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Should we be afraid of powerful banks? The trade-off between bank power and liquidity buffer

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Abstract

In recent years we have observed a significant increase in bank market power worldwide. On the one hand, powerful banks may manage their financial positions more safely to be able to benefit from their position at any time. On the other hand, such banks might explore their power at their own advantage and manage their capital more aggressively exerting typical moral hazard behaviour. In this paper, we analyse how powerful banks manage their liquidity. The results indicate that powerful banks use their power and keep lower liquidity buffers, all else being equal. Though the result is highly significant in developed countries and normal times, it is less marked in emerging countries and during crisis periods. We argue that bank power should be considered as an important factor in banking supervision and regulatory models on liquidity buffers.

Keywords: market power, Lerner index, bank liquidity, liquidity buffer

JEL: C33, G21, G28, G32

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1 Introduction

Liquidity has been shown to be an important factor in banking sector stability (Acharya, Mora 2015; Brunnermeier, Pedersen 2009; Puri, Rocholl, Steffen 2011). The lack of liquidity may cause financial institutions to fall, a lesson learned from the recent financial crisis. For this reason, liquidity risk has become a primary issue in regulatory reform as well as in the academic literature.

Liquidity theory tells us that banks tend to hold liquid assets for two reasons. The first reason is to prevent periods of liquidity distress, which often occurs during runs on banks, as documented by Diamond and Dybvig (1983). The second reason is to take advantage of profitable projects as they emerge (Keynes 1936). These reasons incentivize banks to retain at least some liquidity in their balance sheet but for a long time it has not been clear how much liquidity banks hoard. Though the recent Basel III Accord (2010) imposed minimum liquidity standards on banks, evidence shows that some banks are far from the liquidity targets required by the Basel Committee and would probably not hesitate to circumvent regulations through liquidity arbitrage (DeYoung, Jang 2016).

As liquidity is costly for banks, the literature mentions several reasons why banks refrain from keeping more liquidity, all else holding constant. For example, Bhattacharya and Thakor (1993), Aspachs, Nier and Tiesset (2005), Mink (2011) and Acharya, Shin and Yorulmazer (2011) document that the "lender of last resort" and various implicit or explicit deposit guarantees reduce the incentives for banks to increase their liquidity buffers. Moreover, larger, systemically relevant banks might also try to reduce their liquidity buffers due to the "too big to fail" or "too important to fail" doctrine (Bhattacharya, Thakor 1993; Acharya, Shin, Yorulmazer 2011). In our study we argue, however, a bank's liquidity buffers may also be affected by its market power. The topic is all the more relevant as in the recent years we have observed a significant increase in the market power of individual banking institutions (Fernandez de Guevara, Maudos, Perez 2007; Casu, Girardone 2009). Figure 1 documents how and in which countries banks have increased their power in recent years.

So far, there is limited research on the effect of banks' market power on their behaviour. Moreover, the existing studies mainly attribute banks' market power to their size (Bikker, Spierdijk, Finnie 2006; Demirgüç-Kunt, Huizinga 2010; Kim 2018). We argue, however, that size does not necessary coincide with the power of a bank. The financial crisis of 2008 is the best example when banks with significant market power were able to exercise it against the largest banks with liquidity and capital problems. Therefore, our study differs from the existing research and according to our best knowledge it is the first study which links bank market power to liquidity management policy. In our research we argue that market power may have a significant influence on banks' liquidity policy. On the one hand, more powerful banks are motivated to decrease their liquidity buffer for at least two reasons. First, their market dominance exposes them to higher moral hazards and adverse selection problems (Holmström, Tirole 1998). More powerful banks have the option to exploit their customers by charging them higher interest rates. Consequently, these banks would be encouraged to invest in more profitable but, at the same time, more risky projects and to underinvest in liquid assets (Dinger, Von Hagen 2009). Second, their position would grant them easy access to the borrowing market and thus allow them to manage their liquidity more efficiently. Additionally, greater market power is positively correlated with a bank's bargaining strength, which allows more powerful banks to access funding at lower rates (Berger, Udell 2004; Cocco, Gomes, Martins 2009). On the other hand, more powerful banks might also try to accumulate liquidity to be able to exercise their power against weaker institutions in time of distress (Acharya, Shin, Yorulmazer 2011).

We verify our hypothesis by using a sample of 17.5 thousand banks from 47 countries. Moreover, we analyse these banks' liquidity policies between 1996 and 2013. In line with the existing literature, we measure bank market power using the Lerner index as proposed by Berger, Klapper and Turk-Ariss (2009), Angelini and Cetorelli (2003), Turk-Ariss (2010) and Efthyvoulou and Yildirim (2014). We estimate the market power for all banks and all periods in selected countries. To test how changes in a bank's power influence the bank's liquidity policy, we employ a panel regression with a bank fixed-effect, allowing us to control for individual differences among banks and countries. We include year dummies to capture the unobserved period effects that might influence bank liquidity policy decisions. We expect that banks with greater market power would apply a lower liquidity policy. In addition, we analyse how powerful banks manage their liquidity in a crisis period and in emerging versus developed countries. We also check for a possible non-linear effect stemming from bank market power as banks might accumulate liquidity until a certain threshold is reached to dominate the market later on but having achieved certain market power they might decide to use it to their own advantage, and start behaving in a more risky manner (Stiglitz, Weiss 1981). Finally, we demonstrate that our results are robust. Consequently, we test them under various specifications and methodologies.

Our results show that banks with increased market power can exploit their position in favour of more risky liquidity strategies, and banks with decreased market power decide to keep more liquidity for safety concerns. This seems to confirm the studies arguing that powerful banks benefit from their position and are exposed to the moral hazard problem (Bhattacharya, Thakor 1993; Holmström, Tirole 1998; Mink 2011). These findings suggest that this feature is especially true for developed countries and less observable in emerging countries because banks in less developed countries generally do not rely on the interbank market and thus might have a lower incentive to increase their power to actively manage their liquidity positions (Demirgüç-Kunt, Huizinga 2010). Interestingly, we also find that the results are more significant in the pre-crisis period than in the crisis period. This is because in the crisis period, banks – even the powerful ones – decide to hoard liquidity. This phenomenon was observed and documented in the recent crisis of 2007–2010. Our results point toward important regulatory changes with respect to bank supervision as well as the calculation of liquidity buffers.

This paper is organized as follows. Section 2 presents the literature review, section 3 provides data description and discusses our model. Section 4 presents our results, section 5 proves the robustness of our models, and section 6 concludes.

2 Literature review

Although the literature on liquidity determinants had been scarce, in recent years it has grown rapidly. This literature can be divided into two groups. Controlling for regulatory differences, current studies claim that there exist large cross-bank differences in liquidity policies. One group of studies claims that the level of a bank's liquidity is determined by market conditions, while other studies claim that a bank's financial characteristics predetermine its liquidity holding, keeping all other factors constant.

Regarding the first strand of literature, Baltensperger (1980) developed a model showing that a bank's liquidity policy is affected by two factors. The first factor is the return, i.e. the interest rate which the bank can obtain if it invests its liquid assets rather than keeping them on the balance sheet. Second, a bank's liquidity policy is dependent on the likelihood of an increase in the withdrawal rate. Hence, the liquidity management policy is dependent on the conditions of the market through the

interest rate and on the economic agent's confidence in the banking system that will affect the bank liquidity policy. The latter evidence has also been supported by Allen and Gale (1998) and by Acharya, Shin and Yorulmazer (2011). The authors notice that during a crisis, banks with access to liquidity act at the expense of banks with a liquidity shortage. While the latter banks fire-sell their assets, the former take this opportunity to make a profit. However, Bolton, Santos and Scheinkman (2011) claim that an increase in asymmetric information about the market induces banks to release less liquidity to the market and instead hold it on their balance sheets. Aspachs, Nier and Tiesset (2005) and Acharya, Shin and Yorulmazer (2011) analyse the behaviour of liquidity management along with the economic cycle. The authors document that banks hoard liquidity when the economy is down – probably due to the lower number of profitable projects as well as a high risk of potential deposit withdrawals – and reduce hoarding in times of expansion. Finally, the studies show that the macroeconomic environment might also play a role. These studies specifically show that banks prefer to hoard liquidity when the short-term interest rates are low (Aspachs, Nier, Tiesset 2005; Gatev, Schuermann, Strahan 2007).

The second strand of literature claims that liquidity policies are very bank-specific. The most important variables found to significantly affect a bank's liquidity policy are profitability, efficiency, capital level and size. These studies show that the less profitable and efficient banks are, the higher the liquidity buffer they decide to keep. In the event of a crisis, these banks would suffer more because they have limited internal capital and thus they must rely on expensive external capital. Profitable companies, on the other hand, can use their internal cash flows to face crises reducing the necessity for large amounts of liquid holdings (Aspachs, Nier, Tiesset 2005; Delechat et al. 2012). Similarly, more capitalized banks can access capital more easily and at a cheaper rate, needing less incentive to keep a higher liquidity buffer. Thus, studies in this vein show that capital may complement the liquidity buffer (De Haan, van den End 2013; Distinguin, Roulet, Tarazi 2013). Greater transparency and corporate governance standards may result in less exposure to illiquidity shocks, making banks keep lower liquidity buffers (Tirole 2011; Ratnovski 2013; Bonner, van Lelyveld, Zymek 2014). Finally, the bank's size might also matter. However, the effect is not very clear. In theory, we would expect that the larger the bank, the higher its liquidity buffer. This hypothesis is supported by Bonner, van Lelyveld and Zymek (2014), who show that larger banks would keep greater liquidity due to regulatory requirements on minimum liquidity buffers for systemically important institutions. On the other hand, larger banks have greater access to funding and can manage their liquidity more efficiently by having more frequent cash-flows, which is why they might set lower liquidity ratios (DeYoung, Jang 2016). Moreover, larger banks tend to resort to internal financing as a way of building a capital buffer (Almeida, Campello, Weisbach 2004; Aspachs, Nier, Tiesset 2005). However, larger banks have also more exposure to the lender of last resort (LoLR) institution, which lowers their incentive to maintain higher liquidity ratios (Bhattacharya, Thakor 1993; Aspachs, Nier, Tiesset 2005; Mink 2011). To conclude, we tend to see a lower liquidity buffer at larger and more systemically important banks. None of the studies has addressed the liquidity policy of powerful banks. However, the distress of powerful banks might entail important consequences for the whole system, as argued in the Introduction.

3 Dataset and empirical strategy

3.1 Dataset

We base our research project on financial data from the Bankscope database covering 47 countries between 1996 and 2013.[1] We limit our observations to the period after 1996 (1998 for the USA and Japan) due to unsatisfactory data availability in earlier periods. The World Bank's Development Indicators constitute the second dataset employed in our study, supplementing the Bankscope data with country-level macroeconomic variables. Finally, we examine an unbalanced panel with approximately 80 thousand observations for approximately 17.5 thousand banks.[2] It should be noted that the majority of our observations comes from a limited number of countries, while banks from the United States generate approximately 50% of all observations in the sample. Thus, to draw general conclusions about the market power vs. liquidity relationship, we introduce a weighting scheme that reduces the contribution of US banks to approximately 5% by applying a weight to each observation. Each weight equals the ratio of the natural logarithm of the total number of banks in a given country divided by the sum of natural logarithms of all banks in each country.[3]

3.2 Construction of panel model

To test our hypotheses, we estimate panel regression models with bank fixed-effects and use the within estimator with standard errors clustered at the bank level. To address the problem of a potential endogeneity in our model – since one may also argue that higher liquidity buffers positively impact banks' market power – we lag bank control variables against our liquidity measures by one period.[4] The general construction of our panel regression models is given by eq. (1):

$$LIQ_{i,k,t} = f\begin{pmatrix} BANK.CTR_{i,k,t-1} \\ CTRY.CTR_{k,t} \\ LERNER_{k,t-1} \\ year\ dummies \\ BFE_{i,k,t} \end{pmatrix} \tag{1}$$

where $LIQ_{i,k,t}$ is a measure of the liquidity for bank i in country k in year t.

[1] We exclude countries with a limited number of bank-year observations, as our calculations of the Lerner index would not be robust when performed separately for each country.

[2] The exact number of observations and banks varies depending on the model.

[3] For example, if we had a sample of 80 banks from country A and 20 banks from country B, then the pre-weighted contribution of country A is 80%, but the weighting procedure reduces it to approximately 59%, which is the ratio of the natural logarithm of all banks in country A, i.e. ln(80), divided by the sum of the natural logarithms of all banks in each country, i.e. ln(80) + ln(20).

[4] We are aware of the fact that our model does not fully solve the endogeneity issue stemming from the possibility that higher bank liquidity might also translate into higher bank market power. However, we argue that lagging the market power variable against banks' liquidity positions partially allows us to control for this problem.

The set of controls includes bank- and country-level variables (BANK.CTR and CTRY.CTR, respectively), year dummies, and bank fixed-effects (BFEs). Furthermore, LERNER is a variable used to test our main hypothesis about the impact of market power on the liquidity of banks. The variable is calculated as a bank's traditional Lerner index. Section 3.3 provides technical details about the Lerner index estimations.

To measure a bank's liquidity, we follow Schnabl (2012) and Acharya and Mora (2015). First, we use the INTERBANK variable, which represents a bank's interbank ratio, i.e. money lent to other banks divided by money borrowed from other banks. Second, we take LOANS.TA and LOANS.STF as illiquidity measures. They are calculated as net loans to total assets and net loans to deposits and short-term funding, respectively. Third, we use LIQA.STF and LIQA.BORR to directly reflect liquidity. We define them as a ratio of liquid assets to deposit and short-term funding and a ratio of liquid assets to total deposits and borrowings, respectively.

3.3 Market power measurement

In our research we define market power at a bank-level, instead of using country-level variables which are more apt for describing banking sector competition or concentration level. The existing academic studies define market power in various ways. For example, Shaffer (1989, 1993), Berg and Kim (1994), Shaffer and DiSalvo (1994), Coccorese (2005, 2009), Angelini and Cetorelli (2003), Canhoto (2004), and Uchida and Tsutsui (2005) define market power as a deviation of a firm's marginal revenue from the demand function. Other studies, such as Shaffer (2002, 2004), Molyneux, Lloyd-Williams and Thornton (1994), Coccorese (2005, 2009), De Bandt and Davis (2000), Bikker and Haaf (2002), Claessens and Laeven (2004), Gelos and Roldós (2004), and Matthews, Murinde and Zhao (2007), among others, define market power using the Panzar-Rosse H-statistic. The variable constitutes a sum of a reduced--form revenue elasticity with regard to different factor prices (Panzar, Rosse 1977, 1987). However, in contrast to these studies, we use a third approach – the traditional Lerner index. The traditional Lerner index not only allows us to analyse the product price but also it enables us to link it to marginal cost. More importantly, the calculation of the Lerner index, similarly to that of the Panzar--Rosse H-statistic, abstracts from the product or geographical definition of a market. Recent empirical applications of the Lerner index in the banking studies include Angelini and Cetorelli (2003), De Guevara, Maudos and Pérez (2005), Jiménez et al. (2008), Fernandez de Guevara, Maudos and Perez (2007), Berger, Klapper and Turk-Ariss (2009), Turk-Ariss (2010), Agorak, Delis and Pasiouras (2011), Maudos and Solís (2011), Lozano-Vivas and Weill (2012), Weill (2013), Efthyvoulou and Yildirim (2014), among others. More specifically, the traditional Lerner index captures the disparity between price and marginal cost expressed as a percentage of the price, and it is calculated for each bank i in year t (Berger, Klapper, Turk-Ariss 2009):

$$Lerner_{it} = \left(P_{it} - MC_{it}\right) / P_{it} \tag{2}$$

where P is the price of bank output, proxied by the ratio of total revenue (interest and non-interest income) to total assets, and MC is the marginal cost.

Following the literature, total assets account for the aggregate product of the bank, e.g., Angelini and Cetorelli 2003, Turk-Ariss (2010) and Efthyvoulou and Yildirim (2014)). Following the existing studies, we estimate the MC as a translog cost function:

$$\begin{aligned} ln\frac{TC_{it}}{W_{3,it}} &= \alpha_0 + \sum_{j=1}^{2}\alpha_j ln\frac{W_{j,it}}{W_{3,it}} + \frac{1}{2}\sum_{j=1}^{2}\sum_{k=1}^{2}\alpha_{jk} ln\frac{W_{j,it}}{W_{3,it}} ln\frac{W_{k,it}}{W_{3,it}} + \alpha_q \ln Q_{it} + \\ &+ \frac{1}{2}\alpha_{qq}(\ln Q_{it})^2 + \sum_{j=1}^{2}\alpha_{jq} ln\frac{W_{j,it}}{W_{3,it}} \ln Q_{it} + \alpha_Z Z + \frac{1}{2}\alpha_{ZZ} Z^2 + \\ &+ \sum_{j=1}^{2}\alpha_{jZ} ln\frac{W_{j,it}}{W_{3,it}} Z + \alpha_{qz} \ln Q_{it} Z + \varepsilon_{it} \end{aligned} \tag{3}$$

where TC is a bank's total cost; Q proxies bank output through total assets; W_1, W_2 and W_3 represent input prices of funds, capital, and labour, respectively, calculated as the ratios of interest expenses to total deposits and short-term funding, other operating and administrative expenses to total assets, and personnel expenses to total assets; Z describes the level of technology and is introduced as an annual index of time; and, finally, ε is an error term.

Following de Haan and Poghosyan (2012) and Efthyvoulou and Yildirim (2014), total costs and all terms involving input prices are deflated by W_3 to automatically satisfy the restriction of linear homogeneity for input prices.

In the current studies there is no standard approach to estimating eq. (3). On the one hand, some researchers estimate the cost function using bank-level fixed-effect methodology while others use fixed-effects with regard to the years or countries (Turk-Ariss 2010; Berger, Klapper, Turk-Ariss 2009; Efthyvoulou, Yildirim 2014). Moreover, the literature also varies with respect to the treatment of the sample. Some researchers estimate the cost function individually for each country (Turk-Ariss 2010; Berger, Klapper, Turk-Ariss 2009), while others cover all countries at the same time (Efthyvoulou, Yildirim 2014). In our approach we decided to estimate the translog cost function using the random--effect model, clustering the robust standard errors by bank level. Furthermore, to reflect potentially different technologies across different countries, we carry out the analysis separately for each country.[5] The marginal cost for bank i in year t is finally computed as follows:

$$MC_{it} = \frac{TC_{it}}{Q_{it}}\left(\alpha_q + \alpha_{qq} lnQ_{it} + \sum_{j=1}^{2}\alpha_{jq} ln\frac{W_{j,it}}{W_{3,it}} + \alpha_{qz} Z\right) \tag{4}$$

where α_q, α_{qq}, α_{jq}, and α_{qz} are estimated parameters of the translog cost function from eq. (3).

[5] Nevertheless, we also estimate eq. (3) using the bank fixed-effect model. We prove that the results stay robust, showing that the choice of effect (bank-level, year-level) does not influence our main results. The results are available upon request.

As a result, we obtain values of the Lerner index for the *i*-th bank in year *t* by incorporating eq. (4) in eq. (2). The estimated Lerner index is expected to vary between zero (a perfectly competitive bank) and one (a purely monopolistic bank); thus, a higher value of the Lerner index denotes higher market power. It is worth noting that values below zero are also theoretically possible. They would suggest that the bank's marginal cost exceeds price and, as a result, that the bank is making losses.

3.4 Other control variables

The set of bank controls describes a bank's market share on the basis of its total assets (M.SHARE), its equity-to-assets ratio (EQUITY), and loan loss provisions to total assets (LLP). We expect that larger banks and consequently banks with a greater market share will have lower liquidity ratios due to the "too big to fail" doctrine (Bhattacharya, Thakor 1993; Mink 2011). Moreover, they can also manage their liquidity more efficiently and thus do not require costly liquidity on their balance sheet (DeYoung, Jang 2016). We also control for the bank capital ratio. The effect of capital on the liquidity ratio is ambiguous. Thus, we expect that this variable can go in both directions. On the one hand, more capitalized banks may keep more liquidity, being afraid to lose their charter value in the case of distress (Keeley 1990). On the other hand, more capitalized banks can access capital more easily and at a cheaper rate, needing less incentive to keep higher liquidity ratios (Aspachs, Nier, Tiesset 2005; Delechat et al. 2012). Finally, we also control for loan loss provisions (LLP). Banks with higher LLP might expect higher losses and thus might opt to increase their liquidity buffer (Cornett et al. 2011; Berger, Udell 2004; Berrospide 2013).

We expect our country-level controls to influence bank liquidity measures in the following ways. First, high GDP growth rates (GDP.GR) correspond to lower risk borrowing, which may encourage banks to reduce their liquidity levels. Second, long-term investments make banks more vulnerable to inflation, and thus, high inflation rates (INFLATION) should incentivize banks to hold more liquid assets. Third, on the one hand, high concentration in the banking market (HHI) may discourage banks from keeping liquidity due to the "too important to fail" or "too big to fail" doctrine (Bhattacharaya, Thakor 1993; Holmström, Tirole 1998; Mink 2011). On the other hand, the larger banks may try to establish their power in the market and thus accumulate liquidity (Cocco, Gomes, Martins 2009). To the best of our knowledge, we are the first who provide such extensive evidence on the link between market power and bank liquidity management.

Finally, a bank's liquidity buffer might change depending on the risk of the country in question as well as the risk within different time periods. For example, banks may prefer to hoard liquidity during periods of distress, whereas in normal times, they may prefer to invest it (Angelini, Nobili, Picillo 2011; Acharya, Naqvi 2012). Similarly, banks in developed countries have better access to international markets and are more diversified than those in emerging countries. Thus, these banks will be less exposed to liquidity shocks and will keep a lower liquidity buffer than banks in emerging countries, all else being equal (Kashyap, Rajan, Stein 2002). Consequently, we introduce interaction terms to our baseline specifications. They are the products of a market power measure and a binary variable identifying the emerging countries (as defined by the World Bank) or crisis years (2008–2010), respectively. Furthermore, as the market power versus liquidity relationship can take a non-linear form, we introduce a squared market power measure apart from its traditional, unsquared value.

Table 1 presents the definitions of all the variables used in our regressions, while Table 2 gives descriptive statistics for the dataset.

4 Empirical results

4.1 Effect of market power on liquidity

In Table 3 we present the estimation results that allow us to infer the relationship between market power and the liquidity of banks. In five specifications, we regress different liquidity measures against control variables while using the Lerner index as a bank market power indicator.

Three of five coefficients for the LERNER variable are statistically significant, and in two cases, the significance level is below 1%. In all specifications, the signs of the respective coefficients indicate that banks with increased market power can exploit their position in favour of more risky liquidity strategies, and banks with decreased market power decide to keep more liquidity. This seems to confirm the studies claiming that powerful banks benefit from their position and are exposed to the moral hazard problem (Bhattacharaya, Thakor 1993; Holmström, Tirole 1998; Mink 2011). In turn, smaller banks prefer to hoard liquidity in case of distress as their access to liquidity is limited and dependent on their dealings with other banks (Cocco, Gomes, Martins 2009). The results are also economically significant. For example, an increase of a bank's Lerner index by an interquartile range of the sample would expectedly generate a drop in the bank's interbank ratio by approximately 4.1% of this variable's interquartile range. When we relate this reduction to the bank's average interbank ratio, we may argue that an increase in the Lerner index is associated with a drop in the bank's liquidity ratio by approximately 4%.

Two of the three bank-level controls are consistently statistically significant. First, in four of the five specifications, the results suggest that banks with a less risky capital structure – reflected in high EQUITY – follow less risky strategies in their liquidity management. This result confirms the studies showing that more capitalized banks prefer to hoard liquidity to avoid losing their charter value (Keeley 1990). In addition, more capitalized banks rely less on the interbank market compared to more leveraged banks (Demirguc-Kunt, Huizinga 2010; Cornett et al. 2011). Second, banks with higher loan loss provisions (LLP) experience higher liquidity, which supports earlier evidence that banks expecting higher losses tend to accumulate liquidity guided by the precautionary motive (Berrospide 2013). Finally, we were unable to demonstrate that liquidity is significantly related to a bank's market share in its domestic market. The presence of a respective coefficient for M.SHARE in only one of the five specifications strongly suggests that larger banks might see themselves as "too big to fail" and thus follow strategies involving less liquidity. In this way we support the studies claiming that it is the power not the size of a bank that is related to its liquidity (Buch, Koch, Koetter 2012).

For the country-level control variables, the coefficients for INFLATION indicate a positive relationship with liquidity measures, which supports the hypothesis that high inflation is an incentive to hold more liquid assets. Moreover, we find that economic expansion contributes to bank illiquidity since it decreases the risk of borrowing (Adrian, Shin 2010; Acharya, Naqvi 2012). Finally, we find that banks in more concentrated markets hold more liquidity, which might due to these countries being

dominated by larger banks with higher regulatory buffers. Again, this evidence supports our statement that the size and power of banks are negatively related, as suggested by Buch, Koch and Koetter (2012).

4.2 Emerging vs. developed countries

We expect that the power of banks might be exercised to a lesser degree in less developed countries than in the more developed ones. In more developed countries, banks have better access to capital than in their less developed counterparts and thus can afford to follow a less rigid liquidity policy. To check this hypothesis in this section we investigate potentially different effects of a bank's market power on its liquidity in emerging and developed countries. The classification of countries has been made as suggested by the World Bank. In Panel A of Table 4, we report coefficients for the LERNER variable and its interaction term with a dummy variable identifying emerging economies (LERNER × EMERG), while in Panel B of the table, we present tests for coefficient sums of the variable and the abovementioned interaction term.[6] Thus, Panel A allows us to infer the absolute impact of market power on liquidity in developed countries (LERNER) and the incremental impact of market power on liquidity in emerging countries (LERNER × EMERG). Panel B gives an overview of the absolute impact observed in the emerging economies.

The results consistently suggest that market power impacts liquidity in developed countries. That is, four of the five coefficients for the LERNER variable are statistically significant at levels below 1%, and the remaining coefficient in specification (1) is only marginally insignificant. Nevertheless, the market power versus liquidity relationship is less evident in the emerging economies. First, in two cases the absolute effect is statistically insignificant (tests for coefficient sums for specifications 1 and 4), and in the three remaining cases, the p-values are higher than for the developed countries. Second, coefficients for the interaction terms (LERNER × EMERG) indicate a reduced incremental impact of emerging economies on the negative relationship between market power and the liquidity of banks. The result seems to confirm our hypothesis that powerful banks tend to exercise their power in more developed countries rather than in less developed countries. The reason is that banks in less developed countries, even powerful banks in their local markets, still rely on capital supply from abroad and thus hoard more liquidity (Acharya, Shin, Yorulmazer 2011; Allen et al. 2014). In addition, banks in emerging countries are less exposed to the interbank market, so they might not be interested in accumulating their power to manage the liquidity (Demirgüç-Kunt, Huizinga 2010). Instead, they might exercise it to increase interest spreads and thus increase their profitability (Prager, Hannan 1998; Corvoisier, Gropp 2002).

4.3 Crisis phenomena

Our dataset covers a relatively long time span, which creates an opportunity to investigate whether the effect of a bank's market power on its liquidity policy changed between the crisis of 2008–2010 and normal times. The liquidity effect in crises can go in both directions. First, in times where

[6] To this end we apply the Wald test (Judge et al. 1985, pp. 20–28). Consequently, the H0 to be tested is as following: $Beta_1(Lerner_{t-1}) + Beta_2(Lerner_{t-1}*Emerging\ Dummy) = 0$.

liquidity is costly and difficult to obtain, banks may try to hoard liquidity because of high uncertainty in the market, as they did was during the crisis of 2008–2010 (Angelini et al. 2011; Acharya, Naqvi 2012). On the other hand, banks with greater market power may try to exercise that power and squeeze the weaker banks (Fecht, Nyborg, Rocholl 2011). Similarly, as in the previous case where we investigate the differences between emerging and developing countries, we present both the absolute effects in crisis and non-crisis years and the incremental impact observed during the crisis on the studied relationship. Table 5 presents the results.

In this section, our results are not as unambiguous as in the previous section. Although all coefficients for the interaction terms (LERNER × CRISIS) suggest a reduced impact of crisis phenomena on the relationship under scrutiny, only one is statistically significant. At the same time, only two of the five tests for the coefficient sums indicate an absolute impact of market power on liquidity during the crisis years. Therefore, we can conclude that the crisis phenomena have a limited impact on the link between market power and the liquidity of banks. This conclusion aligns with the studies of Angelini, Nobili and Picillo (2011) and Acharya and Naqvi (2012) suggesting that banks prefer to give up some of their profits and hoard liquidity during times of uncertainty instead.

4.4 Nonlinearity

Theoretically, the impact of a bank's market power on liquidity might be non-linear. Banks without sufficient market power might prefer to hoard liquidity until they increase this power. When they achieve significant power, they might exacerbate their moral hazard and adverse selection problems following a looser liquidity policy (Stiglitz, Weiss 1981). Therefore, in this section we check whether such a non-linear relationship exists. Table 6 presents the results.

Only the results for the INTERBANK regression indicate nonlinearity. In other words, the coefficient for the squared market power measure becomes negative and strongly statistically significant at levels below 1%, while the coefficient for the unsquared variable loses its significance. Thus, the result allows us to conclude that the interbank ratio is expected to drop more for banks with extraordinarily high market power. In other words, the sensitivity of the interbank ratio to market power is a linear negative function of a bank's market power. Figure 2 illustrates the expected increase in a bank's interbank ratio (as a share of the INTERBANK interquartile range) following an increase in the bank's Lerner index by the variable's interquartile range.

For banks with high market power (Lerner index equalling ca. 0.3), the effect amounts to approximately 10% of the interbank ratio's interquartile range. Thus, we can partially confirm our hypothesis that powerful banks profit from their market power by following a looser liquidity policy. This is a clear example of moral hazard behaviour exercised by powerful banks. In addition, Hakenes and Schnabel (2010) show that banks may try to increase their risk to get protection from the government.

5 Robustness check

To prove the robustness of our baseline results from Table 3, we apply a battery of checks. We check whether the results are driven by our choice of the weighting schemes, and we implement additional

data preparation procedures that involve (a) unweighted observations, (b) a sample of equally weighted countries, (c) an unweighted sample but with eliminated observations from the biggest country (i.e. the USA), (d) an unweighted sample but with eliminated observations from three countries with the largest number of banks, (e) equally weighted years, i.e. ensuring that each year has the same impact on our observation, and (f) equally weighted years and countries. The last two specifications require dynamic weights for individual banks and cannot be estimated using a fixed-effect model. Thus, in schemes (e) and (f) we estimate OLS regressions without bank fixed effects. Table 7 presents our estimations.

Table 7 gives estimation results for all additional data preparation schemes. It should be noted that all our robustness checks lead to the same conclusions as in the case of the baseline specifications from Table 3. In some data preparation schemes, the market power vs. liquidity relationship becomes even more evident pointing toward the robustness of our results.

Additionally, one may argue that varying bank liquidity levels might result from varying liquidity regulations across countries. To prove that our estimated effects are independent from country regulations, we regress the liquidity regulation index, REG.INDEX, against the liquidity measures. The liquidity regulation index is a country variable constructed on the basis of answers coming from the World Bank Regulation and Supervision Survey. More specifically, the index is a composite measure of sum of answers (YES – 1; NO – 0) to questions describing the liquidity requirements at the country level, such as the following: 1) are there any regulatory rules or supervisory guidelines regarding asset diversification? 2) are banks limited in their lending to a single borrower or a group of inter--related borrowers? 3) is there a regulatory minimum ratio on liquid assets in place in your jurisdiction (e.g. as a percentage of the total balance sheet or the deposit base)? 4) are banks required to hold either liquidity reserves or any deposits at the central bank? 5) are banks required to hold reserves in foreign currencies or other foreign-denominated instruments? The answers are updated every several years. Higher values of the index suggest greater liquidity requirements, while lower values indicate more relaxed requirements. Tables 8–11 document regression results, controlling for the countries' liquidity requirements.

The results reveal that the regulation index is statistically significant in the regression, suggesting that banks operating in countries with higher liquidity regulations have higher liquidity ratios. At the same time, we find that the loan ratio is lower, an indication that higher liquidity requirements negatively affect bank credit activity. However, more importantly, we find that the regression results do not change the conclusions from our baseline models. We find that market power statistically significantly affects our liquidity measures. The results hold independently from specification or the chosen sub-sample.

6 Conclusions

Up to the moment when we took up our study the relationship between market power and liquidity policy had not been well established. This is surprising since market power had been shown to be negatively correlated with bank size. Moreover, the existence of such a link might have important consequences for market structure and financial stability. This is because powerful banks could dominate markets by controlling prices, generating liquidity and controlling capital supply. Thus, a breakdown of powerful banks might have severe consequences for the whole financial market.

In our paper we try to establish a relationship between a bank's market power and its liquidity policy, hypothesizing that banks want to increase their power to follow a looser liquidity policy, get protection from the government and control prices. Consequently, they risk exposure to the moral hazard problem. To this end, we use more than 17 thousand observations from 47 countries between 1996 and 2013. To establish the relationship, we use a panel regression with a bank-fixed effect and year dummy variables, allowing sufficient heterogeneity between banks.

Our results ultimately confirm that more powerful banks tend to keep a lower liquidity buffer. The result is especially marked in developed countries rather than in emerging economies. However, we also find that the significance of the effect disappears in crisis periods. This supports the finding that banks, even powerful ones, prefer to hoard their liquidity in times of uncertainty (Acharya, Merrouche 2013; Calomiris, Heider, Hoerova 2015).

Our results have significant policy implications. They attest that power should be taken into consideration by supervisors as well as regulators because banks with significant power in terms of their access to capital, the costs of obtaining capital, their relationships with other banks and reduced--cost operations may control market activity and interbank liquidity. Their problems, thus, might have significant implications for the stability of the banking sector. Moreover, our results also suggest that regulators should avoid "one size fits all" policy as in such a case the liquidity of powerful banks will be underestimated endangering banking sector stability. Consequently, the Basel III regulations on the liquidity buffer (to be effectively implemented in 2019) should consider bank-specific power.

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Appendix

Table 1
Definitions of variables

A. Liquidity measures	
INTERBANK	Interbank ratio (due from banks divided by due to banks)
LOANS.TA	Ratio of net loans to total assets
LOANS.STF	Ratio of net loans to deposits and short-term funding. Net loans are defined as gross loans minus non-performing loans. The deposit and short-term funding variable includes total customer deposits (current, savings and term) and short--term borrowing (money market instruments, CDs and other deposits)
LIQA.STF	Ratio of liquid assets to deposits and short-term funding. Liquid assets include cash and due from banks, trading securities and at fair value through income, loans and advances to banks, reverse repos and cash collaterals
LIQA.BORR	Ratio of liquid assets to deposits and total borrowings
B. Other bank-level variables	
LLP	Loan loss provisions to total loans
EQUITY	Capital equity to total assets
M.SHARE	Asset-based market share of a bank in a given country
LERNER	A bank's Lerner index (see section 3.3 for computational details)
C. Country-level variables	
GDP.GR	GDP growth rate
INFLATION	Inflation rate
HHI	A country's Herfindahl-Hirschmann Index calculated with the use of individual banks' asset-based market share
CRISIS	A binary variable that takes a value of 1 for 2008–2010
EMERG	A binary variable that takes a value of 1 for emerging economies (low-income, upper middle-income and lower middle-income countries according to the World Bank)

Table 2
Descriptive statistics

Variable name	Panel A. Bank-level variables								
	banks	observations	average	standard deviation	minimum	1st quartile	median	3rd quartile	maximum
INTERBANK	9,711	61,889	1.1772	1.5610	0.0000	0.2062	0.6276	1.4241	8.6523
LOANS.TA	17,506	175,761	0.6169	0.1633	0.0000	0.5215	0.6364	0.7343	0.9286
LOANS.STF	17,475	175,763	0.7487	0.2374	0.0269	0.6076	0.7458	0.8757	1.8971
LIQA.STF	17,553	176,786	0.1616	0.1611	0.0121	0.0608	0.1111	0.1987	1.4639
LIQA.BORR	17,190	172,334	0.1468	0.1386	0.0110	0.0568	0.1039	0.1850	1.0825
LLP	17,404	173,959	0.0059	0.0093	-0.0129	0.0010	0.0032	0.0072	0.0880
EQUITY	17,533	176,687	0.0978	0.0478	0.0001	0.0718	0.0911	0.1144	0.9356
M.SHARE	17,553	176,786	0.0030	0.0202	0.0000	0.0000	0.0000	0.0001	0.9888
LERNER	17,412	174,210	0.2057	0.1217	-0.5330	0.1404	0.2081	0.2777	0.9840
Variable name	**Panel B. Country-level variables**								
	countries	observations	average	standard deviation	minimum	10th percentile	median	90th percentile	maximum
GDP.GR	47	717	0.0289	0.0336	-0.1480	0.0128	0.0299	0.0481	0.1524
INFLATION	47	717	0.0480	0.0750	-0.0402	0.0173	0.0282	0.0539	0.8464
HHI	47	717	0.1353	0.1100	0.0194	0.0820	0.1138	0.1704	0.9809
EMERG	47	717	0.3710	0.4834	0.0000	0.0000	0.0000	1.0000	1.0000

Notes:
Descriptive statistics in Panel A are calculated with bank-year observations and in Panel B with country-year observations. The statistics describe the observations included in estimations of specification (4) from Table 3.

Table 3
Impact of a bank's market power on bank liquidity (baseline results)

Variables	INTERBANK	LOANS.TA	LOANS.STF	LIQA.STF	LIQA.BORR
	(1)	(2)	(3)	(4)	(5)
LLP_{t-1}	4.728***	-0.949***	-0.983***	0.535***	0.501***
	(1.464)	(0.0931)	(0.166)	(0.154)	(0.139)
$EQUITY_{t-1}$	2.145***	-0.118**	0.469***	0.417***	0.385***
	(0.674)	(0.0475)	(0.0849)	(0.0884)	(0.0858)
$M.SHARE_{t-1}$	-3.035*	-0.0946	-0.0451	-0.0286	-0.109
	(1.671)	(0.119)	(0.165)	(0.135)	(0.133)
HHI_t	-0.191	-0.0703***	0.0796***	0.0740***	0.0390**
	(0.375)	(0.0151)	(0.0290)	(0.0175)	(0.0169)
$GDP.GR_t$	2.125**	-0.446***	-0.673***	0.683***	0.751***
	(0.947)	(0.0527)	(0.0797)	(0.0749)	(0.0678)
$INFLATION_t$	2.471***	-0.319***	-0.503***	0.482***	0.468***
	(0.697)	(0.0430)	(0.0621)	(0.0632)	(0.0663)
$LERNER_{t-1}$	-0.364*	0.0686***	0.117***	-0.0239	-0.0186
	(0.214)	(0.0141)	(0.0208)	(0.0194)	(0.0185)
Constant	1.142***	0.614***	0.687***	0.219***	0.195***
	(0.139)	(0.0102)	(0.0152)	(0.0140)	(0.0133)
Observations	62,589	177,177	177,359	176,786	172,565
Banks	9,785	17,575	17,549	17,553	17,202
R-squared	0.031	0.068	0.085	0.076	0.094
Wald	5.463***	18.26***	22.22***	15.06***	15.35***

Notes:
The table presents fixed-effect estimates giving each observation a weight that equals the natural logarithm of the total number of banks from one country divided by the sum of natural logarithms of the total number of banks from each country in a sample. Year dummies are included in all specifications but remain unreported. Robust standard errors that control for clustering at the bank-level are reported in brackets.
The symbols *, ** and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 4
Impact of a bank's market power on bank liquidity in emerging vs. developed economies

Variables	INTERBANK	LOANS.TA	LOANS.STF	LIQA.STF	LIQA.BORR
	(1)	(2)	(3)	(4)	(5)
	Panel A. Estimation results				
$LERNER_{t-1}$	-0.400	0.0836***	0.146***	-0.0660***	-0.0665***
	(0.246)	(0.0176)	(0.0252)	(0.0243)	(0.0234)
$LERNER_{t-1}$ x EMERG	0.0865	-0.0364	-0.0707	0.103**	0.116***
	(0.465)	(0.0295)	(0.0435)	(0.0404)	(0.0381)
Observations	62,589	177,177	177,359	176,786	172,565
Banks	9,785	17,575	17,549	17,553	17,202
R-squared	0.031	0.069	0.086	0.077	0.096
Wald	5.281***	17.55***	21.45***	14.88***	15.27***
	Panel B. Tests for sums of coefficients				
$LERNER_{t-1}$ + $LERNER_{t-1}$ x EMERG	-0.314	0.0472**	0.0748**	0.0366	0.0497*
F-statistic	0.649	4.0669	4.489	1.309	2.790

Notes:
The table presents fixed-effect estimates giving each observation a weight that equals the natural logarithm of the total number of banks from one country divided by the sum of natural logarithms of the total number of banks from each country in a sample. Year dummies are included in all specifications but remain unreported. For the sake of brevity, we do not report estimation results for the control variables (LLP, EQUITY, M.SHARE, HHI, GDP.GR and INFLATION) and the constant term. Robust standard errors that control for clustering at the bank-level are reported in brackets.
The symbols *, ** and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 5
Impact of a bank's market power on bank liquidity during crisis

Variables	INTERBANK	LOANS.TA	LOANS.STF	LIQA.STF	LIQA.BORR
	(1)	(2)	(3)	(4)	(5)
	Panel A. Estimation results				
$LERNER_{t-1}$	-0.382* (0.211)	0.0759*** (0.0141)	0.122*** (0.0216)	-0.0266 (0.0200)	-0.0216 (0.0187)
$LERNER_{t-1}$ x $CRISIS_t$	0.0843 (0.294)	-0.0333* (0.0188)	-0.0224 (0.0313)	0.0121 (0.0290)	0.0142 (0.0275)
Observations	62,589	177,177	177,359	176,786	172,565
Banks	9,785	17,575	17,549	17,553	17,202
R-squared	0.031	0.069	0.085	0.076	0.094
Wald	5.263***	17.63***	21.37***	14.42***	14.78***
	Panel B. Tests for sums of coefficients				
$LERNER_{t-1}$ + $LERNER_{t-1}$ x $CRISIS_t$	-0.298	0.0426**	0.0995***	-0.0145	-0.00740
F-statistic	0.757	3.883	9.155	0.221	0.0604

Notes:
The table presents fixed-effect estimates giving each observation a weight that equals the natural logarithm of the total number of banks from one country divided by the sum of natural logarithms of the total number of banks from each country in a sample. Year dummies are included in all specifications but remain unreported. For the sake of brevity, we do not report estimation results for the control variables (LLP, EQUITY, M.SHARE, HHI, GDP.GR and INFLATION) and the constant term. A crisis variable is a dummy that equals one for 2007 and onward periods; non-crisis periods are assigned with zeros. Robust standard errors that control for clustering at the bank-level are reported in brackets.
The symbols *, ** and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 6
Impact of a bank's market power on its liquidity – the nonlinearity effect

Variables	INTERBANK	LOANS.TA	LOANS.STF	LIQA.STF	LIQA.BORR
	(1)	(2)	(3)	(4)	(5)
$LERNER_{t-1}$	0.164	0.0835***	0.121***	-0.0263	-0.0218
	(0.240)	(0.0165)	(0.0266)	(0.0236)	(0.0226)
$(LERNER_{t-1})^2$	-1.869***	-0.0519	-0.0133	0.00843	0.0109
	(0.608)	(0.0419)	(0.0646)	(0.0616)	(0.0648)
Observations	62,589	177,177	177,359	176,786	172,565
Banks	9,785	17,575	17,549	17,553	17,202
R-squared	0.032	0.069	0.085	0.076	0.094
Wald	5.436***	17.38***	21.26***	14.74***	15.74***

Notes:
The table presents fixed-effect estimates giving each observation a weight that equals the natural logarithm of the total number of banks from one country divided by the sum of natural logarithms of the total number of banks from each country in a sample. Year dummies are included in all specifications but remain unreported. For the sake of brevity, we do not report estimation results for the control variables (LLP, EQUITY, M.SHARE, HHI, GDP.GR and INFLATION) and the constant term. Robust standard errors that control for clustering at the bank-level are reported in brackets.
The symbols *, ** and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 7
Different sample weighting schemes

Variables	INTERBANK	LOANS.TA	LOANS.STF	LIQA.STF	LIQA.BORR
	Panel A. Unweighted observations				
	(1)	**(2)**	**(3)**	**(4)**	**(5)**
$LERNER_{t-1}$	-0.190*	0.0756***	0.116***	-0.0595***	-0.0592***
	(0.100)	(0.00427)	(0.00592)	(0.00476)	(0.00416)
Observations	62,589	177,177	177,359	176,786	172,565
Banks	9,785	17,575	17,549	17,553	17,202
R-squared	0.027	0.076	0.098	0.052	0.059
Wald	28.39***	275.5***	305.4***	140.4***	173.8***
	Panel B. Equally-weighted countries				
	(6)	**(7)**	**(8)**	**(9)**	**(10)**
$LERNER_{t-1}$	-0.376	0.0659***	0.112***	-0.0176	-0.0100
	(0.233)	(0.0155)	(0.0227)	(0.0212)	(0.0207)
R-squared	0.034	0.073	0.089	0.080	0.098
Wald	5.150***	16.46***	18.84***	13.50***	13.47***
	Panel C. Unweighted sample with eliminated observations from biggest country				
	(11)	**(12)**	**(13)**	**(14)**	**(15)**
$LERNER_{t-1}$	-0.246**	0.0835***	0.140***	-0.0701***	-0.0732***
	(0.123)	(0.00863)	(0.0138)	(0.0128)	(0.0113)
R-squared	0.031	0.046	0.064	0.095	0.105
Wald	26.63***	50.41***	56.34***	53.97***	58.63***
	Panel D. Unweighted sample with eliminated observations from three biggest countries				
	(16)	**(17)**	**(18)**	**(19)**	**(20)**
$LERNER_{t-1}$	-0.261	0.0882***	0.141***	-0.0493***	-0.0424***
	(0.165)	(0.0110)	(0.0168)	(0.0160)	(0.0142)
R-squared	0.017	0.038	0.061	0.031	0.040
Wald	7.032***	19.85***	26.88***	9.250***	12.08***
	Panel E. Equally-weighted years (OLS estimates without bank fixed-effects)				
	(21)	**(22)**	**(23)**	**(24)**	**(25)**
$LERNER_{t-1}$	-0.299***	0.0620***	0.0833***	-0.137***	-0.128***
	(0.101)	(0.00812)	(0.0107)	(0.00765)	(0.00655)
R-squared	0.036	0.048	0.054	0.131	0.120
Wald	49.67***	165.3***	169.0***	188.3***	205.4***
	Panel F. Equally-weighted years and countries (OLS estimates without bank fixed-effects)				
	(26)	**(27)**	**(28)**	**(29)**	**(30)**
$LERNER_{t-1}$	0.0386	0.107***	0.198***	-0.0606**	-0.0739***
	(0.244)	(0.0243)	(0.0336)	(0.0297)	(0.0273)
R-squared	0.016	0.063	0.081	0.085	0.093
Wald	4.969***	17.49***	20.81***	18.81***	21.06***

Notes:
The table presents estimates using different weighting schemes for each observation. Year dummies are included in all specifications but remain unreported. For the sake of brevity, we do not report estimation results for the control variables (LLP, EQUITY, M.SHARE, HHI, GDP.GR and INFLATION) and the constant term. Robust standard errors that control for clustering at the bank-level are reported in brackets.
The symbols *, ** and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 8
Impact of a bank's market power on bank liquidity (controlling for country liquidity requirements)

Variables	INTERBANK	LOANS.TA	LOANS.STF	LIQA.STF	LIQA.BORR
	(1)	(2)	(3)	(4)	(5)
LLP_{t-1}	4.236***	-0.976***	-0.984***	0.690***	0.578***
	(1.491)	(0.0990)	(0.175)	(0.144)	(0.133)
$EQUITY_{t-1}$	1.878***	-0.0980**	0.485***	0.318***	0.325***
	(0.517)	(0.0466)	(0.0888)	(0.0610)	(0.0595)
$M.SHARE_{t-1}$	-1.568	-0.0723	-0.0729	0.0310	-0.0716
	(1.565)	(0.121)	(0.165)	(0.136)	(0.118)
HHI_t	-0.135	-0.0699***	0.0826***	0.0804***	0.0437**
	(0.379)	(0.0154)	(0.0292)	(0.0181)	(0.0175)
$GDP.GR_t$	2.248**	-0.366***	-0.584***	0.599***	0.629***
	(1.031)	(0.0552)	(0.0817)	(0.0805)	(0.0695)
$INFLATION_t$	1.791**	-0.171***	-0.293***	0.359***	0.310***
	(0.857)	(0.0476)	(0.0706)	(0.0673)	(0.0662)
REG.INDEX	0.0293	-0.0172***	-0.0221***	0.0190***	0.0180***
	(0.0426)	(0.00333)	(0.00538)	(0.00443)	(0.00392)
$LERNER_{t-1}$	-0.243	0.0678***	0.120***	-0.0302	-0.0297*
	(0.213)	(0.0149)	(0.0218)	(0.0195)	(0.0176)
Constant	1.090***	0.645***	0.729***	0.190***	0.171***
	(0.157)	(0.0121)	(0.0196)	(0.0152)	(0.0139)
Observations	61,820	173,796	174,004	173,413	169,698
Banks	9,719	17,508	17,484	17,488	17,147
R-squared	0.020	0.062	0.077	0.067	0.081
Wald	3.902***	15.29***	20.53***	12.02***	13.29***

Notes:
The table presents fixed-effect estimates giving each observation a weight that equals the natural logarithm of the total number of banks from one country divided by the sum of natural logarithms of the total number of banks from each country in a sample. Year dummies are included in all specifications but remain unreported. Robust standard errors that control for clustering at the bank-level are reported in brackets.
The symbols *, ** and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 9

Impact of a bank's market power on bank liquidity in emerging vs. developed economies (controlling for country liquidity requirements)

Variables	INTERBANK	LOANS.TA	LOANS.STF	LIQA.STF	LIQA.BORR
	(1)	(2)	(3)	(4)	(5)
	Panel A. Estimation results				
$LERNER_{t-1}$	-0.372	0.0730***	0.139***	-0.0485**	-0.0522**
	(0.246)	(0.0179)	(0.0257)	(0.0236)	(0.0222)
$LERNER_{t-1} \times EMERG$	0.347	-0.0140	-0.0501	0.0492	0.0600
	(0.454)	(0.0315)	(0.0459)	(0.0404)	(0.0368)
Observations	61,820	173,796	174,004	173,413	169,698
Banks	9,719	17,508	17,484	17,488	17,147
R-squared	0.020	0.062	0.078	0.067	0.082
Wald	3.887***	14.74***	19.77***	11.66***	12.88***
	Panel B. Tests for sums of coefficients				
$LERNER_{t-1} + LERNER_{t-1} \times EMERG$	-0.0256	0.0590**	0.0884**	0.000688	0.00783
F-statistic	0.00441	5.135	5.294	0.000430	0.0727

Notes:
The table presents fixed-effect estimates giving each observation a weight that equals the natural logarithm of the total number of banks from one country divided by the sum of natural logarithms of the total number of banks from each country in a sample. Year dummies are included in all specifications but remain unreported. For the sake of brevity, we do not report estimation results for the control variables (LLP, EQUITY, M.SHARE, HHI, GDP.GR, INFLATION, REG. INDEX) and the constant term. Robust standard errors that control for clustering at the bank-level are reported in brackets. The symbols *, ** and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 10
Impact of a bank's market power on bank liquidity during crisis (controlling for country liquidity requirements)

Variables	INTERBANK (1)	LOANS.TA (2)	LOANS.STF (3)	LIQA.STF (4)	LIQA.BORR (5)
	Panel A. Estimation results				
$LERNER_{t-1}$	-0.244	0.0731***	0.122***	-0.0268	-0.0292
	(0.212)	(0.0150)	(0.0224)	(0.0204)	(0.0182)
$LERNER_{t-1} \times CRISIS_t$	0.00439	-0.0250	-0.00901	-0.0161	-0.00216
	(0.300)	(0.0184)	(0.0279)	(0.0282)	(0.0251)
Observations	61,820	173,796	174,004	173,413	169,698
Banks	9,719	17,508	17,484	17,488	17,147
R-squared	0.020	0.062	0.077	0.067	0.081
Wald	3.789	14.79	19.65	11.68	12.77
	Panel B. Tests for sums of coefficients				
$LERNER_{t-1} + LERNER_{t-1} \times CRISIS_t$	-0.239	0.0481	0.113	-0.0429	-0.0314
F-statistic	0.489	4.906**	12.863***	2.0722	1.350

Notes:
The table presents fixed-effect estimates giving each observation a weight that equals the natural logarithm of the total number of banks from one country divided by the sum of natural logarithms of the total number of banks from each country in a sample. Year dummies are included in all specifications but remain unreported. For the sake of brevity, we do not report estimation results for the control variables (LLP, EQUITY, M.SHARE, HHI, GDP.GR, INFLATION, REG. INDEX) and the constant term. A crisis variable is a dummy that equals one for 2007 and onward periods; non-crisis periods are assigned with zeros. Robust standard errors that control for clustering at the bank-level are reported in brackets.
The symbols *, ** and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 11

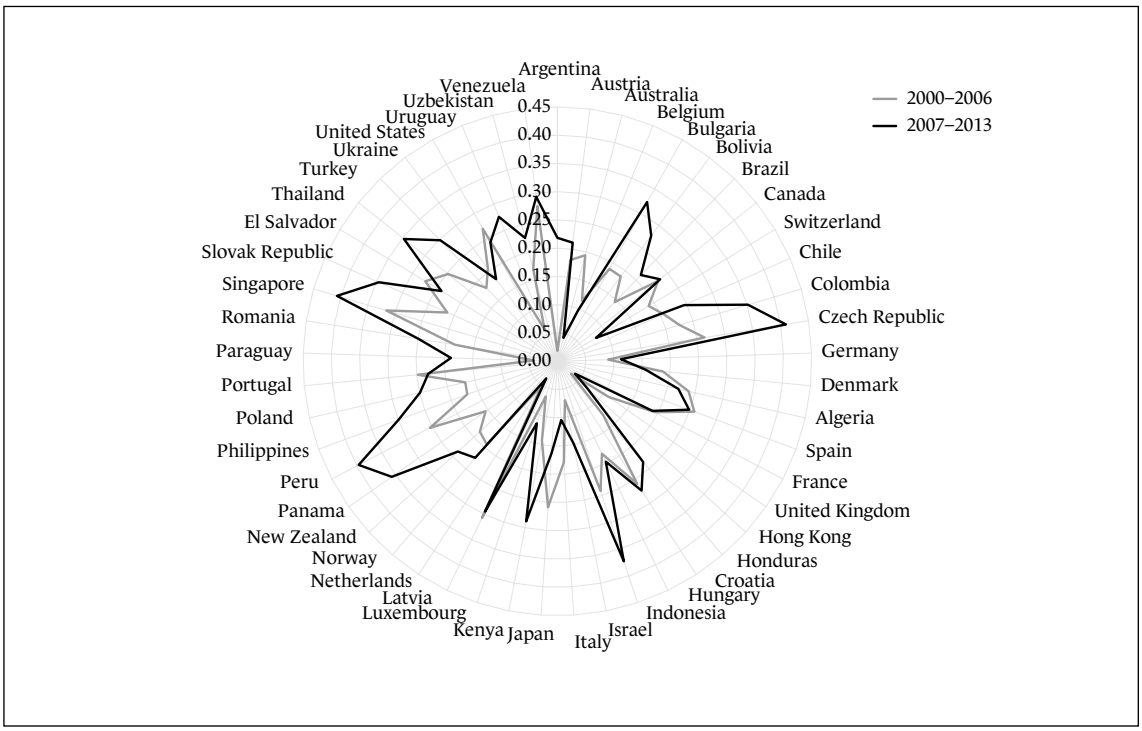
Impact of a bank's market power on its liquidity – the nonlinearity effect (controlling for country liquidity requirements)

Variables	INTERBANK	LOANS.TA	LOANS.STF	LIQA.STF	LIQA.BORR
	(1)	(2)	(3)	(4)	(5)
$LERNER_{t-1}$	0.247	0.0794***	0.114***	-0.0233	-0.0197
	(0.240)	(0.0172)	(0.0276)	(0.0246)	(0.0229)
$(LERNER_{t-1})^2$	-1.843***	-0.0433	0.0240	-0.0262	-0.0359
	(0.596)	(0.0411)	(0.0647)	(0.0568)	(0.0542)
Observations	61,820	173,796	174,004	173,413	169,698
Banks	9,719	17,508	17,484	17,488	17,147
R-squared	0.021	0.062	0.077	0.067	0.082
Wald	3.995***	14.58***	19.80***	11.65***	13.09***

Notes:

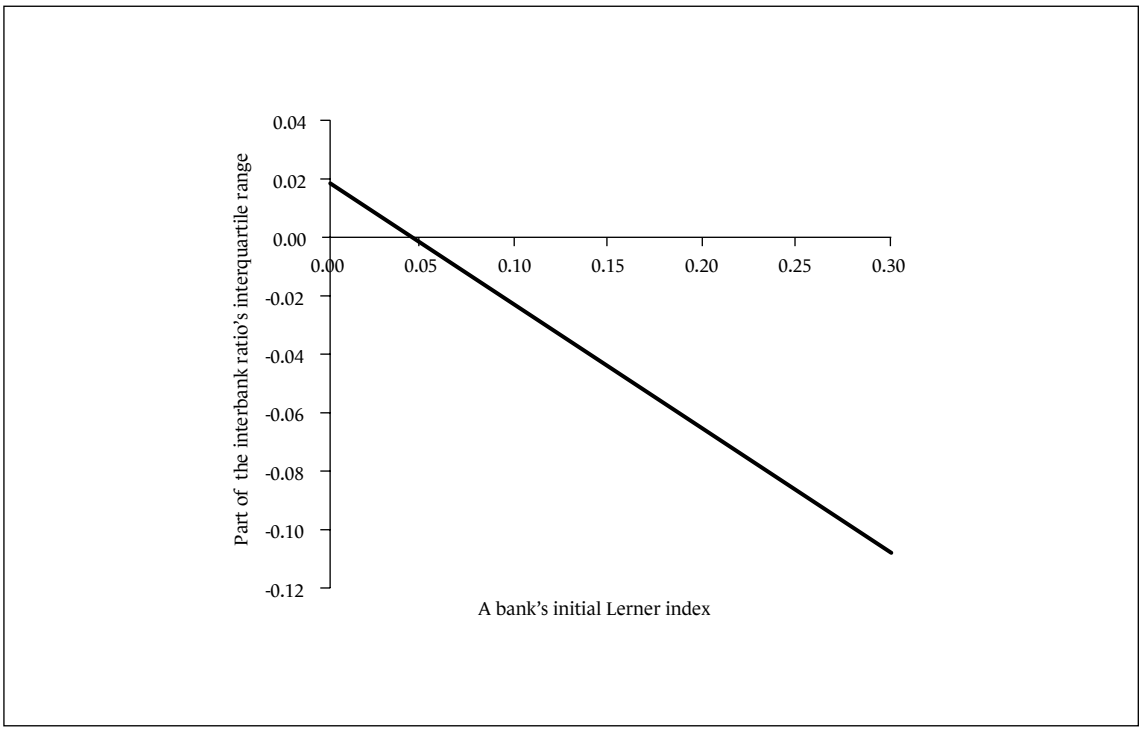
The table presents fixed-effect estimates giving each observation a weight that equals the natural logarithm of the total number of banks from one country divided by the sum of natural logarithms of the total number of banks from each country in a sample. Year dummies are included in all specifications but remain unreported. For the sake of brevity, we do not report estimation results for the control variables (LLP, EQUITY, M.SHARE, HHI, GDP.GR, INFLATION, and REG. INDEX) and the constant term. Robust standard errors that control for clustering at the bank-level are reported in brackets. The symbols *, ** and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Figure 1
Market power of banks in different countries and years



Source: authors' calculations.

Figure 2
Expected increase in a bank's interbank ratio, following an increase in the bank's Lerner index



Czy powinniśmy się obawiać „potężnych" banków? Siła rynkowa banków a ich bufory płynnościowe

W ostatnim czasie mogliśmy zaobserwować rosnącą siłę rynkową pojedynczych banków. Ostatnie badania naukowe, szczególnie z kryzysu z 2008 r., wskazały, że takie instytucje mogą wykorzystywać swoją przewagę konkurencyjną względem pozostałych banków w sektorze czy samych regulatorów. W naszym badaniu analizujemy, w jaki sposób siła rynkowa poszczególnych instytucji, mierzona wskaźnikiem Lernera, przekłada się na ich wskaźniki płynnościowe. Odpowiedź na to pytanie badawcze nie jest oczywista. Z jednej strony możemy oczekiwać, że banki o silniejszej pozycji rynkowej będą ostrożniej zarządzały swoją płynnością ze względu na chęć wykorzystania swojej pozycji konkurencyjnej w każdym momencie. W takich instytucjach powinniśmy również zauważać wyższe wskaźniki płynności aniżeli w instytucjach o słabszej sile rynkowej. Z drugiej strony banki o wyższej sile rynkowej mogą wykorzystywać swoją pozycję rynkową i zachowywać się bardziej agresywnie, a tym samym wykazywać niższe wskaźniki płynności. Nasze badanie ma na celu zweryfikowanie powyższych hipotez. W tym celu analizujemy zależność pomiędzy siłą rynkową 17,5 tys. banków z 47 krajów w latach 1996–2013 a wskaźnikami płynnościowymi tych instytucji. W swojej analizie stosujemy regresję panelową z efektami stałymi, włączając również zmienne binarne w odniesieniu do każdego roku. Nasze wyniki pozostają jednak niezmienne w przypadku wykorzystania innych modeli regresji, co wykazujemy w rozdziale 5 „Robustness check".

Wyniki naszego badania wskazują, że banki o silniejszej pozycji rynkowej utrzymują niższe wskaźniki płynności, przy wszystkich pozostałych efektach *ceteris paribus*. Interesującym wnioskiem z badania jest to, że wyniki różnią się w zależności od specyfiki gospodarki, w której funkcjonują banki, tj. w krajach rozwiniętych *versus* rozwijających się, jak również w zależności od analizowanego okresu działalności. Wyniki regresji są wysoce statystycznie istotne dla banków w krajach rozwiniętych, jak również dla okresu *prosperity*, jednak nie możemy tego potwierdzić dla instytucji działających w krajach rozwijających się czy okresu kryzysu finansowego. Wnioski z naszego badania wskazują na to, że wielkość niekoniecznie powinna być głównym wyznacznikiem regulacyjnym w odniesieniu do działalności banków. Kryzys finansowy pokazał, że siła rynkowa banków może w większym stopniu determinować ich zachowania, co odzwierciedla się w ich wskaźnikach finansowych.

Z tego powodu instytucje nadzorcze powinny zacząć się przyglądać bankom o wysokiej sile rynkowej, a nie tylko instytucjom „zbyt dużym, by upaść".

Słowa kluczowe: siła rynkowa, indeks Lernera, płynność, wskaźnik płynności, bufor płynności