



The role of governance on bank liquidity creation



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ABSTRACT

This paper examines the impact of internal bank governance on bank liquidity creation in the U.S. before, during and after the 2007–2009 financial crisis. Using bank holding company level data, we analyze whether better-governed banks create higher levels of liquidity. We find that this effect is positive and significant but only for large bank holding companies. Further analysis reveals that specific internal governance categories: CEO education, compensation structure, progressive practices, and ownership have a significant effect on bank liquidity. However, this positive effect occurs mostly during the crisis period, and for large banks that are also high liquidity creators. Finally, we find that the effect of governance on liquidity creation increases during the crisis period. These findings are robust even while controlling for liquidity measures, bank size, and endogeneity problems between governance and liquidity creation.

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1. Introduction

The financial crisis of 2007–2009 provided compelling evidence as to how quickly liquidity can evaporate, and that the resulting illiquidity can last for an extended period of time. From the early stages of the crisis, liquidity management problems became apparent even in those financial institutions with adequate capital levels. The Basel Committee on Banking Supervision (BCBS) concluded that many banks failed to follow basic principles of liquidity risk management when liquidity was still abundant (Bank for International Settlements, 2008). Consequently, risk failures and governance issues predominated in new bank regulation¹, banking research studies, and news headlines. According to a 2015 Wall Street Journal article, U.S. bank supervisors, recognize that improvements in bank governance have a positive impact in the soundness of our financial system.²

The financial crisis of 2007–2009 (hereon referred to as “the crisis” or “crisis”) exposed several flaws in our financial system,

but also long-standing gaps in banking studies. We are interested in particular by the exclusion of financial institutions from governance studies. This paper empirically examines for the first time, how internal corporate governance affects bank liquidity creation and how this varies across bank size classes. Our contribution in this paper is two-fold. First, we seek to fill a gap in the bank governance literature by presenting the first examination of whether corporate governance affects bank liquidity creation. Second, we aim to expand the limited but growing empirical literature on bank liquidity creation. While several recent studies look at how internal governance influence risk-taking behavior or bank performance (e.g., see Beltratti and Stulz, 2012; Erkens et al., 2012; Elul and Yerramilli, 2013), we have found no paper which examines whether, and how corporate governance is related to bank liquidity creation. It is well documented that for any bank to be competitive, it must fulfill two core missions; a bank must be able to a) transform risk and b) create liquidity (Bhattacharya and Thakor, 1993). According to risk transformation theory banks transform riskless deposits to finance risky loans (e.g. Diamond, 1984; Ramakrishnan and Thakor, 1984; Boyd and Prescott, 1986). The effect of internal governance on risk transformation and associated risk-taking behavior has been examined extensively in the past; studies exploring the effect of governance on liquidity creation are non-existent, but we believe, equally important. Liquidity creation and risk transformation do not move simultaneously, it is necessary to highlight their differences to fully understand the liquidity

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¹ New guidelines in bank governance for large financial institutions were recently finalized by the OCC in 2014 (press release September 2014) <http://www.occ.gov/news-issuances/news-releases/2014/nr-occ-2014-117.html>

² “Regulators Intensify Scrutiny of Bank Boards” Wall Street Journal, March 30, 2015.

creator role a bank plays in the financial system (Berger and Bouwman, 2009).

The process of liquidity creation exposes banks to numerous risks. Banks create liquidity by transforming liquid deposits into illiquid assets. While this is a vital service to the economy, it leaves banks vulnerable to runs (Diamond and Dybvig, 1983). Despite this vulnerability, banks continue to create liquidity during downturns in the economy, thus performing a critical role in the financial system (e.g. Bryant, 1980; Bernanke, 1983; Dell'Ariccia et al., 2008). However, there are limits to the economic benefits of liquidity creation. According to Acharya and Naqvi (2012), excessive liquidity may drive the banking sector to initiate or aggravate an asset bubble potentially increasing the vulnerability of the banking sector, and instigating a financial crisis. Berger and Bouwman (2014) find evidence that liquidity creation increases immediately before crisis periods, and that excess liquidity creation is predictive of future crises. These studies support the importance of increasing our understanding of bank liquidity creation. In the current paper, it is our intention to expand our knowledge on this topic and specifically on the relation between bank governance and liquidity by answering the following questions; Does internal bank governance affects bank liquidity creation? Is this effect the same for all banks? Are banks that create high levels of liquidity better governed than low liquidity creators?

We answer these questions using empirical measures of bank liquidity creation not only from traditional bank activities, loans and deposits but also from off-balance sheet activities. This dual focus is important because banks not only create liquidity from transforming liquid liabilities into illiquid assets, they also create liquidity from off-balance sheet commitments (e.g. Holström and Tirole, 1998; Berger and Bouwman, 2009; Kashyap et al., 2002). In the current study, we use two liquidity measures: cat fat, and cat nonfat. We use the definitions of these liquidity variables from Berger and Bouwman (2009). Cat nonfat measures liquidity created on the balance sheet, and Cat fat is the sum of on-balance sheet liquidity and off-balance sheet liquidity.

To preview our results, we find evidence that internal bank governance has a positive effect on liquidity creation, and this effect is robust to different definitions of liquidity. We also examine the effect of governance on liquidity creation using three bank subsamples sorted by total assets. We find a positive effect of governance on bank liquidity creation present in the full sample, and for large banks when we split the sample into size subsamples. We also find that before and after the financial crisis, better governance decreases liquidity creation, and during the financial crisis the effect of governance on liquidity creation is positive and statistically significant. This result suggests that boards made significant changes in their supervision and controls during the financial crisis. In particular, we find that better scores in specific governance categories such as audit committee characteristics, compensation incentives, and ownership characteristics have different effects on liquidity creation during the financial crisis than before and after this period. For example, better governance scores of audit committee characteristics had a positive effect before and after the crisis for cat fat and cat nonfat, but this effect is negative during the crisis for cat fat and economically insignificant for cat nonfat.

We also examine how equity capital affects liquidity creation. Cornett et al. (2011) find that banks using more core deposits, a key component of liquidity creation, and more equity capital, saw significant increases in loan production, relative to those banks that rely more on wholesale sources of debt financing during the financial crisis. In our study, we find there is a positive relation between equity and liquidity creation across all liquidity measures. Moreover, the results are robust across bank size subsamples and sample periods.

Further analysis using two subsamples of high liquidity creators (top 25%) and low liquidity creators (bottom 25%) provide additional results. When examining the full sample the data shows that the effect of governance on liquidity creation is only significant for high liquidity creators. When considering individual governance variables, better audit committee characteristics show a positive effect on liquidity creation across the sample period, but only for high liquidity creators. This supports the contention that when their internal governance increases, these banks create more liquidity. On the other hand, excluding ownership characteristics, improvements in internal governance showed no effect on bank liquidity creation for bottom liquidity creators. We also find that the positive effect of governance on liquidity creation is present for ownership characteristic variables during the 2003–2007 sample with no significant differences during the crisis period.

The rest of the paper is organized as follows. Section 2 describes the theoretical framework and hypotheses development. Section 3 describes the sample, data and liquidity, governance and control variables used in the estimation. Section 4 presents the empirical methodology. Section 5 discusses our empirical results. Section 6 offers concluding remarks.

2. Theoretical framework and hypotheses development

In this section, we review existing literature and theories to develop our hypotheses about the relationship between corporate governance and bank liquidity creation and the effect of capital on bank liquidity creation while controlling for internal governance.

Our study expands the existing literature on liquidity creation, and builds upon the growing bank governance literature. Banks perform a critical role in the economy when they create liquidity by funding relatively illiquid loans with liquid deposits. For example, corporate lending, either through traditional business loans or loan commitments, is known to be an important driver of business activity (e.g. Guiso et al., 2004), firm startup (e.g. Kerr and Nanda, 2009), and firm productivity (e.g. Krishnan et al., 2014).

Empirical studies on bank liquidity creation are limited but growing. Berger and Bouwman (2009) fill an important gap in bank research by creating four empirical measures of bank liquidity: cat fat, mat fat, cat nonfat and mat nonfat. These measures are based on loans' categories or maturities (cat or mat), and the inclusion (fat) or exclusion (nonfat) of off-balance sheet activities. Subsequent empirical liquidity creation studies use their measures and find significant links between liquidity creation and equity capital (Horváth et al., 2014), monetary policy (Berger and Bouwman, 2014), economic output (Berger and Sedunov, 2016), and government intervention (Berger et al., 2016). However, ours is the first study to our knowledge that examines the effect of governance on liquidity creation.

2.1. Bank liquidity and corporate governance

H1. Banks with stronger internal governance create more liquidity on the balance sheet (cat nonfat).

H2. Banks with stronger internal governance create more liquidity on and off the balance sheet (cat fat).

In creating liquidity, banks reduce their own liquidity (Bouwman, 2013). Banks are vulnerable to liquidity risk because they must provide on demand liquidity to depositors. At the extreme, systemic increases in liquidity demand can result in bank runs from depositors (Cornett et al., 2011). Thus, regulatory safety nets exist (e.g. deposit insurance) to avert potentially disastrous systemic bank runs. Alternatively, moral hazard and option values

related to the limited liability of banks, drives banks to rely heavily on leverage to produce loans and create liquidity. In addition, depositors are less risk sensitive than other debt holders, and consequently do not demand adequate compensation for banks' risk-taking (Acharya et al., 2009).

Macey and O'Hara (2016) point out that banks have unusual capital structures, and it is precisely because of this unusual characteristic that they have a unique role in generating liquidity for the economy. Diamond and Rajan (2001) explain the strong relationship between leverage and liquidity creation, while Berger et al. (2016), find that a buildup of liquidity supply and excessive risk-taking behavior by banks can precede a financial crisis. There is wide agreement that substantial exposure to subprime mortgages, and a failure of risk management at banks were influential factors of the subprime crisis (Brunnermeier, 2009). Ellul and Yerramilli (2013) propose that strong internal governance is required to prevent risk management failures that cannot be completely controlled by regulatory supervision or external market discipline.

Corporate governance problems exist in banks and their effects have been well documented particularly after the financial crisis (Laeven and Levine, 2009; Pathan, 2009; Fahlenbrach and Stulz, 2011; Aebi et al., 2012; Beltratti and Stulz, 2012; Pathan and Faff, 2013). However, bank governance research is mainly concentrated on investigating the effects on bank performance and/or risk taking behavior. There is no consensus among findings, some studies support that bank governance is important for these variables (Laeven and Levine, 2009; Pathan, 2009), while others find that governance plays an insignificant role in banks (Fahlenbrach and Stulz, 2011; Aebi et al., 2012; Beltratti and Stulz, 2012; Wintoki et al., 2012).

H3. The effect of governance on bank liquidity creation is stronger for large banks

H4. The effect of governance on bank liquidity creation is stronger for banks that are high liquidity creators

In this study, we hypothesize that liquidity creation and governance are related. When strong governance curbs excessive risk, banks can create liquidity with reduced risk of insolvency. Faleye and Krishnan (2014) find that bank board effectiveness reduces risky lending and that this effect is limited to times of distress. They also find that this effect is stronger for banks with credit risk committees. If strong governance allows banks to create liquidity by taking prudent risks, they can increase the value of the firm and stay solvent.

Thus, we would expect that banks with stronger internal governance create more liquidity than banks with weaker internal governance. Additionally, Berger and Bouwman (2009) find that 81% of liquidity in the U.S. banking sector is created by large banks. Furthermore, we believe that banks with stronger internal governance create more liquidity, therefore we would expect to see a significant effect of governance on bank liquidity creation for those banks that create most of the liquidity in the banking system.

H5. Equity has a positive impact on liquidity creation when controlling for bank internal governance, ("risk absorption hypothesis")

Berger and Bouwman (2009) propose two contradicting hypotheses to explain the effect of capital on liquidity creation. On one hand, the "fragility-crowding out" hypothesis predicts that higher capital makes banks less fragile, which in turn will decrease monitoring activity of borrowers and liquidity creation. On the other hand, the "risk absorption" hypothesis predicts that higher capital ratios help banks to be better positioned to absorb risk and thus create more liquidity. Their results support their first hypothesis only for small banks in their samples, whereas the results for

large banks support the risk absorption hypothesis. Our sample includes only public bank holding companies, we believe that their behavior will be similar to large banks and diversified entities. We predict that equity capital helps banks to be better positioned to absorb risks, and the effect on liquidity creation will be positive. Furthermore, if banks take risks and maintain sufficient capital to operate, they will create liquidity by making loans and other off-balance sheet activities.

3. Sample, data and variables descriptions

3.1. Sample and data

We identify public U.S. bank holding companies (BHCs) with firm-level Corporate Governance Quotient (CGQ) scores from the dataset compiled by Institutional Shareholders Services (ISS) from the first quarter of 2003 to the fourth quarter of 2009, we then extend our study to include also BHCs with governance data until 2013. The ISS score is calculated using 8 different governance attributes from 2003–2009, but the index changed in 2010 and now only includes 5 governance attributes (see Appendix). The CGQ scores are available for a total of 495 public BHCs during our sample period. Since 2003, bi-annually, ISS has added additional governance attributes to the CGQ matrix and more firms to the dataset until 2009 when it changed its composition. For consistency, we construct governance measures using the attributes that are available across all 11 years of our study period.

Our final sample is formed by merging ISS governance data with two other data sources: Liquidity creation data collected systematically by Berger and Bouwman³, and FR Y-9C reports from the Federal Reserve Bank of Chicago. First, we aggregate bank level liquidity creation data for 4307 bank holding companies by matching the regulatory top holder to available banks in the bank liquidity dataset. Second, we merge these data with accounting and financial data from FR Y-9C reports available from the Federal Reserve Bank of Chicago, which resulted in 2644 successfully matched BHCs. At this point, 989 BHCs are excluded from the study for the following reasons: i) no loans outstanding; ii) zero deposits; iii) negative values of total equity; or iv) less than one year of financial data. Finally, BHCs are matched with ISS governance scores. Our full dataset includes 247 BHCs and 7721 bank-quarter observations: 3295 for large banks, 2762 for medium banks, and 1645 for small banks. Summary statistics are presented in Table 1.

3.2. Liquidity creation variables

In our study, we use two of Berger and Bouwman's (2009) liquidity creation variables, "catfat" and "cat nonfat". These two variables are gathered from a dataset made publicly available by the authors and calculated following their the three-step procedure. In the first step, assets, liabilities, and equity are classified as liquid, semi-liquid, or illiquid based on the ease, cost, and time it takes for customers to withdraw liquid funds from the bank, and the ease, cost and time it takes for a bank to dispose of their obligations to meet these liquidity demands. All off-balance sheet items are classified following a similar procedure. In the second step, weights are assigned to all bank activities consistent with liquidity creation theory. Positive weights are applied to both illiquid assets and liquid liabilities, thus liquidity is created when a liquid liability is used to finance illiquid assets: for example, when deposits are used to finance a small business. Similarly, negative weights are applied to liquid assets, illiquid liabilities, and equity. In this situation, liquidity decreases when either illiquid liabilities or equity are used

³ Christa Bouwman's website <http://people.tamu.edu/~cbouwman/>

Table 1Definition of variables. In parenthesis, the number of governance items included for 2010–2013 (see [Appendix](#)).

Variable	Definition
<i>Cat Fat</i>	Liquidity created on and off the balance sheet following Berger and Bouwman (2009) .
<i>Cat nonFat</i>	Liquidity created on the balance sheet following Berger and Bouwman (2009) .
<i>Governance</i>	Firm-level governance measure: a comprehensive governance quality measure that is the sum of the 50 firm-specific items listed in Appendix
<i>Audit</i>	Firm-level governance measure category A included in the comprehensive governance measure GOV that includes the sum of 4 (6) items listed in Appendix
<i>Board</i>	Firm-level governance measure category B included in the comprehensive governance measure GOV that includes the sum of 16 (17) items listed in Appendix
<i>Charter</i>	Firm-level governance measure category C included in the comprehensive governance measure GOV that includes the sum of 7 (13) items listed in Appendix .
<i>Director education</i>	Firm-level governance measure category D included in the comprehensive governance measure GOV that includes 1 item listed in Appendix Only for 2003–2009.
<i>Compensation</i>	Firm-level governance measure category E included in the comprehensive governance measure GOV that includes the sum of 10 (17) items listed in Appendix
<i>Ownership</i>	Firm-level governance measure category F included in the comprehensive governance measure GOV that includes the sum of 4 (3) items listed in Appendix
<i>Progressive practices</i>	Firm-level governance measure category G included in the comprehensive governance measure GOV that includes the sum of 7 items listed in Appendix Only available for period of 2003–2009.
<i>Incorporation</i>	Firm-level governance measure category H included in the comprehensive governance measure GOV that includes 1 item listed in Appendix B.
<i>Crisis</i>	A dummy variable that equals 1 from the third quarter of 2007 to the fourth quarter of 2009 and 0 otherwise, according to Berger and Bouwman (2013)
<i>Z-score</i>	By following Laeven and Levine (2009) dividing the sum of ROA and the capital assets ratio (Equity/Total Assets) by the standard deviation of ROA
<i>Equity ratio</i>	Total equity divided by Total Assets
<i>Risk</i>	Computed by dividing Tier 1 risk weighted assets and off balance sheet equivalent assets by Total Assets
<i>ROA</i>	Net Income (loss) divided by Total Assets
<i>ROE</i>	Net Income (loss) divided by Total Equity
<i>Size</i>	Logarithm of <i>Total Assets</i> which have been adjusted for inflation based on annual CPI
<i>GDP growth</i>	Annual growth of quarterly GDP

to finance liquid assets. In the third step, liquidity variables are created by multiplying each item by its respective weight.

[Berger and Bouwman \(2009\)](#) compute four different liquidity variables based on loans' categories or maturities (cat or mat), and the inclusion (fat) or exclusion (nonfat) of off-balance sheet activities. In our study, we only use the classification of loans based on categories, and most importantly the preferred "catfat" liquidity creation measure. [Berger and Bouwman \(2009\)](#) conclude that of the four liquidity measures, "catfat" is their preferred liquidity indicator because maturities relative to categories, are not very good indicators of the time, cost and ease for banks to obtain liquid funds from their obligations, due to how banks use securitization to obtain these funds. Moreover, "fat" variables include off-balance sheet activities, and thus a complete picture of the bank's liquidity creation. To complement our study, we also use cat nonfat in our models. This liquidity creation measure includes only on balance sheet activities.

[Berger and Bouwman \(2009\)](#) show that on average only 50% of liquidity is created from on-balance sheet activities, while the other half is created from off-balance sheet activities. In our study, we find that for the whole sample period on average, large BHCs create 24.5% of total liquidity off the balance sheet, while medium banks and small banks create 11.9% and 12.8% from off balance sheet commitments, respectively. The analysis of off-balance sheet activities is interesting and relevant for the health and soundness of banks since these activities shape the future balance sheet. These activities involve the creation of contingent assets and liabilities that give rise to their future potential placement on the bank's balance sheet ([Saunders and Cornett, 2013](#)).

3.3. Corporate governance

Following [Jiraporn et al. \(2011\)](#), we compute a comprehensive governance index for each bank in our sample. The *Governance* in-

dex is constructed by awarding one point for each of the 50 governance standards that apply to the bank from 2003 to 2009 and 56 governance standards from 2010 to 2013. These standards are listed in the [Appendix](#).⁴

For the 2003–2009 subsample, the index is calculated using 50 different standards from 8 categories: audit, board of directors, charter/bylaws, director education in governance issues, executive and director compensation, ownership, progressive practices, and state of incorporation. For the 2010–2013 subsample, the index is calculated using only 5 categories: audit, board of directors, charter/bylaws, executive director compensation, and ownership. Two of the three categories not included in 2010–2013; director's education in governance issues, and state of incorporation, include only one governance attribute. The third category not included in the 2010–2013 calculation is "progressive practices", which includes attributes like mandatory retirement age for directors or the existence of a board approved CEO succession plan, see the full list in the [Appendix](#). In our analysis, we also exploit our rich governance database and use scores of the aforementioned individual categories.

We believe that our governance index, regardless of the computation change in 2010, measures the internal governance of the BHCs accurately. However, we also consider the possibility of a break in 2010 and show results for two subsamples, each with different index calculations. The advantage of using ISS governance matrix measures, as concluded by [Brown and Caylor \(2006\)](#), is that it is broader in scope and incorporates more firms. At the same time, for a governance measures, this index is more dynamic than other governance indices commonly used by other studies.

⁴ The minimum standard is provided and described in ISS Corporate Governance Quotient- CGQ Best Practices Manual published December 2008.

4. Empirical methodology

For our model estimation, we use panel data for all listed BHCs in our sample using “cat fat” and “cat nonfat” liquidity measures standardized by gross total assets as dependent variables. Gross total assets include total assets plus allowance for loan and lease losses and the allocated risk reserve.

Our baseline empirical model to examine the impact of internal governance on bank liquidity creation follows the equation below:

$$\begin{aligned} \text{Liquidity}_{i,t} &= \alpha_i + \mu_t + \beta_1(\text{Gov})_{i,t} + \beta_2(\text{Crisis} * \text{Gov})_{i,t} + \beta_3(\text{Zscore})_{i,t} \\ &+ \beta_4(\text{Equity})_{i,t} + \beta_5(\text{Risk})_{i,t} + \beta_6(\text{ROA})_{i,t} \\ &+ \beta_7(\text{ROE})_{i,t} + \beta_8(\text{Size})_{i,t} + \beta_9(\text{GDPgrowth})_{i,t} + \varepsilon_{i,t} \end{aligned} \quad (1)$$

where $i = 1, \dots, N$ indexes the BHC, and $t = 1, \dots, T$ indexes the quarter, α_i is a bank-level fixed effect for bank i , μ_t is a time effect for quarter t , and $\varepsilon_{i,t}$ is a random disturbance that is assumed to be normally distributed with mean 0 and variance σ^2 . We include bank fixed effects to account for differences among BHCs over time that are not captured by control variables, and to reduce correlations across error terms. Time fixed effects are also included to account for serial correlation and to control for average differences in liquidity creation across quarters. All regressions are estimated using robust standard errors, clustered by BHC, to control for heteroscedasticity and serial correlation within the same BHC. According to Hausman test results, fixed effects are recommended over random effects for our model estimation.

In our estimation, we control for bank level risk and performance characteristics and macroeconomic conditions. For bank characteristics, we control for bank risk, size and performance. We control for bank risk using z-score and credit risk. The z-score measures the bank's distance to default and it is defined as the return on assets plus the capital asset ratio divided by the standard deviation of asset returns. Higher z-score values represent more stable banks with a greater distance to default. The z-score is highly skewed and thus log-transformed as recommended by Laeven and Levine (2009). The credit risk measure is calculated by dividing total capital (Tier 1 + Tier 2) by total risk-weighted assets, this indicator can suggest an increase (decrease) in risk-taking behavior when total risk weighted assets increase and the ratio decreases (increases). Risk variables are orthogonalized in the estimation to avoid multicollinearity problems. We also include the equity ratio defined as total equity divided by total assets to control for equity levels, and size using the log of total assets. Bank performance is included in the regression using ROA to control for managerial performance and ROE to control for investor performance.

To control for macroeconomic conditions during our sample period, we include a dummy variable to capture the effect of the financial crisis. This variable has a value of 1 from the third quarter of 2007 to the fourth quarter of 2009, and zero otherwise. We follow the definition of the recent recession from Berger and Bouwman (2013). We also include in our model GDP growth to control for economic conditions, particularly during the crisis period. We gather these data from the Federal Reserve Bank of St. Louis. GDP growth is defined as the annual percent change in quarterly GDP.

Furthermore, we perform the same analysis but using size subsamples of BHCs according to industry definitions. Large banks are those BHCs with more than \$3 billion in total assets, medium banks are BHCs with total assets between \$3 billion and \$1 billion and small banks are BHCs with less than \$1 billion in total assets. Also, we first analyze the effect of governance on bank liquidity creation using the total Governance score that includes the

eight categories explained in the Appendix. We continue with a more detailed analysis where we include all eight (five) governance categories for 2003–2009 (2010–2013): *Audit, Board, Charter, Education, Compensation, Ownership, Progressive, and Incorporation* into our regression to determine whether a single governance category has a stronger influence on bank liquidity creation than the others.

4. Empirical results

4.1. Univariate results

Descriptive statistics for all variables are presented in Tables 2 and 3. Table 2 shows descriptive statistics for the full sample period 2003–2013, for all banks, and by bank size and liquidity levels. Table 3 presents statistics for different subsamples, column 1 shows statistics for 2003–2009 and column 4 for time period 2010–2013, columns 2 and 3 show statistics before the crisis. Column 2 shows statistics from the first quarter of 2003 to the second quarter of 2009, and column 3 statistics from the first quarter of 2010 to the fourth quarter of 2013.

All banks created on average \$9.4 and \$5.4 billion measured by cat fat and cat nonfat respectively. We also see a clear and very large difference between the average liquidity created by large banks and small banks in the sample, of approximately 12 billion. The same pattern is present if we compare banks by liquidity levels, high liquidity creators provide \$35 billion on average whereas low liquidity creators only produced \$80 million on average. However, the variation in the high liquidity group is substantial. The standard deviation of the high liquidity group is almost \$102 billion. On the other hand, the standard deviation of cat fat for low liquidity creators is only \$2 million.

The governance score of the average bank is 17.6 during 2003–2013 ranging from a low of 13.3 for small banks and up to 20.1 for large banks. High and low liquidity creators do not show a large difference between governance scores with 18.7 for high liquidity creators and 17 for low liquidity creators. The z-score is 34 on average and 45 for small banks and 35 for large banks, z-scores show greater stability and distance to default as the score increases. The difference between these values suggests that small banks are more stable than large banks in the sample. Equity ratios are 10.69%, 10.21% and 12.20% for large, medium and small banks respectively. Equity ratios for high liquidity creators are on average almost 11% while low liquidity creators show the highest equity ratios on average, reaching around 11.8%. Given these values, univariate results show support for the fragility hypothesis where liquidity creation and equity move in opposite directions. The credit risk ratio is 76.5% on average for all banks in the sample, and very close to this number for large, medium, high liquidity and low liquidity. However, small banks show a credit risk ratio of 86% on average, 10 percentage points higher than the average bank in the sample. ROA and ROE show similar trends for all banks and bank sizes. The average ROA is 0.47% and the average ROE is 4.95% for all banks in the sample.

On Table 3, we can see the different governance scores before and after the crisis. On average, bank governance scores improved from 11 between 2003–2007 to almost 28 after 2009, with a greater variation during 2010–2013. The governance score for the full sample is approximately 17 (see Table 2). Overall, these values are significantly lower than the average governance score of non-financial companies reported in previous studies ranging between 20 and 30 (Jiraporn et al., 2011). Table 3 also shows that total liquidity cat fat before the crisis was \$5.6 billion, during the crisis \$6 billion, and after the crisis \$15.9 billion. These values have increased considerably and show a greater standard deviation as well. The same trend is present when we analyze only on bal-

Table 2
Descriptive statistics by bank size and liquidity levels.

	All banks	Large	Medium	Small	High liquidity	Low liquidity
Observations	7721	3295	2762	1645	1928	1916
BHCs	247	160	168	135	111	173
Cat fat (000's)						
Mean	9412,355	21,263,864	761,551	265,603	35,213,053	80,430
Std Deviation	53,170,176	79,838,426	373,991	134, 551	102,079,344	2015,066
Cat nonfat (000's)						
Mean	5464,249	12,183,380	600,335	211,050	20,260,305	(245,847)
Std Deviation	26,993,879	40,338,977	299,715	108, 664	50,995,048	4663,765
Governance						
Mean	17.63	20.06	17.32	13.33	18.66	17.09
Std Deviation	8.09	8.41	7.87	5.54	8.43	7.96
Z-score						
Mean	33.87	35.21	34.03	45.01	35.85	43.24
Std Deviation	27.51	19.46	20.65	44.54	20.12	41.45
Equity						
Mean	10.84%	10.69%	10.21%	12.20%	10.97%	11.83%
Std Deviation	6.15%	4.10%	5.14%	9.81%	4.93%	8.76%
Credit Risk						
Mean	76.49%	73.04%	74.52%	86.17%	78.04%	78.42%
Std Deviation	40.71%	30.38%	28.95%	66.02%	37.24%	59.05%
ROA						
Mean	0.47%	0.49%	0.44%	0.48%	0.50%	0.44%
Std Deviation	0.74%	0.76%	0.74%	0.68%	0.71%	0.71%
ROE						
Mean	4.95%	4.68%	4.05%	6.97%	5.06%	5.53%
Std Deviation	45.96%	12.48%	28.77%	90.20%	8.09%	88.47%
Total Assets (000's)						
Mean	20,734,744	46,625,187	1851,856	727,435	73,448,108	3779,367
Std Deviation	127,711,939	192,403,988	941,627	455,494	246,420,796	28,740,681

Cat fat is the total liquidity created by the bank. Cat nonfat is the bank liquidity created only on the balance sheet. Governance is bank-level governance where higher scores indicate better governance. Z-score is defined as dividing the sum of ROA and the capital assets ratio (Equity/Total Assets) by the standard deviation of ROA. Equity is defined as total equity divided by total assets. Credit risk is Tier 1 ratio divided by risk-weighted assets. ROA is the return on assets. ROE is the return on equity. Large Banks, Medium Banks, and Small Banks are banks with more than \$3 billion, between \$3 billion and \$1 billion, and less than \$1 billion gross total assets, respectively. High liquidity category includes banks in 75th percentile of cat fat, and low liquidity creators are banks in the 25th percentile of cat fat.

ance sheet liquidity creation, *cat nonfat*. Average z-scores, equity ratios, and credit risk ratios are relatively stable for all time periods. However, we do not see the same stability for ROA, ROE, and GDP growth. These three values capture the disastrous bank performance during the 2007–2009 financial crisis years. ROA and ROE values decreased to 0.22% and 1.89% during the crisis, from 0.69% and 7.85% respectively during 2003–2007. Furthermore, these two performance measures were back up again during 2010–2013, although not a definitive recovery, to 0.40% and 3.83% for ROA and ROE, respectively. The GDP growth statistic presents supporting evidence of the economic recession with values of almost 6% during 2003–2007 to practically no growth during the crisis period, and up to 2.5 on average during 2010–2013. Finally, bank size also provides insight into the banking sector's condition during this time, with a pronounced increase in average total assets with size reaching almost \$37 billion in 2010–2013, from an average value of \$10.4 before the 2007–2009 crisis. These values show the rapid growth in the size and scope of BHCs over the past twenty-five years (Avraham et al., 2012)

Fig. 1a presents a graphical representation of average liquidity 2003–2009 for all banks in the sample. Fig. 1b and c present *Cat fat* and *Cat nonfat* for size subsamples, respectively. Both liquidity measures show an upward trend during the sample period with a dramatic increase in liquidity at the beginning of 2008, but followed by a decrease in liquidity at the beginning of 2009. Both liquidity measures mimic each other, but we see more evidence of volatility in *Cat fat*. We have two possible explanations for this result. First, according to findings by Berger et al. (2016), reduction in liquidity creation can be explained by regulatory interventions

and capital injections. In October 13, 2008 the Treasury, the Federal Reserve, the FDIC and OCC jointly announced the Capital Purchase Program (CCP) under the Troubled Asset Relief Plan (TARP) to inject up to \$250 billion in banks.⁵ Second, Cornett et al. (2011) point out that new credit production measured by new loans and undrawn commitments fell by about \$500 billion in the fourth quarter of 2008. Credit production is an important component of *cat fat* and *cat nonfat*. We believe that both explanations are correlated, the fragile state of the banking sector produced by frozen credit markets during that time, forced regulators to intervene and maintain the soundness of the U.S. banking system.

Table 4 presents the correlation matrices all variables used in our models. Panel A shows the correlation between our main variables, *cat fat*, *cat nonfat*, and governance, and all control variables. Panel B (C) shows the correlation matrix between total governance and individual governance categories for 2003–2009 (2010–2013). On Panel B and C, we can observe that among all the different governance categories, audit and board have a strong and significant correlation with the total governance score. On Panel C, we can also identify a significant and high correlation between total governance and compensation. The responsibilities of the bank audit committee include enhancing supervision through guidance that encourages sound practices within a bank.⁶ Previ-

⁵ Press Release, October 14, 2008. <http://www.treasury.gov/press-center/press-releases/Pages/hp1207.aspx>

⁶ Bank for International Settlements Press Release. The internal audit function in banks. Basel Committee on Banking Supervision. June 2012.

Table 3
Descriptive Statistics by sub samples and crisis period.

	(1) 2003Q1–2009Q4	(2) 2003Q1–2007Q2	(3) 2007Q3–2009Q4	(4) 2010Q1–2013Q4
Observations	4928	3057	1871	2793
Cat fat (000's)				
Mean	5745,392	5580,056	6015,532	15,882,384
Std Deviation	23,394,706	22,413,860	24,918,161	82,374,267
Cat nonfat (000's)				
Mean	3538,892	3372,266	3811,139	8861,371
Std Deviation	13,305,362	12,652,575	14,307,331	41,040,323
Governance				
Mean	11.80	11.39	12.47	27.93
Std Deviation	1.94	1.88	1.86	2.88
Z-score				
Mean	35.73	36.18	34.98	38.91
Std Deviation	29.34	30.72	31.21	23.81
Equity				
Mean	11.04%	11.34%	10.55%	10.49%
Std Deviation	7.51%	8.34%	5.88%	2.22%
Risk				
Mean	79.61%	79.35%	80.03%	69.60%
Std Deviation	50.02%	55.36%	39.80%	19.37%
ROA				
Mean	0.51%	0.69%	0.22%	0.40%
Std Deviation	0.73%	0.42%	0.98%	0.75%
ROE				
Mean	5.58%	7.84%	1.89%	3.83%
Std Deviation	9.19%	4.70%	12.83%	74.44%
Total Assets (000's)				
Mean	11,590,092	10,416,906	13,506,943	36,869,671
Std Deviation	53,625,927	39,651,024	70,722,151	199,037,646
GDP growth				
Mean	3.87%	5.85%	0.64%	2.51%
Std Deviation	3.18%	1.05%	2.84%	1.44%

Cat fat is the total liquidity created by the bank. Cat nonfat is the bank liquidity created only on the balance sheet. Governance is bank-level governance where higher scores indicate better governance. Z-score is defined as dividing the sum of ROA and the capital assets ratio (Equity/Total Assets) by the standard deviation of ROA. Equity is defined as total equity divided by total assets. Credit risk is Tier 1 ratio divided by risk-weighted assets. ROA is the return on assets. ROE is the return on equity. Size is measured by Total Assets.

ous studies propose that independent auditors prevent earnings management (Klein, 2002) at the same time. Also, according to Xie et al. (2003), the composition of the board and audit committee has an impact on the likelihood of engaging in earnings management. Several bank studies have explored the relationship between board composition and bank risk and performance, but the effect of audit committee practices on bank performance has not been previously researched. We will explore this relationship further through including individual governance categories into our regression.

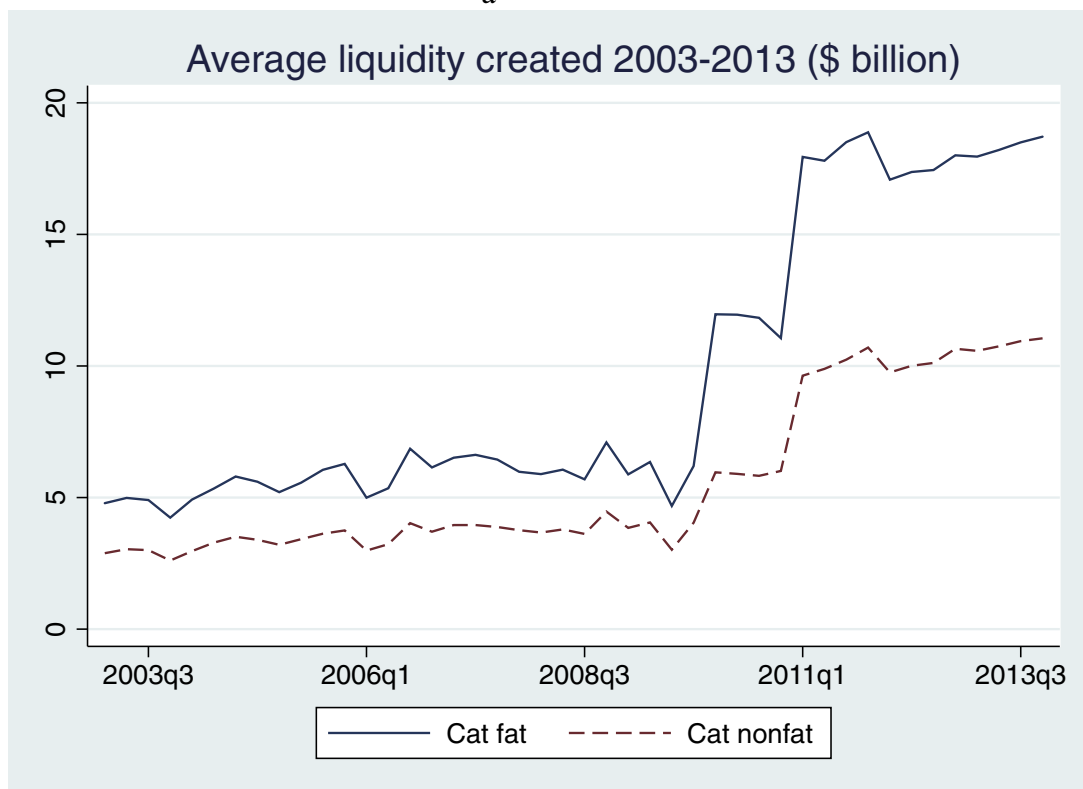
We propose that the effect of governance on liquidity creation depends not only on bank size but also on liquidity creation levels. Table 5 provides insight into the differences between governance scores of high liquidity creators and low liquidity creators. High liquidity creators are those banks in the 75th percentile, and low liquidity creators are banks in the 25th percentile of the preferred measured, *cat fat*. Overall, large and medium banks show significant difference between governance scores of high liquidity creators and low liquidity creators. Small banks show no significant differences, and governance scores are lower for high liquidity creators than low liquidity creators. Panel C shows the greatest difference between high and low liquidity creators but only for large banks using both, *cat fat* and *cat nonfat*. These differences are also apparent among bank sizes, where large banks show higher governance scores than medium and small banks in all panels and liquidity creation measures.

4.2. Multivariate results

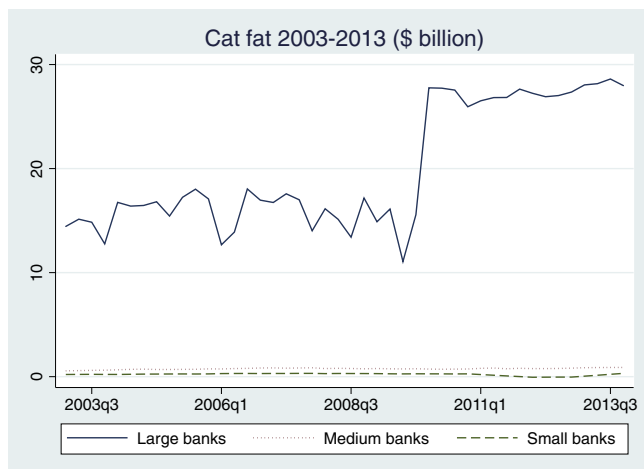
This section includes panel estimation results of Eq. (1). The fixed effect results of our baseline model are presented in Tables 6 and 7. Table 6 shows results of all banks in six different columns. Columns 1 and 2, show results using the pooled sample 2003–2013. Columns 3 and 4 show results of sub sample 2003–2009. Columns 5 and 6 show results of the baseline model using the 2010–2013 subsample. Table 6 shows that for all banks, the total governance score has a positive and statistically significant effect on *cat fat* only during 2003–2009, but this effect is very small and we believe, not economically significant. The total effect of governance is 0.005 on liquidity creation, and 0.007 during the financial crisis. This result is significant but negative, for the 2010–2013 subsample. On the other hand, the effect of internal governance on *cat nonfat* is positive and significant in the full sample and in the 2003–2009 sub sample. The dummy interaction term has a significant effect on liquidity creation in columns 2, 3, and 4. This result suggests that the effect of governance is not only positive and significant when present but it is even more pronounced during the 2007–2009 financial crisis. Banks with better internal controls created more liquidity than those banks with lower governance scores.

Tables 7 and 8 present results from Eq. (1) and same dependent variables but using three size subsamples, large, medium, and small banks, and using the preferred liquidity measure, *cat fat* and

a



b



c

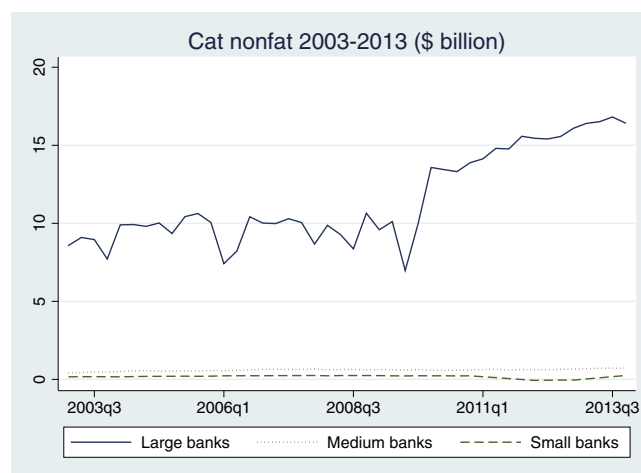


Fig. 1. (a). Quarterly average liquidity created 2003–2013 in \$billion. (b) Average “cat fat” liquidity created 2003–2013 by bank size in \$billion. (c) Average “cat nonfat” liquidity created 2003–2013 by bank size in \$billion.

on balance sheet liquidity, *cat nonfat*, respectively. Performing the same analysis by bank size provides further evidence that the effect of governance on liquidity creation is positive and significant but only for large banks and in particular during the crisis period subsample. The importance of internal governance during the crisis period is also present for the full sample but only for medium and large banks. This result suggests that only large banks' liquidity is sensitive to changes in internal governance but only before and after the financial crisis. The effect of internal governance on

liquidity creation after 2009 disappears completely for all banks and both liquidity measures. In fact, small banks show that better internal governance diminished liquidity created by these banks during 2010–2013 using both liquidity measures. We believe that a possible explanation of this result is related to increased regulation on all banks during this period, causing a particular burden on small banks.

Furthermore, we find that the equity ratio has a negative and significant effect on bank liquidity for the full sample and all size

Table 4
Correlation between variables.

Panel A. All variables full sample period 2003–2013									
	Cat fat	Cat nonfat	Governance	Equity	Z-score	Risk	ROA	ROE	Size
Cat fat									
Cat nonfat	0.93***								
Governance	0.03***	0.05***							
Equity	−0.04***	−0.06***	−0.04***						
Z-score	0.01	−0.0204	0.04***	0.44***					
Risk	0.12***	0.09***	−0.11***	0.86***	0.33***				
ROA	0.00	−0.05***	−0.07***	0.07***	0.34***	−0.02*			
ROE	0.00	−0.0558	−0.11	0.04	0.40***	−0.03	0.15***		
Size	0.20***	−0.0106	0.31***	0.08***	0.04***	0.08***	0.01**	0.01	
GDP growth	−0.02*	−0.07***	−0.27***	0.04***	0.07***	0.04***	0.30***	0.31***	−0.13***
Panel B. Governance categories 2003–2009									
	Governance	Audit	Board	Charter	Education	Compensation	Ownership	Progressive	
Governance									
Audit	0.55***								
Board	0.94***	0.25***							
Charter	0.14***	−0.06***	0.18***						
Education	0.26***	0.18***	0.22***	−0.06***					
Compensation	0.19***	0.14***	0.16***	−0.12***	0.24***				
Ownership	0.23***	0.18***	0.20***	−0.14***	0.37***	0.27***			
Progressive	0.40***	0.29***	0.35***	−0.08***	0.41***	0.37***	0.46***		
Incorporation	0.25***	0.08***	0.26***	0.23***	0.05***	0.02	−0.04***	0.05***	
Panel C. Governance categories 2010–2013									
	Governance	Audit	Board	Charter	Compensation				
Governance									
Audit	0.30***								
Board	0.72***	0.09***							
Charter	0.47***	0.02	0.10***						
Compensation	0.62***	0.02	0.19***	0.01					
Ownership	0.36***	0.08***	0.18***	0.10***	0.08				

Cat fat is the total liquidity created by the bank. Cat nonfat is the bank liquidity created only on the balance sheet. Governance is bank-level governance where higher scores indicate better governance. Z-score is defined as dividing the sum of ROA and the capital assets ratio (Equity/Total Assets) by the standard deviation of ROA. Equity ratio is defined as total equity divided by total assets. Credit risk is Tier 1 ratio divided by risk-weighted assets. ROA is the return on assets. ROE is the return on equity. Size is measured by Total Assets. GDP growth is the annual growth of quarterly GDP. Governance is total governance score, the higher score the better governance. Audit is the total score of items in category A in [Appendix](#) Board is the total score of items in category B. Charter is the total score of items in category C. Education is the total score of items in category D. Compensation is the total score of items in category E. Ownership is the total score of items in category F. Progressive is the total score of items in category G.

*** Indicate significance at 1%.

** Indicate significance at 5%.

* Indicate significance at 10%.

subsamples before and during the crisis, supporting the “fragility” hypothesis ([Berger and Bouwman, 2009](#)). On the other hand, after the financial crisis, the effect on liquidity creation is positive, showing support for the “risk absorption” hypothesis but only when using the preferred *cat fat* measure (see [Table 6](#)). The z-score is positive and significant for the pooled sample and all banks, but only for small banks when using size subsamples. Credit risk has a positive and economically and statistically significant effect on bank liquidity creation before, during and after the crisis for all banks in the sample and robust to liquidity measures. However, when the sample is divided into bank sizes, this effect is still positive but only significant before and during the financial crisis (subsample 2003–2009).

On [Table 6](#), ROA (ROE) shows a positive (negative) and significant effect on bank liquidity created on all banks and subsamples, for both *cat fat* and *cat nonfat*, the only exception is the non-significant effect of ROE in the 2010–2013 subsample using only on balance sheet liquidity, *cat nonfat*. Size subsamples also show the same sign for ROA and ROE when this effect is statistically significant. Bank size, measured by the logarithm of total assets, has a positive and significant effect on both bank liquidity measures but only after the crisis, and this effect is also positive when using *cat fat* for all banks in the full sample period. Size is not sig-

nificant for the 2003–2009 subsample, but positive and significant for the after-crisis subsample, 2010–2013. [Tables 7](#) and [8](#), on the other hand, this effect is only positive for large and medium banks, but negative for small banks. This result suggests that banks that were growing after the crisis, increased their liquidity creation levels, but small banks that experienced growth after the crisis decreased their creation of liquidity. Finally, GDP growth affects bank liquidity positively during the 2003–2009 period and negatively after the financial crisis period, however, this effect is only present when we use *cat fat* to measure liquidity creation.

4.2.1. High vs. low liquidity creators

For our next analysis, we examine banks by their liquidity creation levels, mainly those that create the most (high liquidity creators) and least (low liquidity creators) liquidity in the economy to test our hypothesis of whether governance has a positive effect on liquidity creation and in particular high liquidity creators. In each size group and liquidity measure, we divide banks into “high liquidity creators” and “low liquidity creators”. Every quarter, we define high and low liquidity creators as those in the top 25% (75th percentile) and bottom 25% (25th percentile), respectively. According to mean difference tests, statistically significant differences exist between governance scores of high and low liquidity creators

Table 5
Governance scores by liquidity creation levels.

Panel A. Average governance scores: pooled sample 2003–2013								
	Cat fat				Cat nonfat			
	All banks	Large	Medium	Small	All banks	Large	Medium	Small
75 Pct	18.663	21.02184	17.63861	13.429	18.637	20.9546	17.66533	13.55432
Obs	1930	824	689	415	1930	859	747	451
25 Pct	17.090	19.59322	17.07815	13.647	17.118	19.611	17.049	13.579
Obs	1931	826	691	416	1931	891	739	436
Difference	1.573	1.429	0.560	−0.218	1.519	1.344	0.617	−0.025
<i>t stat</i>	5.962**	3.297***	1.344*	−0.569	5.746***	3.194***	1.541*	−0.121
Wilcoxon stat	11.124**	5.631***	2.203**	−0.716	11.167***	5.540***	2.647**	−0.329
Panel B. Average governance scores: sample 2003–2009								
	Cat fat				Cat nonfat			
	All banks	Large	Medium	Small	All banks	Large	Medium	Small
75 Pct	12.522	12.599	12.061	11.492	12.552	12.584	12.122	11.551
Obs	1232	427	442	362	1232	445	477	392
25 Pct	11.360	11.689	11.621	11.62707	11.323	11.667	11.587	11.585
Obs	1232	428	443	362	1232	463	474	381
Difference	1.162	0.910	0.440	−0.135	1.229	0.917	0.535	−0.034
<i>t stat</i>	16.229**	6.656***	3.125**	−1.061	17.251***	6.989**	3.973**	−0.278
Wilcoxon stat	15.958**	6.092***	3.034**	−0.770	16.801***	6.357***	3.866**	0.151
Panel C. Average governance scores: sample 2010–2013								
	Cat fat				Cat nonfat			
	All banks	Large	Medium	Small	All banks	Large	Medium	Small
75 Pct	29.503	30.081	27.619	26.660	29.378	30.023	27.393	27.012
Obs	698	397	247	53	698	397	247	53
25 Pct	27.193	20.093	26.827	27.185	27.332	28.124	26.661	27.204
Obs	699	398	248	54	699	398	248	54
Difference	2.310	9.988	0.792	−0.525	2.046	1.899	0.732	−0.192
<i>t stat</i>	15.162**	10.312***	3.204**	−0.832	13.027***	9.341***	2.922**	−0.300
Wilcoxon stat	14.185**	10.162***	3.129**	−0.860	12.412***	9.427**	2.995**	−0.348

Cat fat is the total liquidity created by the bank. Cat nonfat is the bank liquidity created only on the balance sheet. Governance is bank-level governance where higher scores indicate better governance. Large Banks, Medium Banks, and Small Banks are banks with more than \$3 billion, between \$3 billion and \$1 billion, and less than \$1 billion gross total assets, respectively. High liquidity are banks in 75th percentile of cat fat, and low liquidity creators are banks in the 25th percentile of cat fat.

*** Indicate significance at 1%.

** Indicate significance at 5%.

* Indicate significance at 10%.

for all liquidity measures (see Table 5). High *cat fat* and *cat nonfat* liquidity creators show significantly higher levels of governance in the full sample and all size subsamples, except for small banks. For the full sample, and large banks, top liquidity creators show significantly higher internal governance scores. However, small banks that are low liquidity creators show greater internal governance scores than high liquidity creators, although this difference is not statistically significant.

Table 9 shows results for Eq. (1) using our full sample and two subsamples, and *cat fat* values of high and low liquidity creators per quarter.⁷ For top and bottom liquidity creators, governance has a statistically significant effect on bank liquidity for the full sample and 2003–2009 subsample. Also, the effect of internal governance on bank liquidity created in the banking sector increased significantly during the crisis for top and bottom liquidity creators during the 2003–2009 sub sample but only for the 25th percentile using the full sample period. This result suggests that high liquidity creators with higher governance scores experienced an increase in liquidity levels during the crisis period. All control variables show similar signs and significance as previous results, but ROA and ROE only have significant effects on liquidity creation for high liquidity creators, regardless of the time period under consid-

eration. Furthermore, the macroeconomic environment, captured by GDP growth, has a positive and significant impact only for low liquidity creators in both subsamples.

Table 10 shows fixed effect regression for high and low liquidity creators by size groups. Results for the 2003–2009 sub period are reported in Panel A and Panel B shows results for the 2010–2013 sub sample. These results show a clear difference between time periods and the effect of the financial crisis on bank liquidity creation. Governance has a positive and significant effect on liquidity creation for large banks across all levels of liquidity creation during 2003–2009. This result together with our previous results suggests that the effect of governance on liquidity creation is not unique to the crisis period but only present for large banks. The interaction term between governance and the crisis period is significant and positive for medium and small banks that are also low liquidity creators, suggesting that internal governance was only significantly important for these banks during the crisis period. Medium and small banks that were creating low levels of liquidity improved their liquidity levels during the crisis period.

4.2.2. Governance categories

We extend our analysis of whether corporate governance has a positive effect on bank liquidity creation, as follows, we explore the possibility that the effect of individual governance characteristics may be present but that the effects are concealed by our use

⁷ Results using the alternative measure, *cat nonfat*, are not shown but available under request.

Table 6
Liquidity creation variables and total internal governance.

Variables	Full sample		2003–2009		2010–2013	
	Cat fat	Cat nonfat	Cat fat	Cat nonfat	Cat fat	Cat nonfat
Governance	0.000 (0.001)	0.001** (0.001)	0.005*** (0.002)	0.003** (0.001)	−0.002* (0.001)	−0.001 (0.001)
Crisis* Gov	0.001 (0.001)	0.001* (0.000)	0.002*** (0.000)	0.002*** (0.000)		
Equity	−1.090*** (0.281)	−0.814*** (0.224)	−0.832*** (0.166)	−0.619*** (0.126)	0.416* (0.247)	0.243 (0.208)
Z-score	0.015** (0.007)	0.012* (0.006)	0.009 (0.006)	0.005 (0.005)	0.005 (0.004)	0.002 (0.004)
Credit Risk	0.158*** (0.048)	0.117*** (0.037)	0.132*** (0.028)	0.098*** (0.021)	0.068** (0.027)	0.055** (0.024)
ROA	2.350** (0.920)	1.563* (0.799)	2.635*** (0.899)	1.880** (0.782)	1.570** (0.658)	1.140** (0.567)
ROE	−0.117* (0.070)	−0.111* (0.060)	−0.144* (0.076)	−0.122* (0.066)	−0.111** (0.056)	−0.078 (0.048)
Size	0.024*** (0.006)	0.002 (0.006)	0.004 (0.013)	0.003 (0.010)	0.099*** (0.026)	0.081*** (0.022)
GDP growth	0.001 (0.001)	−0.001 (0.001)	0.003*** (0.001)	0.001** (0.001)	−0.001* (0.001)	−0.000 (0.001)
Observations	7685	7685	4911	4911	2774	2774
# of BHCs	247	247	247	247	238	238
Adjusted R-squared	0.138	0.082	0.158	0.156	0.123	0.109

Dependent variable is cat fat or cat nonfat divided by Gross Total Assets. Cat fat is the bank liquidity created on and off the balance sheet. Cat nonfat is the bank liquidity created only on the balance sheet. Governance is bank-level governance where higher scores indicate better governance. Crisis is a dummy variable equal to 1 during 2007Q3–2009Q4. Z-score is defined as dividing the sum of ROA and the capital assets ratio (Equity/Total Assets) by the standard deviation of ROA. Equity ratio is defined as total equity divided by total assets. Credit risk is Tier 1 ratio divided by risk-weighted assets. ROA is the return on assets. ROE is the return on equity. Size is measured by Total Assets. GDP growth is the annual growth of quarterly GDP. All models include bank and quarter fixed effects. Robust standard errors in parentheses.

*** Indicate significance at 1%.

** Indicate significance at 5%.

* Indicate significance at 10%.

Table 7
Cat fat and governance by bank size.

Variables	Full sample			2003–2009			2010–2013		
	Large	Medium	Small	Large	Medium	Small	Large	Medium	Small
Governance	0.000 (0.001)	0.000 (0.001)	0.001 (0.002)	0.007*** (0.002)	0.002 (0.003)	0.001 (0.003)	−0.002 (0.001)	0.000 (0.001)	−0.017* (0.009)
Crisis* Gov	0.000 (0.001)	0.002** (0.001)	0.003*** (0.001)	0.001*** (0.000)	0.002*** (0.001)	0.001** (0.001)			
Equity	−0.596 (0.401)	−0.549 (0.459)	−1.237*** (0.290)	−0.485* (0.256)	−1.047*** (0.275)	−0.663*** (0.192)	0.507 (0.311)	0.148 (0.336)	−1.554* (0.806)
Z-score	0.012 (0.009)	0.001 (0.010)	0.022** (0.010)	0.004 (0.009)	0.028** (0.012)	0.001 (0.009)	0.009 (0.006)	0.000 (0.006)	−0.018*** (0.005)
Credit Risk	0.317*** (0.090)	0.068 (0.079)	0.245*** (0.057)	0.213*** (0.058)	0.308*** (0.057)	0.199*** (0.045)	0.143 (0.118)	0.247 (0.265)	−0.018 (0.139)
ROA	2.948* (1.630)	−0.546 (0.855)	0.845 (0.827)	5.191** (2.009)	0.228 (0.862)	1.580** (0.776)	4.377*** (1.254)	0.218 (0.586)	0.836 (1.186)
ROE	−0.219* (0.126)	0.118 (0.077)	−0.055 (0.061)	−0.352** (0.175)	−0.012 (0.077)	−0.073 (0.063)	−0.370*** (0.096)	0.012 (0.044)	0.139** (0.042)
Size	0.002 (0.011)	0.020 (0.026)	−0.090*** (0.031)	−0.034 (0.021)	−0.020 (0.021)	0.010 (0.033)	0.108*** (0.032)	0.079** (0.037)	−0.575*** (0.081)
GDP growth	0.002 (0.001)	0.002 (0.001)	0.004*** (0.001)	0.002** (0.001)	0.002* (0.001)	0.005*** (0.001)	−0.003*** (0.001)	−0.000 (0.001)	−0.001 (0.001)
Observations	3289	2755	1641	1706	1770	1435	1583	985	206
Number of BHCs	160	168	135	99	125	106	111	98	57
Adjusted R-squared	0.209	0.051	0.241	0.245	0.277	0.255	0.234	0.094	0.634

Dependent variable is cat fat divided by Gross Total Assets. Cat fat is the bank liquidity created on and off the balance sheet. Governance is bank-level governance where higher scores indicate better governance. Crisis is a dummy variable equal to 1 during 2007Q3–2009Q4, zero otherwise. Z-score is defined as dividing the sum of ROA and the capital assets ratio (Equity/Total Assets) by the standard deviation of ROA. Equity is defined as total equity divided by total assets. Credit risk is Tier 1 ratio divided by risk-weighted assets. ROA is the return on assets. ROE is the return on equity. Size is measured by Total Assets. GDP growth is the annual growth of quarterly GDP. Large Banks, Medium Banks, and Small Banks are banks with more than \$3 billion, between \$3 billion and \$1 billion, and less than \$1 billion gross total assets, respectively. All models include bank and quarter fixed effects. Robust standard errors in parentheses.

*** Indicate significance at 1%.

** Indicate significance at 5%.

* Indicate significance at 10%.

Table 8

Cat nonfat and governance by bank size.

Variables	Full sample			2003–2009			2010–2013		
	Large	Medium	Small	Large	Medium	Small	Large	Medium	Small
Governance	0.001 (0.001)	0.001 (0.001)	0.002 (0.001)	0.004** (0.002)	0.001 (0.002)	0.001 (0.002)	−0.001 (0.001)	0.001 (0.001)	−0.016*** (0.006)
Crisis* Gov	−0.000 (0.001)	0.002** (0.001)	0.002** (0.001)	0.001*** (0.000)	0.002*** (0.000)	0.001*** (0.000)			
Equity	−0.350 (0.348)	−0.411 (0.388)	−1.026*** (0.256)	−0.398* (0.232)	−0.801*** (0.234)	−0.534*** (0.162)	0.343 (0.263)	−0.004 (0.251)	−1.676*** (0.482)
Z-score	0.010 (0.008)	0.001 (0.009)	0.020** (0.009)	0.007 (0.009)	0.017 (0.011)	−0.001 (0.008)	0.004 (0.005)	−0.000 (0.005)	−0.014*** (0.005)
Credit Risk	0.239*** (0.075)	0.048 (0.062)	0.200*** (0.048)	0.146*** (0.042)	0.228*** (0.048)	0.157*** (0.035)	0.091 (0.099)	0.236 (0.196)	−0.023 (0.148)
ROA	2.487 (1.520)	−0.927 (0.701)	0.520 (0.743)	3.753** (1.463)	−0.059 (0.712)	1.364* (0.739)	3.572*** (1.024)	0.039 (0.555)	1.436 (0.972)
ROE	−0.229* (0.117)	0.104 (0.064)	−0.060 (0.056)	−0.298** (0.127)	0.005 (0.069)	−0.083 (0.062)	−0.302*** (0.078)	0.022 (0.041)	0.087** (0.043)
Size	−0.022** (0.010)	0.011 (0.023)	−0.081*** (0.027)	−0.028* (0.014)	−0.018 (0.018)	0.006 (0.025)	0.087*** (0.027)	0.077** (0.031)	−0.522*** (0.080)
GDP growth	−0.001 (0.001)	0.000 (0.001)	0.002** (0.001)	0.000 (0.001)	0.000 (0.001)	0.002*** (0.001)	−0.002** (0.001)	0.001 (0.001)	−0.001 (0.001)
Observations	3289	2755	1641	1706	1770	1435	1583	985	206
Number of BHCs	160	168	135	99	125	106	111	98	57
Adjusted R-squared	0.190	0.053	0.226	0.218	0.245	0.224	0.168	0.141	0.636

Dependent variable is cat nonfat divided by Gross Total Assets. Cat fat is the bank liquidity created on and off the balance sheet. Governance is bank-level governance where higher scores indicate better governance. Crisis is a dummy variable equal to 1 during 2007Q3–2009Q4, zero otherwise. Z-score is defined as dividing the sum of ROA and the capital assets ratio (Equity/Total Assets) by the standard deviation of ROA. Equity is defined as total equity divided by total assets. Credit risk is Tier 1 ratio divided by risk-weighted assets. ROA is the return on assets. ROE is the return on equity. Size is measured by Total Assets. GDP growth is the annual growth of quarterly GDP. Large Banks, Medium Banks, and Small Banks are banks with more than \$3 billion, between \$3 billion and \$1 billion, and less than \$1 billion gross total assets, respectively. All models include bank and quarter fixed effects. Robust standard errors in parentheses.

*** Indicate significance at 1%.

** Indicate significance at 5%.

* Indicate significance at 10%.

Table 9

Cat fat and governance by liquidity creation levels.

Variables	Full sample		2003–2009		2010–2013	
	High liquidity	Low liquidity	High liquidity	Low liquidity	High liquidity	Low liquidity
Governance	0.004** (0.002)	0.005*** (0.001)	0.007*** (0.002)	0.003 (0.003)	−0.001 (0.001)	−0.000 (0.002)
Crisis* Gov	0.000 (0.001)	0.002* (0.001)	0.001* (0.000)	0.001** (0.001)		
Equity	−0.847*** (0.296)	−1.146*** (0.292)	−0.766*** (0.222)	−0.599*** (0.180)	0.245 (0.386)	−0.435 (0.328)
Z-score	0.008 (0.007)	0.027*** (0.009)	0.019* (0.009)	0.003 (0.008)	0.011** (0.005)	−0.007 (0.005)
Credit Risk	0.247*** (0.060)	0.225*** (0.048)	0.198*** (0.051)	0.159*** (0.036)	0.625*** (0.178)	0.353*** (0.109)
ROA	5.419*** (1.755)	1.410 (0.940)	3.912** (1.865)	1.162 (0.701)	5.698* (2.985)	−0.079 (0.380)
ROE	−0.361** (0.150)	−0.123 (0.077)	−0.295** (0.146)	−0.055 (0.054)	−0.526* (0.304)	0.021 (0.034)
Size	−0.028*** (0.007)	−0.118*** (0.011)	−0.055** (0.024)	−0.008 (0.030)	0.043 (0.039)	−0.030 (0.029)
GDP growth	0.001 (0.001)	0.001 (0.001)	0.002 (0.001)	0.003*** (0.001)	−0.003* (0.001)	0.002** (0.001)
Observations	1928	1911	1230	1220	698	691
Number of BHCs	111	173	74	109	48	114
Adjusted R-squared	0.261	0.426	0.244	0.190	0.529	0.227

Dependent variable is cat nonfat divided by Gross Total Assets. Cat fat is the bank liquidity created on and off the balance sheet. Governance is bank-level governance where higher scores indicate better governance. Crisis is a dummy variable equal to 1 during 2007Q3–2009Q4, zero otherwise. Z-score is defined as dividing the sum of ROA and the capital assets ratio (Equity/Total Assets) by the standard deviation of ROA. Equity ratio is defined as total equity divided by total assets. Credit risk is Tier 1 ratio divided by risk-weighted assets. ROA is the return on assets. ROE is the return on equity. Size is measured by Total Assets. GDP growth is the annual growth of quarterly GDP. Large Banks, Medium Banks, and Small Banks are banks with more than \$3 billion, between \$3 billion and \$1 billion, and less than \$1 billion gross total assets, respectively. High liquidity category includes banks in 75th percentile of cat fat, and low liquidity category includes banks in the 25th percentile of cat fat. All models include bank and quarter fixed effects. Robust standard errors in parentheses.

*** Indicate significance at 1%.

** Indicate significance at 5%.

* Indicate significance at 10%.

Table 10
Cat fat by liquidity levels and bank size.

Panel A. Sample 2003–2009						
	High liquidity			Low liquidity		
	Large	Medium	Small	Large	Medium	Small
Governance	0.011*** (0.004)	0.001 (0.005)	0.001 (0.003)	0.005* (0.002)	0.004 (0.003)	0.003 (0.005)
Crisis * Governance	−0.000 (0.001)	0.000 (0.001)	0.001 (0.001)	0.000 (0.001)	0.002* (0.001)	0.001** (0.001)
Equity	−0.596*** (0.184)	0.038 (0.392)	−0.011 (0.408)	0.595 (0.606)	−0.243 (0.296)	−0.420*** (0.129)
Z-score	0.001 (0.011)	0.012 (0.019)	−0.008 (0.008)	−0.019 (0.011)	−0.003 (0.019)	0.011 (0.009)
Credit Risk	0.161* (0.080)	0.403*** (0.122)	0.140* (0.073)	0.410*** (0.094)	0.137 (0.086)	0.079** (0.031)
ROA	4.355*** (1.196)	−1.513 (1.671)	5.252 (4.088)	4.495* (2.312)	−0.820 (2.171)	3.369** (1.303)
ROE	−0.234** (0.093)	0.176 (0.171)	−0.413 (0.352)	−0.320 (0.196)	0.081 (0.210)	−0.260** (0.125)
Size	0.013 (0.028)	−0.061** (0.023)	−0.067** (0.028)	−0.017 (0.014)	0.030 (0.031)	0.017 (0.030)
GDP_growth	0.002 (0.002)	0.004** (0.002)	0.002 (0.001)	0.005*** (0.001)	0.002** (0.001)	0.003** (0.001)
Observations	427	441	360	428	443	357
Number of BHCs	39	49	39	46	46	45
Adjusted R-squared	0.263	0.371	0.179	0.519	0.196	0.096
Panel B. Sample 2010–2013						
	High liquidity			Low liquidity		
	Large	Medium	Small	Large	Medium	Small
Governance	0.000 (0.001)	−0.001 (0.002)	−0.003 (0.003)	0.002 (0.004)	0.001 (0.001)	−0.029 (0.017)
Equity	0.368 (0.320)	0.616 (0.644)	0.189 (0.615)	−0.207 (0.304)	−0.068 (0.396)	−0.631 (1.717)
Z-score	0.022*** (0.004)	−0.005 (0.010)	−0.010 (0.008)	−0.002 (0.005)	−0.006 (0.007)	−0.020*** (0.007)
Credit Risk	0.758*** (0.104)	0.649*** (0.144)	0.575*** (0.113)	0.817*** (0.070)	0.298*** (0.080)	−0.159** (0.056)
ROA	4.006 (2.755)	−2.086 (1.475)	−2.070 (2.567)	−0.425 (0.815)	0.463 (0.627)	−0.074 (1.943)
ROE	−0.426 (0.293)	0.249 (0.168)	0.141 (0.138)	−0.015 (0.040)	−0.039 (0.059)	0.131** (0.059)
Size	0.004 (0.057)	0.108** (0.049)	−0.264*** (0.075)	0.089 (0.070)	−0.065* (0.037)	−0.406 (0.316)
GDP growth	−0.002* (0.001)	0.000 (0.001)	0.001 (0.002)	0.001 (0.002)	0.002** (0.001)	−0.001 (0.002)
Observations	397	246	51	393	247	51
Number of BHCs	32	34	18	48	41	14
Adjusted R-squared	0.637	0.324	0.322	0.592	0.227	0.817

Dependent variable is cat fat divided by Gross Total Assets. Cat fat is the bank liquidity created on and off the balance sheet. Governance is bank-level governance where higher scores indicate better governance. Crisis is a dummy variable equal to 1 during 2007Q3–2009Q4, zero otherwise. Z-score is defined as dividing the sum of ROA and the capital assets ratio (Equity/Total Assets) by the standard deviation of ROA. Equity is defined as total equity divided by total assets. Credit risk is Tier 1 ratio divided by risk-weighted assets. ROA is the return on assets. ROE is the return on equity. Size is measured by Total Assets. GDP growth is the annual growth of quarterly GDP. Large Banks, Medium Banks, and Small Banks are banks with more than \$3 billion, between \$3 billion and \$1 billion, and less than \$1 billion gross total assets, respectively. High liquidity category includes banks in 75th percentile of cat fat, and low liquidity category includes banks in the 25th percentile of cat fat. All models include bank and quarter fixed effects. Robust standard errors in parentheses.

*** Indicate significance at 1%.

** Indicate significance at 5%.

* Indicate significance at 10%.

of a comprehensive governance measure. Accordingly, the real effect of governance on liquidity creation is not visible until we isolate these characteristics and include them individually in our bank liquidity model.

Tables 11 and 12 present results using *cat fat* as dependent variable and each of the individual governance categories used to calculate our broad governance score (see Appendix) to analyze the effect of governance on bank liquidity creation. Table 11 shows results for the 2003–2009 sample period, and Table 12 presents results for the 2010–2013 period. This division of the sample into two subsamples is even more important when performing this last

analysis because the definition of the governance variable changed in 2010, and only five categories have been included since that time to calculate the governance score. In comparison, during the 2003–2009 period, eight categories are used to calculate the governance score. We also perform the analysis by estimating the model by size groups and liquidity creation levels.

These models are estimated by replacing the total governance score *Gov* in Eq. (1) with its eight individual governance components for 2003–2009 and five components for 2010–2013, please see the full list of categories for each sample period in the

Table 11
Liquidity and Individual Governance categories 2003–2009.

Variables	(1) All banks	(2) Large banks	(3) Medium banks	(4) Small banks	(5) High liquidity	(6) Low liquidity
Audit	0.002 (0.004)	0.008 (0.006)	−0.001 (0.006)	−0.001 (0.008)	0.005 (0.007)	0.007 (0.006)
Audit * Crisis	−0.001 (0.005)	−0.015* (0.009)	0.001 (0.009)	0.006 (0.009)	−0.016 (0.010)	0.003 (0.007)
Board	0.001 (0.002)	0.003 (0.003)	0.001 (0.003)	−0.004 (0.003)	0.005 (0.003)	−0.002 (0.003)
Board * Crisis	0.004* (0.002)	0.006* (0.003)	0.001 (0.003)	0.006** (0.003)	0.003 (0.003)	0.006* (0.003)
Charter	0.003 (0.003)	−0.001 (0.005)	0.010** (0.005)	0.001 (0.005)	−0.004 (0.007)	−0.004 (0.004)
Charter * Crisis	−0.000 (0.003)	−0.001 (0.004)	0.003 (0.005)	−0.005 (0.004)	−0.001 (0.004)	−0.002 (0.004)
Compensation	0.009*** (0.002)	0.003 (0.004)	0.005 (0.004)	0.013*** (0.004)	0.001 (0.006)	0.009*** (0.003)
Compensation * Crisis	−0.002 (0.003)	0.004 (0.005)	0.000 (0.005)	−0.002 (0.004)	0.008 (0.006)	−0.004 (0.004)
Ownership	0.005 (0.004)	0.002 (0.005)	−0.004 (0.008)	0.016* (0.009)	0.004 (0.004)	−0.000 (0.010)
Ownership * Crisis	0.001 (0.006)	−0.002 (0.008)	0.006 (0.009)	−0.013 (0.011)	−0.003 (0.008)	0.003 (0.010)
Education	0.013** (0.005)	0.017* (0.009)	0.016 (0.011)	0.009 (0.012)	0.015 (0.009)	0.004 (0.012)
Education * Crisis	−0.023*** (0.008)	−0.035*** (0.012)	−0.011 (0.013)	−0.018 (0.015)	−0.048*** (0.013)	−0.001 (0.017)
Incorporation	0.008* (0.005)	0.012 (0.009)	0.003 (0.006)	0.004 (0.011)	0.019*** (0.007)	0.004 (0.006)
Incorporation * Crisis	−0.002 (0.003)	−0.003 (0.004)	−0.005 (0.004)	−0.003 (0.004)	−0.000 (0.004)	−0.012** (0.005)
Progressive	0.010*** (0.002)	0.006** (0.003)	0.009*** (0.003)	0.012*** (0.003)	0.003 (0.003)	0.010*** (0.003)
Progressive * Crisis	0.002 (0.003)	0.002 (0.006)	−0.001 (0.006)	0.002 (0.004)	0.004 (0.007)	0.000 (0.005)
Equity	−0.675*** (0.150)	−0.475* (0.275)	−0.823*** (0.276)	−0.620*** (0.181)	−0.805*** (0.237)	−0.549*** (0.149)
Z-score	0.006 (0.005)	0.001 (0.010)	0.023* (0.012)	−0.001 (0.007)	0.018** (0.009)	0.001 (0.006)
Credit Risk	0.114*** (0.025)	0.209*** (0.054)	0.270*** (0.052)	0.184*** (0.043)	0.200*** (0.052)	0.144*** (0.030)
ROA	2.456*** (0.886)	4.788*** (1.805)	−0.011 (0.853)	1.867*** (0.688)	3.274* (1.650)	1.388** (0.645)
ROE	−0.112 (0.074)	−0.314** (0.154)	0.027 (0.075)	−0.068 (0.053)	−0.242* (0.125)	−0.056 (0.046)
Size	−0.029** (0.013)	−0.047** (0.023)	−0.051** (0.023)	−0.052 (0.035)	−0.065** (0.025)	−0.043 (0.030)
GDP_growth	0.002*** (0.001)	0.002 (0.001)	0.001 (0.001)	0.003** (0.001)	0.002 (0.001)	0.001 (0.001)
Observations	4911	1706	1770	1435	1230	1220
Number of BHCs	247	99	125	106	74	109
Adjusted R-squared	0.221	0.293	0.319	0.329	0.301	0.267

Dependent variable is cat fat divided by Gross Total Assets. Cat fat is the bank liquidity created on and off the balance sheet. Audit is the total score of items in category A in [Appendix](#) Board is the total score of items in category B. Charter is the total score of items in category C. Education is the total score of items in category D. Compensation is the total score of items in category E. Ownership is the total score of items in category F. Progressive is the total score of items in category G. Crisis is a dummy variable equal to 1 during 2007Q3–2009Q4, zero otherwise. Z-score is defined as dividing the sum of ROA and the capital assets ratio (Equity/Total Assets) by the standard deviation of ROA. Equity is defined as total equity divided by total assets. Credit risk is Tier 1 ratio divided by risk-weighted assets. ROA is the return on assets. ROE is the return on equity. Size is measured by Total Assets. GDP growth is the annual growth of quarterly GDP. Large Banks, Medium Banks, and Small Banks are banks with more than \$3 billion, between \$3 billion and \$1 billion, and less than \$1 billion gross total assets, respectively. High liquidity category includes banks in 75th percentile of cat fat, and low liquidity category includes banks in the 25th percentile of cat fat. All models include bank and quarter fixed effects. Robust standard errors in parentheses.

*** Indicate significance at 1%.

** Indicate significance at 5%.

* Indicate significance at 10%.

[Appendix](#) All control variables included in the baseline model remain the same.⁸

⁸ We also estimate these models using a stepwise regression method with similar results.

[Table 11](#) demonstrates results using the sample period 2003–2009. Results show that liquidity created by all banks in the sample is affected positively by better governance characteristics in *compensation*, *education* and *progressive practices*. Liquidity creation improves for large banks when scores in director's *education* and *progressive practices* improve. For medium banks, better *charter*

Table 12
Liquidity and Individual Governance Categories 2010–2013.

Variables	(1) All banks	(2) Large banks	(3) Medium banks	(4) Small banks	(5) High liquidity	(6) Low liquidity
Audit	0.002 (0.005)	−0.003 (0.005)	0.007 (0.005)	−0.041* (0.023)	0.004 (0.005)	−0.005 (0.008)
Board	−0.005** (0.002)	−0.005* (0.003)	−0.003 (0.003)	−0.010 (0.010)	−0.006** (0.003)	0.001 (0.002)
Charter	0.006 (0.004)	0.011** (0.004)	0.010** (0.005)	−0.005 (0.018)	0.007 (0.005)	0.002 (0.005)
Compensation	−0.002 (0.002)	−0.001 (0.002)	0.001 (0.002)	−0.002 (0.014)	−0.001 (0.002)	0.000 (0.003)
Ownership	0.014** (0.007)	0.004 (0.007)	0.031*** (0.010)	0.072* (0.039)	0.003 (0.006)	0.027** (0.012)
Equity	0.340 (0.246)	0.447 (0.305)	0.140 (0.325)	−0.277 (0.541)	0.254 (0.370)	−0.410 (0.277)
Z-score	0.006 (0.004)	0.011* (0.006)	−0.002 (0.005)	−0.012** (0.005)	0.013** (0.005)	−0.010** (0.005)
Credit Risk	0.066** (0.027)	0.139 (0.115)	0.233 (0.260)	0.101 (0.156)	0.594*** (0.177)	0.334*** (0.105)
ROA	1.462** (0.670)	4.707*** (1.260)	−0.088 (0.544)	−0.655 (1.109)	5.241* (2.792)	−0.172 (0.375)
ROE	−0.100* (0.057)	−0.407*** (0.096)	0.043 (0.045)	0.098** (0.045)	−0.475 (0.289)	0.036 (0.030)
Size	0.085*** (0.029)	0.097*** (0.034)	0.068 (0.041)	−0.261*** (0.061)	0.028 (0.038)	−0.031 (0.028)
GDP growth	−0.001 (0.001)	−0.002*** (0.001)	0.001 (0.001)	0.000 (0.001)	−0.002* (0.001)	0.002** (0.001)
Observations	2774	1583	985	206	698	691
Number of BHCs	238	111	98	57	48	114
Adjusted R-squared	0.140	0.253	0.137		0.543	0.254

Dependent variable is cat fat divided by gross total assets. Cat fat is the bank liquidity created on and off the balance sheet. Audit is the total score of items in category A in Appendi. Board is the total score of items in category B. Charter is the total score of items in category C. Education is the total score of items in category D. Compensation is the total score of items in category E. Ownership is the total score of items in category F. Progressive is the total score of items in category G. Crisis is a dummy variable equal to 1 during 2007Q3–2009Q4, zero otherwise. Z-score is defined as dividing the sum of ROA and the capital assets ratio (Equity/Total Assets) by the standard deviation of ROA. Equity is defined as total equity divided by total assets. Credit risk is Tier 1 ratio divided by risk-weighted assets. ROA is the return on assets. ROE is the return on equity. Size is measured by Total Assets. GDP growth is the annual growth of quarterly GDP. Large Banks, Medium Banks, and Small Banks are banks with more than \$3 billion, between \$3 billion and \$1 billion, and less than \$1 billion gross total assets, respectively. High liquidity category includes banks in 75th percentile of cat fat, and low liquidity category includes banks in the 25th percentile of cat fat. All models include bank and quarter fixed effects. Robust standard errors in parentheses.

*** Indicate significance at 1%.

** Indicate significance at 5%.

* Indicate significance at 10%.

and bylaws characteristics as well as better *progressive* practices improve liquidity creation levels. Liquidity created by small banks increases when scores in *compensation*, *ownership* and *progressive* practices improve. The last two columns of Table 11 show results for high liquidity creators and low liquidity creators in the sample. High liquidity creators improve their liquidity levels only when incorporation characteristics improve, but low liquidity creators see a more significant sensitivity to governance characteristics and see their liquidity improve when scores in *compensation* and *progressive* practices increase across all size groups. We also include crisis interaction terms for each governance category variable in the model. Overall, we find that the effect of *board* characteristics during the crisis period is positive for all banks in the sample but only significant for all banks and for large, small and low liquidity banks. On the other hand, higher scores on director's education on governance issues has a negative influence during the crisis period for every sub group under consideration, but only significant for all banks, and large and high liquidity banks. When this result is added to the individual effect of education on all banks and large banks, the total effect of this category on liquidity creation is in fact negative, the coefficient of education on

liquidity creation is 0.013 but during the crisis, the total effect is 0.013–0.023 = −0.01. This effect is negative but not economically significant.

Table 12 shows results for sample period 2010–2013. Previously, for the same sample period but using the total governance score for banks, we found that the effect of governance was negative, significant at a 10% level but not economically significant (see Table 6). Results from Table 12 show significant differences from Table 6 and also with results from the 2003–2009 sample period. *Audit* has a significant negative effect on liquidity creation for small banks, better *board* characteristics negatively affect liquidity creation of large banks and high liquidity creators, higher scores of *charter* and bylaws improve significantly improve liquidity levels of large and medium banks, and better *ownership* scores improve liquidity levels of all banks, and medium, small and low liquidity creators in the sample. Overall, column 1 shows that board negatively impacts the amount of liquidity created but ownership has a positive impact, and given this positive impact this effect is greater than the negative effect of board characteristics. One important result we should point out is that compensation has no significant effect on liquidity creation during 2010–

Table 13

Baseline model with dynamic GMM.

Variables	Cat fat			Cat nonfat		
	2003–2013	2003–2009	2010–2013	2003–2013	2003–2009	2010–2013
Liquidity $t-1$	0.645*** (0.037)	0.553*** (0.050)	0.781*** (0.130)	0.650*** (0.036)	0.462*** (0.058)	0.834*** (0.101)
Governance	−0.001** (0.001)	0.005* (0.001)	−0.006*** (0.001)	−0.001* (0.000)	0.002*** (0.001)	−0.003*** (0.001)
Crisis* Gov	−0.001*** (0.000)	−0.001*** (0.000)		−0.000* (0.000)	0.000 (0.000)	
Equity	−0.147 (0.171)	−0.534*** (0.135)	0.469* (0.269)	−0.179 (0.149)	−0.492*** (0.102)	0.308 (0.238)
Z-score	0.012*** (0.004)	0.009** (0.003)	−0.002 (0.005)	0.009** (0.004)	0.006** (0.003)	0.001 (0.003)
Credit Risk	0.060** (0.029)	0.114*** (0.030)	0.119* (0.062)	0.050** (0.025)	0.094*** (0.022)	0.094* (0.050)
ROA	1.741*** (0.455)	1.190*** (0.373)	1.557*** (0.458)	1.774*** (0.419)	0.973*** (0.342)	1.283*** (0.453)
ROE	−0.159*** (0.042)	−0.096 (0.683)	−0.107*** (0.041)	−0.154*** (0.039)	−0.080*** (0.030)	−0.068 (0.043)
Size	0.018*** (0.007)	0.082*** (0.012)	−0.003 (0.042)	−0.002 (0.006)	−0.033*** (0.009)	−0.023 (0.023)
GDP growth	0.001*** (0.000)	0.004*** (0.000)	−0.000 (0.001)	0.001*** (0.000)	0.001** (0.000)	0.000 (0.000)
Observations	6121	3533	2265	6121	3533	2265
Number of BHCs	245	243	237	245	243	237
Sargan Test	236.226	231.450	172.870	234.513	232.775	163.700
p-value	0.990	0.999	0.366	0.999	0.999	0.264

Liquidity creation variables are dependent variables in the panel estimation. Cat fat is total bank liquidity creation divided by Gross Total Assets. Cat nonfat is on balance sheet bank liquidity creation divided by Gross Total Assets. Liquidity $t-1$ is the lagged value of the dependent variable in each model. Crisis dummy is defined as 1 from third quarter of 2007 to the fourth quarter of 2009. Governance is the total internal governance score for the bank holding company. Z-score is defined as dividing the sum of ROA and the capital assets ratio (Equity/Total Assets) by the standard deviation of ROA. Equity is defined as total equity divided by total assets. Risk is Tier 1 capital divided by total risk weighted assets. Governance is bank-level governance where higher scores indicate better governance. ROA is the return on total assets, ROE is the return on equity. GDP growth is the annual growth of quarterly GDP. All models include bank and quarter fixed effects. Robust standard errors in parentheses.

*** Indicate significance at 1%.

** Indicate significance at 5%.

* Indicate significance at 10%.

2013, which is significantly different from the 2003–2009 period. We believe that this is an unexpected result given that compensation scores in fact increased considerably for almost all banks in the sample. However, the greatest positive changes in compensation scores happened during the crisis period for the banks in our sample.

Results using the total governance score do not show a significant effect of governance on liquidity creation during the 2010–2013 sample (see Table 9). Furthermore, using individual governance categories and bank groups divided by liquidity creation levels revealed the following; Better board composition characteristics have a negative effect on liquidity for high liquidity creator and better ownership structure improves liquidity levels for low liquidity creating banks. One possible explanation for the first result is that the board of directors of high liquidity creators impose risk management measures and as a consequence decrease bank liquidity creation. Conversely in the case of low liquidity creators, a better ownership score implies that CEO's incentives are better aligned with those of stockholders, and this is expected to improve the bank's loan production and performance.

Table 11 also shows that for banks during the 2003–2009 period, higher equity ratios (credit risk) has a negative (positive) effect on liquidity creation for all bank subsamples. Z-score has a positive impact on liquidity created by medium size and high liq-

uidity creating banks in the sample. ROA and ROE have similar signs and significance from other estimations. Size has a negative impact on liquidity creation for all banks except for small and low liquidity creators in the sample. GDP growth has a positive effect on liquidity creation but only shows a significant effect for all banks in the sample and small banks. Overall, economic growth supports previous results found by Berger and Sedunov (2016). For the 2010–2013 period, column 1 of Table 12 shows that for all banks in the sample, higher credit risk, ROA and size have a positive impact on liquidity creation, but higher ROE decreases bank liquidity creation. Column 2 shows that for large banks, distance to default, ROA and size affect positively the amount of liquidity creation, but ROE and GDP growth diminishes liquidity creation. For high liquidity creators in the sample (column 5), distance to default, ROA and credit risk increase liquidity creation. For small banks and low liquidity creators, higher z-scores reduce liquidity creation, but higher ROE increases liquidity creation for small banks and credit risk has a similar effect for low liquidity creators. Taken as a whole our results support previous findings about the importance and relevance of using different size samples when replicating bank studies and in our particular case liquidity levels, when analyzing the effect of governance on bank performance, output, and most importantly liquidity creation.

5. Robustness

5.1. Endogeneity

It is our goal to gain a robust understanding of the role governance plays on liquidity creation to suggest best practices or regulatory guidance. However, the notion of causation is delicate: Do certain characteristics lead a bank to create liquidity or does high liquidity creation lead to better-governed institutions?

Due to the endogeneity problem, most of these relationships should often be interpreted as correlation and not causalities. To address endogeneity, we use the Arellano-Bover/Blundell-Bond system GMM estimator. This measure employs lagged differences of the dependent variable ($y_{i,t}$) as instruments for equations in levels, in addition to lagged levels of $y_{i,t}$ as instruments for equations in first differences (Arellano and Bover, 1995) where $y_{i,t}$ is liquidity creation, the dependent variable in our model. It has been well documented (see e.g. Blundell and Bond, 1998) that the first differences GMM estimator can have very poor finite sample properties in terms of bias and precision when the series are persistent, as the instruments are then weak predictors of the endogenous changes. The system GMM estimator has been shown in Monte Carlo studies by Blundell and Bond (1998) and Blundell et al. (2000) to have greater finite sample properties in terms of bias and root mean squared error than that of the difference GMM estimator. This method assumes no autocorrelation in the idiosyncratic errors and requires the initial condition that the panel-level effects be uncorrelated with the first difference of the first observation of the dependent variable. We also present Sargan tests of instrument validity. The results of these statistical tests confirm the validity of the instruments used in our model.

Table 13 presents results of our base model Eq. (1), but estimated using GMM dynamic regression, using *cat fat* as dependent variable in columns 1, 2, and 3, for the pooled sample and two subsamples respectively. Columns 4, 5, and 6 show regression results with *cat nonfat* as the dependent variable and using the pooled sample and two subsamples. Results show that the positive influence of corporate governance on bank liquidity creation is statistically significant only when we account for the possibility of endogeneity in our model and use the pre crisis and crisis period, columns 2 and 5 on Table 13. When we account for endogeneity in the model, the effect of governance on liquidity creation is negative and statistically significant when we use the pooled sample period, columns 1 and 4, and after the financial crisis, columns 3 and 6. Results are also robust to liquidity creation measures. Furthermore, control variables maintain the same significance and signs in the estimation. Results from columns 3 and 6 provide supporting evidence for the “risk absorption” hypothesis, and columns 2 and 4 provide support for the “fragility” hypothesis. ROA and ROE show the same effect for all sample periods and liquidity measures. Overall, we can conclude that banks with better internal governance created more liquidity before and during the financial crisis. However, this result has changed since 2010 and now improved internal governance has a negative impact on liquidity creation.

6. Conclusions

Banks fulfill an essential role in the economy by performing two fundamental functions: 1) creating liquidity, and 2) transforming risk to facilitate economic growth. Prior research has revealed

that risk transformation is closely related to bank risk-taking, bank regulation, and bank failures. Bank liquidity, however, remains a relatively unexplored area, especially its relationship to the roles of bank risk-taking, bank regulation/governance, and the probability of bank failure. Ours is the first study to show that banks' liquidity is positively related to banks' internal governance and capital levels.

We investigate the role of corporate governance on bank liquidity creation by studying bank holding companies over the period from 2003 to 2013. Our evidence shows that bank liquidity creation increases over the period from 2003 to 2007 and levels off after the onset of the financial crisis in the third quarter of 2007. First, we find banks' liquidity creation increases with better governance during 2003–2009, and that there is a significant increase in liquidity creation during the 2007–2009 financial crisis. Moreover, we show that corporate governance plays an important role in liquidity creation and that this effect varies with bank size and within bank liquidity creation levels. Bank holding companies with better shareholder protection have a higher level of liquidity creation relative to poorly governed banks. Further analysis, using narrow measures of governance, provides additional support for our first hypothesis. We find that higher scores in the quality of CEO's awareness of governance issues, better aligned compensation incentives, and bank progressive practices have a positive and significant effect on liquidity creation.

Finally, we examine banks that create the most (high liquidity creators) and least (low liquidity creators) liquidity in our sample of public BHCs. For top liquidity creators, governance has a statistically significant effect on bank liquidity. Also, the amount of liquidity created in the banking sector increased significantly during the crisis for both high and low liquidity creators and the interaction term of the crisis period with the governance score is positive and significant suggesting that the effect of governance on liquidity is stronger during the crisis. This result suggests that during the crisis period executive boards of banks with better internal governance made significant changes by being more conservative and reducing their liquidity risk exposure while still creating liquidity for the economy.

Overall, our results expand the empirical evidence on liquidity creation and bank governance by exposing the positive relation between bank liquidity creation and internal governance. In particular, we uncover how better aligned compensation incentives, CEO education in corporate governance and inclusion of progressive practices curb excessive risk-taking behavior by managers, and increase bank liquidity creation.

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Appendix. Items comprising the GOV index

For each firm, we compute GOV by assigning one point for each of the items listed below and summing. A higher score indicates better governance. The index changed in 2010.

2002–2009	2010–2013
<p><i>A. Audit</i> Audit committee consists solely of independent outside directors. Auditors were ratified at the most recent annual meeting. Consulting fees paid to auditors are less than audit fees paid to auditors. Company has a formal policy on auditor rotation.</p> <p><i>B. Board of directors</i> Managers respond to shareholder proposals within 12 months of shareholder meeting. CEO serves on no more than two additional boards of other public companies. All directors attend at least 75% of board meetings or had a valid excuse for nonattendance. Size of the board of directors is at least six but not more than 15 members. No former CEO serves on board. CEO is not listed as having a “related party transaction” in proxy statement.</p> <p>Board is controlled by more than 50% independent outside directors.</p> <p>Compensation committee is comprised solely of independent outside directors. The CEO and chairman duties are separated or a lead director is specified.</p> <p>Shareholders vote on directors selected to fill vacancies. Board members are elected annually. Shareholder approval is required to change board size.</p> <p>Nominating committee is comprised solely of independent directors. Shareholders have cumulative voting rights to elect directors.</p> <p>Board guidelines are in each proxy statement.</p> <p>Policy exists requiring outside directors to serve on no more than five additional boards.</p> <p><i>C. Charter/bylaws</i> A simple majority vote is required to approve a merger (not a supermajority).</p> <p>Company either has no poison pill or a pill that was shareholder approved. Shareholders are allowed to call special meetings. A majority vote is required to amend charter/bylaws (not a supermajority). Shareholders may act by written consent and the consent is non-unanimous. Company is not authorized to issue blank check preferred stock. Board cannot amend bylaws without shareholder approval or can only do so under limited circumstances.</p> <p><i>D. Executive and director compensation</i> No interlocks exist among directors on the compensation committee. Nonemployees do not participate in company pension plans.</p> <p>Option repricing did not occur within last three years.</p> <p>Stock incentive plans were adopted with shareholder approval.</p> <p>Directors receive all or a portion of their fees in stock.</p> <p>Company does not provide any loans to executives for exercising options.</p> <p>The last time shareholders voted on a pay plan, ISS did not deem its cost to be excessive.</p>	<p><i>A. Audit</i> Audit committee consists solely of independent outside directors. Non-auditing fees paid to auditors are less than audit fees paid to auditors. Auditors issued unqualified opinion in the past year. The company did not restate financial statements or make late financial disclosure filings for any period within past two years. A securities regulator did not take enforcement action against the company in the past two years. The company did not disclose any material weaknesses in its internal controls in the past two years.</p> <p><i>B. Board of directors</i> Over 66% of board members are independent.</p> <p>The roles of chairman and CEO are separated. All members of the nominating committee are independent.</p> <p>All members of the compensation committee are independent. All members of the audit committee are independent. The CEO or non-executives do not serve on an excessive number of outside boards. All directors attend at least 75% of board meetings or had a valid excuse for nonattendance. The company discloses board/governance guidelines. None of the directors receive withhold/against votes of 50% or greater at the last annual meeting. None of the directors are involved in material RPTs. The company has a majority vote standard with a director resignation policy. There are no directors on the board that are not up for election by all classes of common shareholders. All directors are elected annually. The board did not fail to implement a shareholder resolution supported by a majority vote. Executives receive stock options based on a target or peer group which is disclosed. Executives receive restricted shares based on a target or peer group which is disclosed. Executives receive other long term plans based on a target or peer group that is disclosed.</p> <p><i>C. Charter/bylaws</i> The company has a majority vote standard with a director resignation policy in uncontested elections. The company does not have classes of stock with different voting rights. Company either has no poison pill or a pill that was shareholder approved. The trigger threshold for the poison pill is 10%. The poison pill has a sunset provision. The poison pill has a TIDE provision. The poison pill has a qualified offer clause.</p> <p>The board is not authorized to issue blank check preferred stock. The company does not require a super-majority vote to approve amendments to the charter and bylaws. The company does not require a super-majority vote to approve mergers/business combinations. The shareholder rights plan expires in no more than three years. The share capital needed to convene a special meeting is less than or equal to 10%. Shareholders can act by written consent.</p> <p><i>D. Executive and director compensation</i> All the compensation committee members are independent. Company does not grant stock options, SARs, or Full Value Awards or Burn rate policy does not apply. Executives receive stock options based on a target or peer group which is disclosed. Executives receive restricted shares based on a target or peer group which is disclosed. Executives receive other long term plans based on a target or peer group that is disclosed. The minimum vesting periods mandated in the plan documents for executives' stock options or SARs in the equity plan adopted/amended in the last three years are five years. The minimum vesting periods mandated in the plan documents, adopted/amended in the last three years for executive' restricted stock are five years.</p>

(continued on next page)

2002–2009	2010–2013
<p>The average options granted in the past three years as a percentage of basic shares outstanding did not exceed 3% (option burn rate). Option repricing is prohibited.</p> <p>Company expenses stock options.</p> <p><i>E. Ownership</i> All directors with more than one year of service own stock.</p> <p>Officers' and directors' stock ownership is at least 1% but not more than 30% of total shares outstanding.</p> <p>Executives are subject to stock ownership guidelines. Directors are subject to stock ownership guidelines.</p> <p><i>F. Progressive practices</i> Mandatory retirement age for directors exists. Performance of the board is reviewed regularly. A board-approved CEO succession plan is in place. Board has outside advisors. Directors are required to submit their resignation upon a change in job status. Outside directors meet without the CEO and disclose the number of times they met. Directors' term limits exist.</p> <p><i>G. State of incorporation</i> Incorporation in a state without any antitakeover provisions.</p> <p><i>H. Director education</i> At least one member of the board has participated in an ISS-accredited director education program.</p>	<p>The holding period for stock options for executives is at least 24 months, or until end of employment, or until stock ownership guidelines are met. The holding period for restricted shares for executives is at least 24 months, or until end of employment, or until stock ownership guidelines are met. The company did not reprice options or exchanged them for shares, options or cash without shareholder approval in the last three years. At least six times the salary is subject to stock ownership requirements/guidelines for the CEO. There are no change-in-control agreements. None of the NEOs are eligible for multi-year guaranteed bonuses. There is no employment agreement under which the CEO will receive multiple of salary due to a change-in-control event; or the CEO will receive no more than three multiple of salary. There are no severance agreements under which the CEO will receive multiple of salary plus bonus upon a change-in-control; or the CEO will receive no more than three multiple of salary. The company does not provide excise tax gross-ups for change-in-control payments. The employment agreement with the CEO is less than five years, or there is no such agreement in place.</p> <p><i>E. Ownership</i> The CEO is subject to stock ownership guideline which is beyond the five-times salary threshold. Directors are subject to stock ownership guideline which is beyond the six-times the retainer threshold or more (Canadian market) or beyond five-times the directors' base retainer threshold (US market). All directors with more than one year of service own stock.</p>

References

- Acharya, V., Philippon, T., Richardson, M., Roubini, N., 2009. The financial crisis of 2007–2009: causes and remedies. In: Acharya, V., Richardson, M. (Eds.), *Restoring Financial Stability*. John Wiley & Sons, New York.
- Acharya, V., Naqvi, H., 2012. The seeds of a crisis: a theory of bank liquidity and risk taking over the business cycle. *J. Financ. Econ.* 106, 349–366.
- Aebi, V., Sabato, G., Schmid, M., 2012. Risk management, corporate governance, and bank performance in the financial crisis. *J. Bank. Finance* 36 (12), 3213–3226.
- Arellano, M., Bover, O., 1995. Another look at the instrumental variable estimation of error-components models. *J. Econometrics* 68, 29–51.
- Avraham, D., Selvaggi, P., Vickery, J., 2012. A Structural View of U.S. Bank Holding Companies. *FRBNY Econ. Pol. Rev.* (July) 65–81.
- Bank for International Settlements Press Release, Basel Committee on Banking Supervision, June 2008. Principles for Sound Liquidity Risk Management and Supervision.
- Beltratti, A., Stulz, R.M., 2012. The credit crisis around the globe: why did some banks perform better. *J. Financ. Econ.* 105, 1–17.
- Berger, A.N., Bouwman, C.H.S., 2009. Bank liquidity creation. *Rev. Financ. Stud.* 22, 3779–3837.
- Berger, A.N., Bouwman, C.H.S., 2013. How does capital affect bank performance during financial crises. *J. Financ. Econ.* 109, 146–176.
- Berger, A.N., Bouwman, C.H.S., 2014. Bank Liquidity Creation, Monetary Policy, and Financial Crises Working Paper.
- Berger, Allen N., Bouwman, C.H.S., Kick, T., Schaeck, K., 2016. Bank risk taking and liquidity creation following regulatory interventions and capital support. *J. Financ. Intermed.* 26, 115–141.
- Berger, A.N., Sedunov, J., 2016. Bank Liquidity Creation and Real Economic Output Working Paper.
- Bernanke, B., 1983. Nonmonetary effects of the financial crisis in propagation of the great depression. *Am. Econ. Rev.* 73 (3), 257–276.
- Bhattacharya, S., Thakor, A.V., 1993. Contemporary banking theory. *J. Financ. Intermed.* 3, 2–50.
- Blundell, R., Bond, S., 1998. Initial conditions and moment restrictions in dynamic panel data models. *J. Econometrics* 87, 115–143.
- Blundell, R., Bond, S., Windmeijer, F., 2000. Estimation in dynamic panel data models: improving on the performance of the standard GMM estimator. In: Baltagi, B. (Ed.), *Nonstationary Panels, Panel Cointegration, and Dynamic Panels*. *Advances in Econometrics*, vol. 15. JAI Press, Elsevier Science.
- Boyd, J.H., Prescott, E., 1986. Financial intermediary-coalitions. *J. Econom. Theory* 38 (2), 211–232.
- Bouwman, C.H.S., 2013. Liquidity: how banks create it and how it should be regulated. *The Oxford Handbook of Banking*.
- Brown, L.D., Caylor, M.L., 2006. Corporate governance and firm valuation. *J. Account. Public Policy* 25, 409–434.
- Bryant, J., 1980. A model of reserves, bank runs, and deposit insurance. *J. Bank. Finance* 4 (4), 335–344. doi:10.1016/0378-4266(80)90012-6.
- Brunnermeier, M.K., 2009. Deciphering the liquidity and credit crunch 2007–2008. *J. Econ. Perspect.* 23, 77–100.
- Cornett, M.M., McNutt, J.J., Strahan, P.E., Tehranian, H., 2011. Liquidity risk management and credit supply in the financial crisis. *J. Financ. Econ.* 101, 297–312.
- Dell'Ariccia, G., Detragiache, E., Rajan, R., 2008. The real effect of banking crises. *J. Financ. Intermed.* 17, 89–112.
- Diamond, D.W., Dybvig, P.H., 1983. Bank runs, deposit insurance, and liquidity. *J. Polit. Econ.* 91, 401–419.
- Diamond, D.W., 1984. Financial intermediation and delegated monitoring. *Rev. Econ. Stud.* 51, 393–414.
- Diamond, D.W., Rajan, R.G., 2001. Liquidity risk, liquidity creation, and financial fragility: a theory of banking. *J. Polit. Econ.* 109, 287–327.
- Ellul, A., Yerramilli, V., 2013. Stronger risk controls, lower risk: evidence from U.S. bank holding companies. *J. Finance* 68, 1757–1803.

- Erkens, D., Hung, M., Matos, P., 2012. Corporate governance in the 2007–2008 financial crisis: evidence from financial institutions worldwide. *J. Corp. Finance* 18, 389–411.
- Fahlenbrach, R., Stulz, R.M., 2011. Bank CEO incentives and the credit crisis. *J. Financ. Econ.* 99 (1), 11–26.
- Faleye, O., Krishnan, K., 2014. Risky Lending: Does Bank Corporate Governance Matter? Working Paper.
- Guiso, L., Sapienza, P., Zingales, L., 2004. Does local financial development matter? *Q. J. Econ.* 119, 929–969.
- Holström, B., Tirole, J., 1998. Private and public supply of liquidity. *J. Polit. Econ.* 106 (1), 1–40.
- Horváth, R., Seidler, Weill, L., 2014. Bank capital and liquidity creation Granger-causality evidence. *J. Financ. Serv. Res.* 45, 341–361.
- Jiraporn, P., Kim, J.C., Kim, Y.S., 2011. Dividend payouts and corporate governance quality. *Financ. Rev.* 46, 251–279.
- Kashyap, Anil.K., Raghuram, Rajan, Jeremy, C.Stein, 2002. Banks as liquidity providers: an explanation for the coexistence of lending and deposit-taking. *J. Rev. Econ. Stud. Finance* 57, 33–73.
- Kerr, W.R., Nanda, R., 2009. Democratizing entry: banking deregulations, financing constraints, and entrepreneurship. *J. Financ. Econ.* 94, 124–149.
- Klein, A., 2002. Audit committee, board of director characteristics, and earnings management. *J. Account. Econ.* 33, 375–400.
- Krishnan, K., Nandy, D., Puri, M., 2015. Does financing spur small business productivity? Evidence from a natural experiment. *Rev. Financ. Stud.* 28 (6), 1768–1809.
- Laeven, L., Levine, R., 2009. Bank governance, regulation and risk taking. *J. Financ. Econ.* 93, 259–275.
- Macey, J., O'Hara, M., 2016. Bank corporate governance: a proposal for the post-crisis world. *FRBNY Econ. Policy Rev.* (August) 85–106.
- Pathan, S., 2009. Strong boards, CEO power and bank risk-taking. *J. Bank. Finance* 33 (7), 1340–1350.
- Pathan, S., Faff, R., 2013. Does board structure in banks really affect their performance. *J. Bank. Finance* 37 (5), 1573–1589.
- Ramakrishnan, R.T.S., Thankor, A.V., 1984. In: *Information Reliability and a Theory of Financial Intermediation*, LI, pp. 415–432.
- Saunders, A., Cornett, M.M., 2013. *Financial Institutions Management: A Risk Management Approach*, eight ed. McGraw-Hill/Irwin.
- Xie, B., Davidson, W.N., DaDalt, P.J., 2003. Earnings management and corporate governance: the role of the board and the audit committee. *J. Corp. Finance* 9, 295–316.
- Wintoki, M.B., Linck, J.S., Netter, J.M., 2012. Endogeneity and the dynamics of internal corporate governance. *J. Financ. Econ.* 105 (3), 581–606.