         | -2.48**   | -2.28**              | -2.11***  | -2.50*** |
| $AB \ test \ AR(2)$     | 0.29  | 0.69                 | -0.34   | 0.45     |
|                         | (5)   | (6)                  | (7)   | (8)      |
|                         | Without th  | e period of financia | l crisis  |          |
| Lerner <sub>total</sub> | 0.12**  | 0.11*                | 0.16***   | 0.20***  |
|                         | (0.03)  | (0.09)               | (0.01)  | (0.00)   |
| Bank controls           | Yes   | Yes                  | Yes   | Yes      |
| Macro controls          | No  | Yes                  | No  | Yes      |
| Observations            | 566   | 566                  | 566   | 566      |
| Sargan test             | 17.30   | 12.44                | 22.38   | 18.33    |
| AB test $AR(1)$         | -3.19***  | -2.28**              | -2.82***  | -2.88*** |
| AB test $AR(2)$         | 0.56  | -0.08                | 0.51  | -0.24    |

We use the two-step system GMM estimator with Windmeijer's (2005) corrected standard errors (reported in brackets). \*\*\*, \*\*, and \* indicate that p is less than 0.01, 0.05, and 0.1, respectively. The Sargan/Hansen test of the overidentifying restrictions for the GMM estimators is the null hypothesis that instruments used are not correlated with the residuals, and hence the overidentifying restrictions are valid. The Arellano–Bond (AB) test for serial correlation concerns the first differenced residuals. The null hypothesis is that errors in the first difference regression do not exhibit second-order serial correlation. The variable *Lerner*<sub>total</sub> is the estimated coefficient for the test that the sum of lagged terms is not different from zero (*p*-values are reported in brack-ets). Other coefficients are not reported for the sake of brevity. Columns (1)–(4) present the results with 6 lags of the Lerner index, while columns (5)–(8) present the results for the period 2000–2007, i.e., excluding the period of the financial crisis.

### **BOFIT Discussion Papers**

A series devoted to academic studies by BOFIT economists and guest researchers. The focus is on works relevant for economic policy and economic developments in transition / emerging economies.

- 2012 No 1 Walid Marrouch and Rima Turk-Ariss: Bank pricing under oligopsony-oligopoly: Evidence from 103 developing countries
  - No 2 Ying Fang, Shicheng Huang and Linlin Niu: De facto currency baskets of China and East Asian economies: The rising weights
  - No 3 Zuzana Fungáčová and Petr Jakubík: Bank stress tests as an information device for emerging markets: The case of Russia
  - No 4 Jan Babecký, Luboš Komárek and Zlatuše Komárková: Integration of Chinese and Russian stock markets with World markets: National and sectoral perspectives
  - No 5 Risto Herrala and Yandong Jia: Has the Chinese growth model changed? A view from the credit market
  - No 6 Sanna Kurronen: Financial sector in resource-dependent economies
  - No 7 Laurent Weill and Christophe Godlewski: Why do large firms go for Islamic loans?
  - No 8 Iftekhar Hasan and Ru Xie: A note on foreign bank entry and bank corporate governance in China
  - No 9 Yi Yao, Rong Yang, Zhiyuan Liu and Iftekhar Hasan: Government intervention and institutional trading strategy: Evidence from a transition country
  - No 10 Daniel Berkowitz, Mark Hoekstra and Koen Schoors: Does finance cause growth? Evidence from the origins of banking in Russia
  - No 11 Michael Funke and Michael Paetz: A DSGE-based assessment of nonlinear loan-to-value policies: Evidence from Hong Kong
  - No 12 Irina Andrievskaya: Measuring systemic funding liquidity risk in the Russian banking system
  - No 13 Xi Chen and Michael Funke: The dynamics of catch-up and skill and technology upgrading in China
  - No 14 Yin-Wong Cheung, Menzie D. Chinn and XingWang Qian: Are Chinese trade flows different?
  - No 15 Niko Korte: Predictive power of confidence indicators for the Russian economy
  - No 16 Qianying Chen, Michael Funke and Michael Paetz: Market and non-market monetary policy tools in a calibrated DSGE model for Mainland China
  - No 17 Pierre L. Siklos: No coupling, no decoupling, only mutual inter-dependence: Business cycles in emerging vs. mature economies
  - No 18 José R. Sánchez-Fung: Examining the role of monetary aggregates in China
  - No 19 Konstantins Benkovskis and Julia Wörz: Non-price competitiveness of exports from emerging countries
  - No 20 Martin Feldkircher and likka Korhonen: The rise of China and its implications for emerging markets Evidence from a GVAR model
  - No 21 Pierre Pessarossi and Laurent Weill: Does CEO turnover matter in China? Evidence from the stock market
  - No 22 Alexey Ponomarenko: Early warning indicators of asset price boom/bust cycles in emerging markets
  - No 23 Gabor Pula and Daniel Santabárbara: Is China climbing up the quality ladder?
  - No 24 Christoph Fischer: Currency blocs in the 21st century
  - No 25 Duo Qin and Xinhua He: Modelling the impact of aggregate financial shocks external to the Chinese economy
  - No 26 Martin Feldkircher: The determinants of vulnerability to the global financial crisis 2008 to 2009: Credit growth and other sources of risk
  - No 27 Xi Chen and Michael Funke: Real-time warning signs of emerging and collapsing Chinese house price bubbles
  - No 28 Yi David Wang: Convertibility restriction in China's foreign exchange market and its impact on forward pricing
  - No 29 Risto Herrala and Rima Turk Ariss: Credit conditions and firm investment: Evidence from the MENA region
  - No 30 Michael Funke and Michael Paetz: Financial system reforms and China's monetary policy framework:
    - A DSGE-based assessment of initiatives and proposals
  - No 31 Zuzana Fungáčová, Pierre Pessarossi and Laurent Weill: Is bank competition detrimental to efficiency? Evidence from China
- 2013 No 1 Aaron Mehrotra: On the use of sterilisation bonds in emerging Asia
  - No 2 Zuzana Fungáčová, Rima Turk Ariss and Laurent Weill: Does excessive liquidity creation trigger bank failures?
    - No 3 Martin Gächter, Aleksandra Riedl and Doris Ritzberger-Grünwald: Business cycle convergence or decoupling? Economic adjustment in CESEE during the crisis
    - No 4 likka Korhonen and Anatoly Peresetsky: What determines stock market behavior in Russia and other emerging countries?
    - No 5 Andrew J. Filardo and Pierre L. Siklos: Prolonged reserves accumulation, credit booms, asset prices and monetary policy in Asia
    - No 6 Mustafa Disli, Koen Schoors and Jos Meir: Political connections and depositor discipline
    - No 7 Qiyue Xiong: The role of the bank lending channel and impacts of stricter capital requirements on the Chinese banking industry
    - No 8 Marek Dabrowski: Monetary policy regimes in CIS economies and their ability to provide price and financial stability
    - No 9 Rajeev K. Goel and Michael A. Nelson: Effectiveness of whistleblower laws in combating corruption
    - No 10 Yin-Wong Cheung and Rajeswari Sengupta: Impact of exchange rate movements on exports: An analysis of Indian non-financial sector firms
    - No 11 Martin Feldkircher, Roman Horvath and Marek Rusnak: Exchange market pressures during the financial crisis: A Bayesian model averaging evidence
    - No 12 Alicia Garcia-Herrero and Le Xia: China's RMB bilateral swap agreements: What explains the choice of countries?
    - No 13 Markus Eller, Jarko Fidrmuc and Zuzana Fungáčová: Fiscal policy and regional output volatility: Evidence from Russia
    - No 14 Hans Degryse, Liping Lu and Steven Ongena: Informal or formal financing? Or both? First evidence on the co-funding of Chinese firms
    - No 15 likka Korhonen and Anatoly Peresetsky: Extracting global stochastic trend from non-synchronous data
    - No 16 Roman Horvath, Jakub Seidler and Laurent Weill: How bank competition influence liquidity creation

BOFIT Discussion Papers http://www.bof.fi/bofit\_en • email: bofit@bof.fi ISSN 1456-6184, online