# Will Basel III Liquidity Measures Affect Banks' Funding Costs and Financial Performance?: Evidence from U.S. Commercial Banks

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**Abstract**

Basel III has introduced new liquidity standards to directly enhance asset liquidity and funding stability within deposit taking institutions. We investigate the links between asset liquidity and funding stability as measured under the Basel III regulatory framework and US banks' deposit funding costs and their financial performance as well. We find that banks derive benefits from a lower cost of deposit funding in response to improved funding stability and that Basel III liquidity measures also improve banks' financial performance. However, whilst larger banks perform better financially in response to improvements in their funding stability, greater asset liquidity instead reduces their financial performance. Finally, banks with higher capital buffers benefit from having access to cheaper deposit funding in response to greater funding stability. There are clear policy implications from our findings to guide further bank regulatory reforms.

*Keywords:* Basel III, liquidity, bank funding costs, capital, deposits

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## 1. Introduction

The Basel Committee on Banking Supervision (BCBS) initiated new liquidity standards in global banking regulation due to the serious liquidity disruptions occurring during the global financial crisis of 2007-2008. In 2010, the BCBS proposed two new liquidity gauges - the liquidity coverage ratio (LCR) and the net stable funding ratio (NSFR) which are designed to increase banks' liquidity buffers and funding stability respectively. To identify the potential effect of Basel III liquidity measures we look back in time and analyze how they have been historically related to banks' cost of debt funding and financial performance. Hence, this study uses historical data to calculate the LCR and NSFR for U.S. commercial banks from 2001 to 2014 in order to examine the relation between these liquidity measures and banks' debt funding costs and financial performance as the benefits of higher bank liquidity and funding stability are not well understood despite the emphasis placed on asset liquidity and funding stability as part of recent regulatory reforms culminating in Basel III framework. LCR requires banks to maintain sufficient high-quality liquid assets to meet their liquidity needs under a serious liquidity stress scenario when there is likely to be a significant proportion of cash outflows. The NSFR requires banks to use more stable funding sources like long-term debt for supporting their assets and off-balance sheet activities and to hold more high-quality liquid assets. Conceptually, LCR reduces banks' liquidity risk by increasing their high-quality liquid assets and NSFR the reduces funding and interest rate risks originating from the maturity mismatch between assets and liabilities (King (2013)). However, it is not clear how banks meeting these new liquidity standards will be affected in their deposit funding costs and in turn, financial performance. We empirically explore these issues in this study.

Asset liquidity and funding stability may affect banks' cost of funds and financial performance in an opposing manner. On the one hand, fund suppliers may consider more liquid banks to be less likely to default. Hence, banks with larger liquidity buffers and more stable funding can potentially attract fund suppliers to provide funds at lower costs. However, the new liquidity standards may affect banks' performance by reducing profitability and squeezing lending margins (Bank for International Settlements (2010); Härle, et al. (2010)). Banks having higher liquidity may face lower cost of funds as King (2013) shows that banks with higher NSFR are expected to have lower costs of capital and higher charter values.

However, lower NSFR banks may also benefit from lower funding costs as a result of using less costly short-term funding (Dietrich, Hess and Wanzenried (2014)). Similarly, banks with higher LCRs need to make more short-term liquid investments. Upward sloping yield curves suggest that yield would be higher on longer-term sources of funds. Therefore, higher NSFR banks should face a higher cost of debt if there are upward sloping yield curves. Similarly, higher LCR banks may be less profitable as upward sloping yield curves also suggest they will earn lower returns from holding very liquid assets. In sum, LCR and NSFR will reduce cost of funds if fund suppliers prefer banking stability to profitability. NSFR is argued to reduce the maturity mismatch of assets and liabilities, profitability and lending margin (Dietrich, Hess and Wanzenried (2014)). Moreover, bank size and capital buffers may also affect the relation between liquidity and cost of funds. We calculate the LCR and NSFR of U.S. commercial banks for the period from 2001-2014 using Call Report data. We investigate the effect of LCR, NSFR and their components on banks' cost of funds and financial performance. Bank's costs of debt funding is proxied by the interest expenses to total deposits ratio and rate sensitive deposit funding costs and financial performance is proxied by banks' net interest margin and return on equity. Major findings of this study are: 1) Banks benefit from a lower cost of debt funding and superior financial performance in response to increases in Basel III liquidity measures. 2) Increases in regulatory asset liquidity reduce debt-funding costs and financial performance of larger banks whilst funding stability increases the cost of debt funding and financial performance of larger banks. 3) Banks having higher capital buffers face a lower cost of debt funding and higher return on equity in response to increases in regulatory funding stability.

We present empirical evidence in this study that strongly indicates a significant negative (positive) relation between bank liquidity and bank cost of funds (financial performance) across all banks. Our results are consistent with the theoretical predictions in the extant literature that asset liquidity reduces firm's cost of borrowing (Diamond and Verrecchia (1991); Ortiz-Molina and Phillips (2014)). However, our results are contrary to the existing literature that liquidity reduces financial performance (Härle, et al. (2010); Kim, Mauer and Sherman (1998)). Our results indicate that fund suppliers are willing to provide funds at lower costs in response to improvements in bank liquidity. The relation is stronger for banks with higher capital buffers. However, increases in funding stability is likely to increase the cost of funds for larger banks as debtors perceive a greater risk that liquid assets will not remain in more complex business models typically adopted by large banks.

This is the first empirical study to identify the effects of both LCR and NSFR on banks' cost of debt funding and financial performance. Contrary to the mixed evidence showing on European banks that increases in NSFR either reduces or has no impact on banks' financial performance (Dietrich, Hess and Wanzenried (2014); Härle, et al. (2010)), we find that historically US banks with more stable funding sources have performed better. Whilst the existing study of Dietrich, Hess and Wanzenried (2014) uses only NSFR to investigate the impact of new liquidity standards of Basel III on banks' cost of funds and financial performance, we use LCR, NSFR and their components to do that. Several recent studies (Dietrich, Hess and Wanzenried (2014); Distinguin, Roulet and Tarazi (2013); King (2013)) attempted to calculate NSFR but they simplified the assumptions of the weights of available stable funding (ASF) and required stable funding (RSF). Our findings contribute to the current literature on Basel III and suggest that Basel III liquidity measures will help the banks by reducing debt funding costs and improving financial performance. There are clear implications from our findings for policy makers and market participants alike because banks are concerned whether Basel III liquidity measures will have adverse impacts on their profitability going forwards. Our paper provides evidence that it will not be costly for the banks to implement the new Basel III liquidity standards.

The remainder of this paper is organized as follows. Section 2 summarizes the Basel III liquidity standard and related literature. Section 3 describes the data used. Section 4 presents our empirical model. Section 5 discusses the empirical results. Finally, conclusions are provided in Section 6.

## 2. Background and Literature Review

### *2.1 Definitions of Basel III liquidity risk measures*

The objective of the Basel III LCR standard is to require a bank to hold an adequate level of unencumbered, high-quality liquid assets that can be converted easily and immediately into cash to meet its liquidity needs for the next 30 days under a serious liquidity stress scenario. The LCR is defined accordingly as the ratio of the stock of high-quality liquid assets to the total net cash outflows over the next 30 calendar days:

$$\text{LCR} = \frac{Stock\ of\ High\ Quality\ liquid\ assets}{Total\ net\ cash\ outflows\ over\ the\ next\ 30\ days} \qquad (1)$$

Banks are required to maintain a LCR at least equal to 100%. The value of LCR depends on the assumptions used in the calculations of the stock of high quality liquid assets (HQLA) and the cash inflows and outflows. HQLA are divided into Level 1 Assets and Level 2 Assets. While calculating LCR we need to make assumptions on the classification of Level 1 Assets and Level 2 Assets, weights assigned to these asset categories, and rates of cash outflows and inflows for different liability and asset categories.

The objective of the NSFR is to maintain medium and long-term funding stability. NSFR is defined as the ratio of available stable funding (ASF) to required stable funding (RSF).

$$\text{NSFR} = \frac{Available\ Stable\ Funding}{Required\ Stable\ Funding} \qquad (2)$$

Under Basel III liquidity rules, NSFR should be at least equal to 100%. In calculating NSFR, we also need to make assumptions on the classifications of different assets and liabilities, and the weights assigned to different categories. We calculated LCR and NSFR according to the revised versions of the LCR and NSFR made in January 2013 and January 2014 by the Basel Committee respectively. We follow the assumptions of Hong, Hang and Wu (2014) for calculating the LCR and NSFR. Summary of the LCR and NSFR and the assumptions used in the computation are provided in Appendix B, C and D.

### *2.2. Related Literature*

#### *Bank Liquidity and Cost of Funds*

The literature on liquidity is extensive. In particular, one strand of the literature highlights that banks' liquidity and credit risks are closely related. Banks with lower liquidity risk also have a lower probability of default (Hong, Huang and Wu (2014)). It is likely that, fund suppliers may provide cheaper debt to banks with lower liquidity risk. Therefore, banks having low LCR and NSFR may have higher cost of funds and improving in liquidity within these banks may further reduce cost of funds. Moreover, it has also been shown for non-financial firms that real asset liquidity reduces firm's cost of capital as a result of increased operating flexibility (Ortiz-Molina and Phillips (2014)). Firms having more illiquid assets are unable to reduce their investments during economic downturns but need to maintain unproductive capital which requires higher returns for the capital suppliers (Ortiz-Molina and Phillips (2014)). Myers and Rajan (1998) show that liquidity may reduce the borrowing

capability of firms' assets because asset liquidity increases agency problems by giving managers greater discretion to act at creditor's cost. Therefore, creditors are likely to demand a higher credit risk premium thereby pushing up banks' cost of funds. In contrast, asset liquidity increases borrowing capacity when debt covenants prohibit the sale of assets (Morellec (2001)). Improved funding stability effectively reduces banks' interest rate risk and improves bank charter values (King (2013)). However, Dietrich et al. (2014) find European banks with higher NSFR have higher cost of funds but lower loan loss provisions and variability of profits. Under Basel III, banks are required to maintain high quality liquid assets including cash and highly liquid low risk assets. It has been shown that during financial distress cash balances allow managers significant operating discretion (DeAngelo, DeAngelo and Wruck (2002)). Moreover, the marginal value of cash is higher for firms with low levels of cash holdings, low leverage and financial constraints (Faulkender and Wang (2006)). As the price of bank's uninsured deposits depends on the bank's output level, output quality, financial capital level and risk measures (Hannan and Hanweck (1988); Hughes and Mester (1993)). Illiquidity is likely to increase funding costs for banks. Consistent with this, Diamond and Verrecchia (1991) show that increased liquidity through greater information disclosure reduces firms' cost of capital . Overall, the literature indicates that banks having low liquidity risk through high asset liquidity and funding stability should face a lower cost of debt funding.

Hypothesis 1: Higher Basel III liquidity measures help to lower banks' cost of debt funding

***Liquidity and Financial Performance***

The relationship between bank liquidity and performance remains an empirical question. Liquid assets reduce the return on investments but help firms to avoid external financing (Kim, Mauer and Sherman (1998)). Consistent with this notion Bordeleau and Graham (2010) Liquid assets initially increases profitability but beyond a certain level liquid assets reduces bank profitability. Increases in liquid assets reduces net interest margins of banks as a result of a lower liquidity risk premium (Angbazo (1997)). Dietrich et al. (2014) find that NSFR do not affect banks' financial performance proxied by net interest margin, return on equity and return on assets. To meet the required NSFR banks have to hold more higher-rated securities and expand the maturity of wholesale funding which in turn reduces net interest margins by reducing interest revenue whilst increasing interest expenses (King (2013)). Harle

et al. (2010) predict that Basel III liquidity measures will reduce banks' return on equity as a result of the depressed lending margins. Therefore, the existing literature indicates that banks having high asset liquidity and funding stability should have worse financial performance.

*Hypothesis 2: Basel III liquidity measures are negatively banks' financial performance*

***Bank Size***

It has been documented in the finance literature that larger firms face a higher cost of debt and use less debt (Binsbergen, et al. (2010); Faulkender and Petersen (2006)). Additionally, bank profitability is both weakly related to bank size (Goddard, Molyneux and Wilson (2004)) and negatively related to bank size (Pasiouras and Kosmidou (2007)). Large banks are more diversified in their assets and activities so they face a diversification discount but large banks face lesser reduction in cost of funds than medium-sized banks (Deng, Elyasiani and Mao (2007)). Therefore, large banks increase cost of debt funding when they are forced to raise more long-term funds to increase NSFRs. Therefore, the existing literature suggests that larger banks will have a higher cost of debt funding and worse financial performance in response to higher asset liquidity and funding stability.

*Hypothesis 3: Larger banks will face a higher cost of debt funding in response to higher Basel III liquidity measures*

*Hypothesis 4: Larger banks will have worse financial performance in response to higher Basel III liquidity measures*

***Bank Capital***

Berger and Bouwman (2009) introduce a measure of bank liquidity creation and find that bank capital increases liquidity creation and liquidity risk for large banks whereas bank capital reduces liquidity creation for small banks. Corroborating to this inverse relationship between bank capital and bank liquidity, Distinguin, Roulet and Tarazi (2013) also find that banks reduce their regulatory capital ratio when they have a lower NSFR. It has been documented in previous studies that increased capital buffers reduce funding costs of banks as the credit risk premium demanded by lenders are lower when the capital cushion is visibly larger (Babihuga and Spaltro (2014); Demirgüç-Kunt and Huizinga (1999)). However, regulatory capital requirement works to increase the cost of equity and the effect is higher for raising new external equity compared to holding equity on the balance sheet (Kashyap, Stein

and Hanson (2010)). Bank capital increases the profitability of banks (Athanasoglou, Brissimis and Delis (2008); Goddard, Molyneux and Wilson (2004); Pasiouras and Kosmidou (2007)). Therefore, the existing literature indicates that banks with higher capital buffers will face a lower cost of debt funding and improved financial performance in response to higher asset liquidity and funding stability requirements.

*Hypothesis 5: Banks with higher capital buffers will face a lower cost of debt funding in response to higher Basel III liquidity measures*

*Hypothesis 6: Banks with higher capital buffers will have superior financial performance in response to higher Basel III liquidity measures*

## 3. Data

We use U.S. commercial bank data from quarterly Call Reports provided by the Federal Reserve Bank of Chicago. We exclude bank-quarters when total assets, total deposits, total loans and total liabilities are either missing or less than one million U.S. dollars. Quarterly data for the sample period from 2001:Q1 to 2014:Q4 is used in this study. We choose 2001 as the start of our sample period because commercial banks did not report risk-weighted assets in different risk categories in their call reports before 2001, and this level of classification is necessary for calculating the LCR and NSFR. The final quarterly data set contains 411,298 bank-quarters for 10,390 commercial banks. We require commercial bank data to compute the two key Basel III liquidity ratios, namely the LCR and NSFR capturing the degree of asset liquidity and funding stability respectively.

Descriptive statistics for our sample of commercial banks used in the regressions are reported in Table 1. The average LCR and NSFR for the sample of commercial banks are 291% and 113% respectively. For the average commercial banks, interest expenses constitute 1.37% of total deposits. The average rate sensitive funding costs, net interest margin, return on equity and tier 1 capital ratio are 2.45%, 2.61%, 5.22%, and 16.50% respectively. On average, the real estate loans and loan loss provisions for our sample of commercial banks constitute 68.09% and 0.31% of total loans respectively. For the average commercial banks, total liabilities and interest expenses constitute 89.01% of total assets and 30.47% of interest income respectively. For the average commercial banks in the sample, the cash, level 1

assets, level 2 assets, available stable funding and required stable funding constitute 6.42%, 8.74%, 4.65%, 77.49% and 71.67% of total assets respectively.

<Insert Table 1>

Table 2 reports the pair-wise correlation coefficients of the variables used in this study. We do not find the bank variables employed as explanatory variables to be highly correlated indicating that multicollinearity is not a major problem in our empirical analyses. The correlation coefficients of the banks' cost of debt funding (interest expense to total deposit ratio and rate sensitive funding costs) with LCR are 0.01 and 0.00 respectively and with NSFR are -0.03 and -0.01, respectively. The correlation coefficients of the banks' financial performance proxied by their net interest margins and return on equity with LCR are 0.04 and 0.01 respectively and with NSFR are 0.02 and 0.00 respectively.

<Insert Table 2>

Figure 1 depicts the average LCR and NSFR of U.S. commercial banks for the period 2001:Q1 to 2014:Q4. LCR decreases from 2001:Q1 to 2005:Q4, increases from 2006:Q1 to 2009:Q4 and again decreases from 2010:Q1 to 2014:Q4. NSFR decreases from 2001:Q1 to 2008:Q3 and increases from 2008:Q4 to 2014:Q4 indicating that bank liquidity varies significantly over time.

<Insert Figure 1>

Additionally, the summary statistics of LCR and NSFR are reported in appendix E for each year within our full sample period.

## 4. Model

In order to test the impact of Basel III liquidity measures on banks' cost of funds and financial performance we use 90th percentile panel data regressions with heteroskedasticity robust

standard errors[3]. The empirical model includes a number of control variables for bank characteristics and activities, which may influence banks' cost of funds and financial performance. Time fixed effects are captured by introducing quarter dummies. Time dummies specifically capture macroeconomic effects on banks' funding costs and financial performance over time.

The model developed to test the impact of bank liquidity on banks' cost of funds is:

$$\Delta CostofFunds_{i,t} = \beta\ \Delta Liquidity_{i,t} + \gamma\ Controls_{i,t}\ + \delta_t + \varepsilon_{i,t} \quad (3)$$

where $\beta$ , $\gamma$ and $\delta$ reflect the extent to which the relative factor of the model contributes to the change in the dependent variable, and $\varepsilon_{i,t}$ represents the error term for bank *i* in quarter *t*.

$$\Delta CostofFunds_{i,t} = \frac{CostofFundsi,t - CostofFundsi,t-1}{CostofFundi,t-1} \quad (4)$$

$$\Delta Liquidity_{i,t} = \frac{Liquidityi,t - Liquidityi,t-1}{Liquidityi,t-1} \quad (5)$$

*The dependent variable, CostofFunds* is a vector of changes in banks' cost of funds variables for bank *i* in quarter *t*. Bank cost of funds has been measured by the ratio of interest expenses to total deposits and in turn rate sensitive funding costs computed as:

$$(\text{Rate Sensitive Funding Costs})_t = [(\text{Interest Expense on Time Deposit})_t - (\text{Interest Expense on Time Deposit})_{t-1}]/(\text{Time Deposits with a remaining maturity of 3 months or less})_{t-1} \quad (6)$$

The model developed to test the impact of bank liquidity on banks' financial performance is:

$$\Delta Performance_{i,t} = \alpha\ \Delta Liquidity_{i,t} + \varphi\ Controls_{i,t}\ + \theta_t + \xi_{i,t} \quad (7)$$

where $\alpha$ , $\varphi$ and $\theta$ reflect the extent to which the relative factor of the model contributes to the change in the dependent variable, and $\xi_{i,t}$ represents the error term for bank *i* in quarter *t*.

$$\Delta Performance_{i,t} = \frac{Performancei,t - Performancei,t-1}{Performancei,t-1} \quad (8)$$

*The dependent variable, Performance* is a vector of changes in the alternative banks' financial performance variables for bank *i* in quarter *t*. Banks' financial performance has been measured by the net interest margin and return on equity.

[3] We also used 10th percentile regressions and OLS regressions and the results are qualitatively similar.

*The independent test variable*, *Liquidity* is a vector of changes in the alternative Basel III liquidity measures and their underlying components for bank *i* in quarter *t*. We use LCR, NSFR, and the ratios of cash-to-total assets (Cash), level 1 assets-to-total assets (Level1Asset), level 2 assets-to-total assets (Level2Asset), available stable funding-to-total assets (ASF) and required stable funding-to-total assets (RSF),

*The independent control variables* are bank characteristics for bank *i* in quarter *t*. In all 90th percentile panel regressions we include bank characteristics as well as quarter fixed effects to control for other unobservable factors that affect banks' costs of funds and financial performance. The list of control variables for bank characteristics and activities used in this study are commonly adopted in the literature. Consistent with Angbazo (1997), Araten et al. (2013), Cole et al. (2012) and Distinguin et al. (2013) we consider the ratios of total liabilities to total assets (Leverage), tier 1 capital-to-risk weighted assets (Tier 1 Capital), real estate loan-to-total loans (REL), loan loss provisions-to-total loans (LLP) and interest expense-to-interest income (CostEff) as potential determinants of bank cost of funds. The ratios of tier 1 capital-to-risk weighted assets, loan loss provisions-to-total loans, interest expense-to-interest income and real estate loan-to-total loans are used to capture capital adequacy, asset quality, cost efficiency and asset risk of banks, respectively.

We use simultaneous regressions to account for potential reverse causality between bank liquidity and banks' cost of funds and financial performance. There is a possibility that banks' cost of funds and financial performance may affect the levels of liquidity. Simultaneous equations are widely used in the literature to address endogeneity concerns (Distinguin, Roulet and Tarazi (2013); Shrieves and Dahl (1992)). The models used to test the reverse causality of bank liquidity on banks' cost of funds and financial performance are respectively:

$$\Delta Liquidity_{i,t} = \beta\ \Delta CostofFunds_{i,t} + \gamma\ Controls_{i,t}\ + \delta_t + \varepsilon_{i,t} \quad (9)$$

$$\Delta Liquidity_{i,t} = \alpha\ \Delta Performance_{i,t} + \varphi\ Controls_{i,t}\ + \theta_t + \xi_{i,t} \quad (10)$$

We extend the model to test the relationship between bank liquidity and banks' cost of funds and in turn financial performance for large banks and banks with high capital buffers and large banks by generating test dummies and the following models:

$$\Delta\ CostofFunds_{i,t} = \beta_1 \Delta\ Liquidity_{i,t} + \beta_2\ Testdummy_{i,t} + \beta_3\ Testdummy_{i,t} \times \Delta\ Liquidity_{i,t} + \gamma Controls_{i,t} + \delta_t + \varepsilon_{i,t} \quad (11)$$

$$\Delta\ Performance_{i,t} = \alpha_1 \Delta\ Liquidity_{i,t} + \alpha_2\ Testdummy_{i,t} + \alpha_3\ Testdummy_{i,t} \times \Delta\ Liquidity_{i,t} + \varphi\ Controls_{i,t} + \theta_t + \xi_{i,t} \quad (12)$$

We use *Testdummy* to capture the effects of bank types. Firstly, *Big* is an indicator variable taking on a value of 1 for the banks in the top decile by total asset value and zero otherwise. Secondly, *HCB* is an indicator variable taking on a value of 1 for the top decile banks in terms of the size of their capital buffers and zero otherwise.

The regression models include quarter dummies to account for omitted time-specific effects. All regressions are estimated using robust standard errors to control for heteroskedasticity.

### 4.1 Proxies for Bank Liquidity

Given their prominence within the bank new liquidity standards that are just coming into force, in this study we use Basel III liquidity measures and their components as proxies of bank liquidity. Hence, LCR, NSFR, and the ratios of cash-to-total assets (Cash), level 1 assets-to-total assets (Level1Asset), level 2 assets-to-total assets (Level2Asset), available stable funding-to-total assets (ASF) and required stable funding-to-total assets (RSF) are our liquidity measures. LCR and NSFR have also recently been used in the literature as proxies of bank liquidity (Dietrich, Hess and Wanzenried (2014); Distinguin, Roulet and Tarazi (2013); Hong, Huang and Wu (2014); King (2013)). Cash, level 1 assets and level 2 assets are the underlying sub-components of LCR and by construction, all of these are positively related to LCR. Similarly, ASF is positively related to NSFR whereas RSF is negatively related to NSFR.

### 4.2 Proxies for Banks' Cost of Funds

We consider interest expense-to-total deposits as a proxy of banks' cost of deposit funding. Interest expense-to-total deposit is widely used in the literature to measure banks' cost of funds (Araten and Turner (2013); Dietrich, Hess and Wanzenried (2014)).

Alternatively, we use rate sensitive funding costs as another proxy of banks' cost of debt funding. Rate sensitive funding costs measure the costs of debt funding that are being repriced within a quarter. Rate sensitive funding costs capture the interest rate risk of the liabilities. It focuses the current costs of debt financing because it the rate that has to paid for raising funds through time deposit within a quarter.

### 4.3 Proxies for Banks' Financial Performance

We consider the net interest margin and return on equity as proxies of banks' financial performance. Net interest margin and return on equity are widely used in the literature for assessing the financial performance of banks (Dietrich, Hess and Wanzenried (2014)).

### 4.4 Quantile Regression

We use $90^{th}$ quantile regressions to identify the link between the various Basel III liquidity measures with banks' cost of debt funding and financial performance. Different from the approach of ordinary least squares regression, which estimates the relationship based on the mean of the conditional distribution of the dependent variable, quantile regressions are based at different points of a conditional distribution of the dependent variable (Martins and Pereira (2004)). Quantile regression estimates the relationship between the independent variable and a particular quantile of the dependent variable. Quantile regression offers a better view of the relationship because it permits an examination of the relationship between dependent variable and independent variables in different quantiles of the distributions of the dependent variable (Benoit and Van den Poel (2009)). We use $90^{th}$ quantile regressions to estimate the effect of Basel III liquidity ratios on the highest levels of banks' cost of debt funding and financial performance to ascertain whether new liquidity requirements will significantly affect these measures at high levels where the regulation can affect banks' competitive advantages.

For brevity, we use interest expenses, cash, level 1 assets, level 2 assets, ASF and RSF in referring to the ratios of total interest expenses to total deposits, liquidity coverage ratio, net stable funding ratio, cash to total assets, level 1 assets to total assets, level 2 assets to total assets, available stable funding to total assets and required stable funding to total assets respectively, in the remainder of the paper.

## 5. Discussion of Results

### 5.1 Cost of debt funding for All Banks

We first examine the effect of changes in Basel III liquidity measures on the changes in the interest expense-to-total deposits ratio for all banks. 90th percentile panel regressions are shown in Table 3.

<Insert Table 3>

Panel A of Table 3 shows that NSFR, ASF and RSF are related to interest expense-to-total deposits ratio at the 1% level of significance. Increases in the NSFR and ASF reduce interest expenses whereas RSF increases interest expenses. RSF is negatively related to NSFR and increases in RSF indicate a reduction in liquidity. Therefore, increases in Basel III liquidity ratios reduce the cost of debt. This suggests that fund suppliers are willing to charge lower cost to the banks for improving their liquidity.

The control variables are significant in the expected manner. Panel A of Table 3 shows that leverage, tier 1 capital and real estate loans to total loans are negatively related to interest expenses to total loans at 1% level of significance. Hence, banks having higher liabilities, equity and real estate loans have lower cost of funds. However, loan loss provisions to total loans and cost efficiency are positively related to interest expenses to total loans at 1% level of significance. Therefore, our results indicate that banks with lower asset quality and cost efficiency face higher cost of funds.

Panel B of Table 3 reports the simultaneous regression results to test the reverse causality on the effect of liquidity on the cost of debt. Interest expenses do not affect the Basel III liquidity measures with the exception of RSF. Therefore, we can reject the existence of reverse causality between bank liquidity and cost of debt.

The impact of Basel III liquidity measures on banks' cost of debt funding as proxied by rate sensitive funding costs is reported in Table 4.

<Insert Table 4>

Panel A of Table 4 shows that NSFR is negatively related to rate sensitive funding costs at the 1% level of significance indicating that funding stability reduces the cost of debt funding.

Again, the RSF is positively related to the return on equity at the 1% level of significance. Therefore, increases in Basel III liquidity measures reduce the rate sensitive deposit funding costs. Panel B of table 4 reports the simultaneous regression results to test the reverse causality on the effect of Basel III liquidity measures on rate sensitive funding costs. Rate sensitive funding costs affects only LCR and RSF at the 10% level of significance.

We find evidence that increases in Basel III liquidity measure reduce the cost of debt consistent with the previous findings of Ortiz-Molina and Phillips (2014).

### 5.2 Financial Performance for All Banks

The impact of Basel III liquidity measures on banks' financial performance as proxied by the return on equity is reported in Table 5.

<Insert Table 5>

Panel A of Table 5 shows that Cash, level 1 assets, level 2 assets, NSFR, ASF and RSF are all positively related to net interest margins at the 1% level of significance indicating that asset liquidity and funding stability increase banks' financial performance. Panel B of Table 5 reports the simultaneous regression results to address the potential reverse causality on the effect of Basel III liquidity measures on financial performance. Net interest margins do not affect the Basel III liquidity measures. Therefore, we can reject the reverse causality concern between Basel III liquidity measures and the net interest margin.

The impact of Basel III liquidity measures on financial performance as proxied by banks' return on equity is reported in Table 6.

<Insert Table 6>

Panel A of Table 4 shows that level 2 assets is positively related to return on equity at the 1% level of significance indicating that liquidity increases financial performance. However, RSF is also positively related to the return on equity at the 1% level of significance indicating that liquidity decreases the cost of equity. Therefore, the relation between Basel III liquidity measures and return of equity are mixed. Panel B of table 4 reports the simultaneous regression results to address the possibility of reverse causality between liquidity and financial performance. Return on equity does not affect the Basel III liquidity measures.

Therefore, we can reject the reverse causality between Basel III liquidity measures and financial performance.

We find evidence that Basel III liquidity measures improve banks' financial performance based on banks' net interest margin and return on equity. We reject the findings of the existing literature that liquidity reduces banks' profitability (Härle, et al. (2010); Kim, Mauer and Sherman (1998)).

### 5.3 Cost of Debt Funding for Big Banks

The effect of bank size on the relation between Basel III liquidity measures and interest expenses to total deposits ratio is reported in Table 7.

<Insert Table 7>

Table 7 shows that the indicator variable for bank size, Big, is negatively related to interest expenses at the 1% level of significance. Therefore, large banks have a lower cost of debt. The interactive term for bank size with level 1 assets and NSFR are positively related to interest expenses at the 5% and 1% significance level, respectively. However, the relation is negative for RSF. These results indicate that the cost of debt increases more in response to increases in asset liquidity and funding stability for big banks.

The effect of bank size on the relation between Basel III liquidity measures and rate sensitive funding costs is reported in Table 8.

<Insert Table 8>

Table 10 shows that the indicator variable for bank size, Big, is negatively related to rate sensitive funding costs at the 1% level of significance. Therefore, large banks have a lower cost of debt funding. The interactive term for bank size with LCR, cash and level 1 assets are negatively related to rate sensitive funding costs at the 10%, 5% and 1% significance level, respectively. Therefore, rate sensitive funding costs decreases more in response to increases in asset liquidity within big banks. The interactive term for bank size with NSFR and ASF is negatively related to rate sensitive funding costs at the 1% and 10% significance level, respectively. These results indicate that cost of debt funding increases more in response to increase in funding stability of big banks.

Our results provide new empirical evidence that whilst larger banks have lower cost of funds their cost of funds increases more in response to increases in Basel III funding stability which is consistent with the findings of Binsbergen et al. (2010) and Faulkender et al. (2006) that larger banks face a higher cost of debt. However, we also find that large banks' cost of debt reduces more in response to increases in regulatory asset liquidity required by the LCR under Basel III liquidity rules.

### 5.4 Financial Performance for Big Banks

The effect of bank size on the relation between Basel III liquidity measures and net interest margins is reported in Table 9.

<Insert Table 9>

Table 9 shows that the indicator variable for bank size, Big, is negatively related to net interest margins at the 1% level of significance. Therefore, large banks have lower financial performance. The interactive term for bank size with LCR, cash and level 1 assets are negatively related to net interest margin at the 1% significance level. Therefore, net interest margin decreases more in response to increases in regulatory asset liquidity of big banks. The interactive term for bank size with ASF and RSF are positively related to net interest margins at the 5% and 1% significance levels, respectively. Therefore, the relation between funding stability and net interest margin is mixed.

The effect of bank size on the relation between Basel III liquidity measures and return on equity is reported in Table 10.

<Insert Table 10>

Table 10 shows that the indicator variable for bank size, Big, is negatively related to return on equity at the 1% level of significance. Therefore, large banks have lower financial performance. The interactive term for bank size with NSFR and ASF are positively related to interest expenses at the 1% significance level. Nevertheless, the relation is negative for RSF. These results indicate that return of equity increases more in response to increases in funding stability for big banks.

We find evidence that large banks experience lower financial performance which is consistent with the existing literature showing that bank profitability is negatively related to size (Pasiouras and Kosmidou (2007)).

### 5.5 Cost of Debt Funding of Banks with High Capital Buffers

The effect of bank capital buffers on the relation between Basel III liquidity measures and interest expenses to total deposits ratio is reported in Table 11.

<Insert Table 11>

Table 11 shows that the interactive term for bank capital buffers with NSFR and ASF are negatively related to interest expenses at the 1% significance level. Nevertheless, the relation is positive for RSF. These results indicate that cost of debt reduces more in response to increases in regulatory funding stability for banks with higher capital buffers.

The effect of bank capital buffers on the relation between Basel III liquidity measures and rate sensitive funding costs is reported in Table 12.

<Insert Table 12>

Table 12 shows that the interactive term for bank capital buffers with NSFR and ASF are negatively related to interest expenses at 1% significance level. However, the relation is positive for RSF. These results indicate that rate sensitive funding costs reduce more in response to increases in regulatory funding stability for banks with higher capital buffers.

We find empirical evidence that banks with higher capital buffers reduce cost of debt in response to increases in Basel III funding stability which is consistent with the findings of Babihuga and Spaltro (2014) that increased capital buffers reduce banks' funding costs.

### 5.6 Financial Performance of Banks with High Capital Buffers

The effect of bank capital buffers on the relation between Basel III liquidity measures and net interest margins is reported in Table 13.

<Insert Table 13>

Table 13 shows that the indicator variable for bank capital buffers, HCB, is negatively related to net interest margins at the 1% level of significance. Therefore, banks with high capital buffers have lower financial performance. The interactive term for bank capital buffers with NSFR and ASF are negatively related to net interest margin at 1% significance level. Nevertheless, the relation is positive for RSF. These results indicate that net interest margin decreases more in response to increases in liquidity for banks with higher capital buffers.

The effect of bank capital buffers on the relation between Basel III liquidity measures and return on equity is reported in Table 14.

<Insert Table 14>

The interactive term for bank capital buffers with NSFR and ASF are positively related to interest expenses at the 1% significance level. Nevertheless, the relation is positive for RSF. These results indicate that return on equity increases more in response to increases in liquidity for banks with higher capital buffers which is consistent with the existing literature that bank profitability is negatively related to bank capital (Athanasoglou, Brissimis and Delis (2008); Goddard, Molyneux and Wilson (2004); Pasiouras and Kosmidou (2007)).

## 6. Conclusion

In this study, we calculate Basel III liquidity measures for U.S. commercial banks using historical call report data over the period from 2001 to 2014 to investigate the impact of increasing asset liquidity and funding stability required under liquidity standards in Basel III on banks' debt funding costs and financial performance. We find empirical evidence to suggest that increases in Basel III liquidity measures and their components generally reduce banks' cost of funds and improve their financial performance. Our results are consistent with the existing literature that asset liquidity reduces cost of capital (Diamond and Verrecchia (1991); Ortiz-Molina and Phillips (2014)). Whilst increases in asset liquidity reduce debt-funding costs and financial performance in larger banks, funding stability by requiring the use of longer term funds to better match uses of funds increases the cost of debt funding and financial performance of larger banks. We also find that banks having higher capital buffers face a lower cost of debt funding and a higher return on equity in response to increases in funding stability. Our results are consistent with the recent literature documenting that larger

firms face a higher cost of debt (Binsbergen, et al. (2010); Faulkender and Petersen (2006)) and that banks with larger capital buffers also face lower funding costs (Babihuga and Spaltro (2014)). Our results indicate that fund suppliers are willing to provide funds to banks at lower costs in response to increases in bank liquidity for holding more liquid assets and a broader liability maturity structure to meet Basel III liquidity standards and to effectively minimize maturity mismatches on banks' balance sheets.

Future research on bank liquidity standards should focus on assessing their effects on banks' market valuations. We leave the value relevance of Basel III liquidity measures to further work in this area.

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**Figure 1.A: LCR of U.S. Commercial Banks**

This figure shows the mean LCR of U.S. Commercial Banks from 2001:Q1 to 2014:Q4.

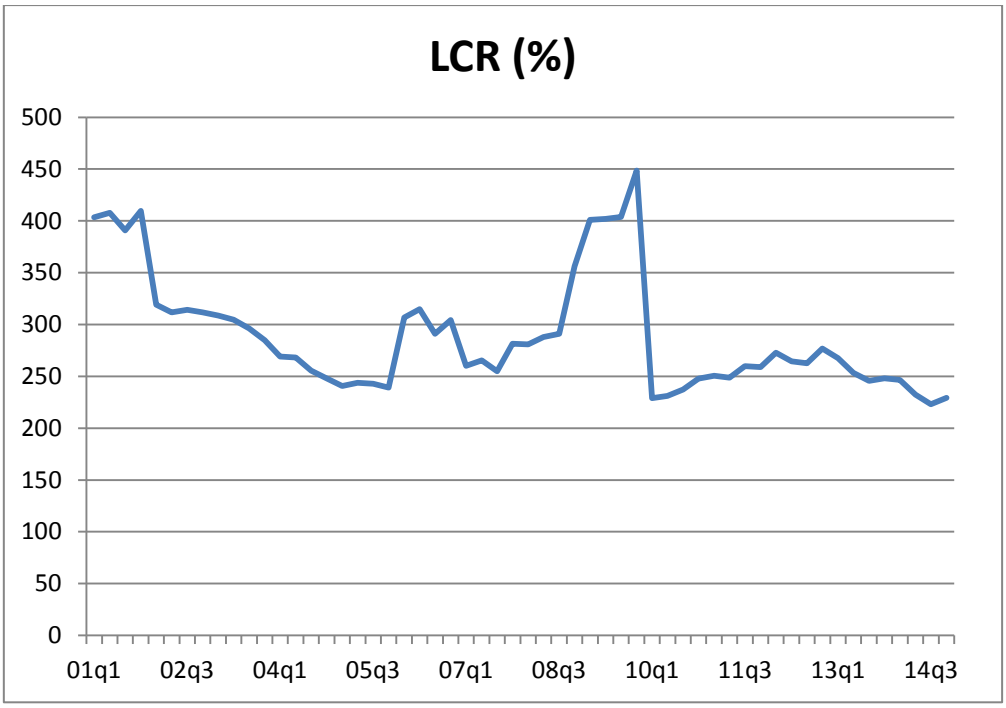


**Figure 1.A: NSFR of U.S. Commercial Banks**

This figure shows the mean NSFR of U.S. Commercial Banks from 2001:Q1 to 2014:Q4.

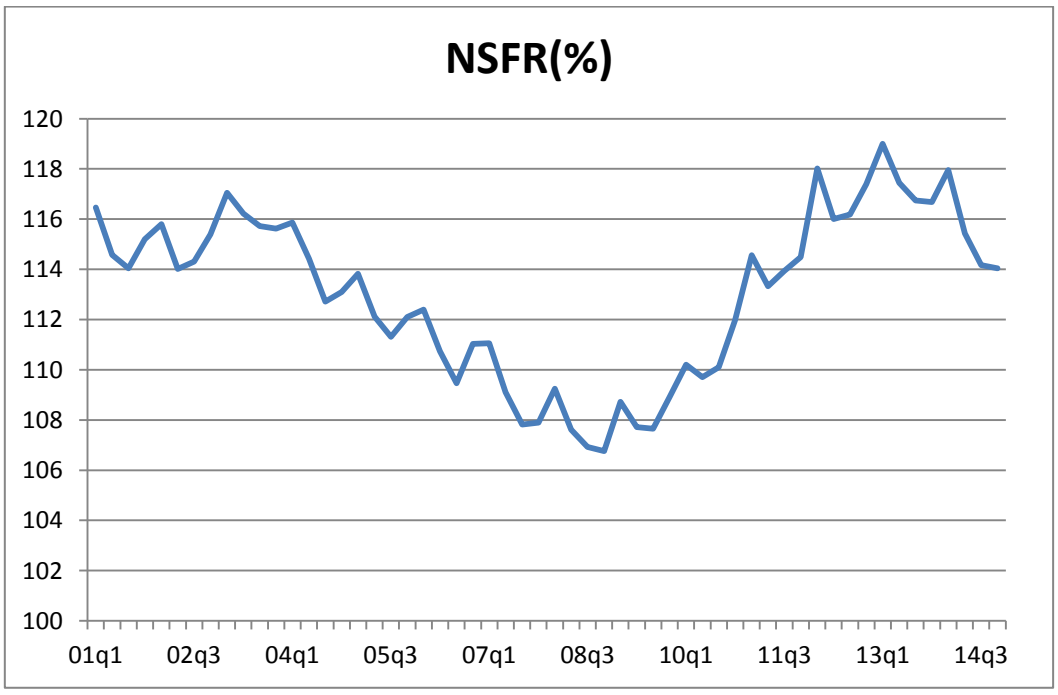

**Table 1. Summary Statistics**

This table reports the summary statistics of quarterly data for 10,390 Commercial Banks from 2001:Q1 to 2014:Q4.

| Variable | Mean | Std. Dev. | Min | Max | Observations |
|---|---|---|---|---|---|
| IntExp | 0.0137 | 0.1067 | -0.0001 | 40.0347 | 411,298 |
| RSFC | 0.0245 | 2.3797 | -547.6667 | 912.5490 | 409,496 |
| NIM | 0.0261 | 0.0154 | -0.0637 | 3.4255 | 411,298 |
| ROE | 0.0522 | 5.9833 | -887.4583 | 3061.8850 | 411,298 |
| LCR | 2.9149 | 3.3723 | 0.0002 | 99.9102 | 411,298 |
| NSFR | 1.1302 | 0.3200 | 0.0003 | 26.2083 | 411,298 |
| Cash | 0.0642 | 0.0653 | 0.0000 | 0.9473 | 411,298 |
| Level1Asset | 0.0874 | 0.0816 | 0.0000 | 0.9497 | 411,298 |
| Level2Asset | 0.0465 | 0.0365 | 0.0000 | 0.3276 | 411,298 |
| ASF | 0.7749 | 0.0581 | 0.0003 | 0.9937 | 411,298 |
| RSF | 0.7167 | 0.1330 | 0.0357 | 4.5616 | 411,298 |
| Leverage | 0.8901 | 0.0470 | 0.0308 | 1.1351 | 411,298 |
| T1CR | 0.1650 | 0.1098 | -0.1677 | 12.6990 | 411,298 |
| REL | 0.6809 | 0.1953 | 0.0000 | 1.1032 | 411,298 |
| LLP | 0.0031 | 0.0104 | -2.2110 | 2.2717 | 411,298 |
| CostEff | 0.3047 | 0.1375 | -0.1642 | 4.5000 | 411,249 |

**Table 2. Pairwise Pearson Correlation Coefficients**

This table reports the correlation coefficients of quarterly data for 10,390 Commercial Banks from 2001:Q1 to 2014:Q4.

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 IntExp | 1.00 | | | | | | | | | | | | | | | |
| 2 RSFC | 0.00 | 1.00 | | | | | | | | | | | | | | |
| 3 NIM | 0.07 | 0.01 | 1.00 | | | | | | | | | | | | | |
| 4 ROE | 0.00 | 0.00 | 0.00 | 1.00 | | | | | | | | | | | | |
| 5 LCR | 0.01 | 0.00 | 0.04 | 0.01 | 1.00 | | | | | | | | | | | |
| 6 NSFR | -0.03 | -0.01 | 0.02 | 0.00 | 0.34 | 1.00 | | | | | | | | | | |
| 7 Cash | -0.04 | 0.00 | 0.11 | 0.00 | 0.45 | 0.32 | 1.00 | | | | | | | | | |
| 8 Level1Asset | -0.04 | 0.00 | 0.06 | 0.00 | 0.59 | 0.44 | 0.80 | 1.00 | | | | | | | | |
| 9 Level2Asset | -0.04 | 0.00 | 0.00 | 0.00 | 0.51 | 0.44 | 0.53 | 0.68 | 1.00 | | | | | | | |
| 10 ASF | 0.00 | -0.01 | -0.01 | 0.00 | 0.06 | 0.19 | -0.05 | -0.08 | -0.10 | 1.00 | | | | | | |
| 11 RSF | 0.04 | 0.00 | 0.06 | 0.00 | -0.34 | -0.83 | -0.35 | -0.48 | -0.53 | 0.08 | 1.00 | | | | | |
| 12 Leverage | 0.01 | -0.01 | -0.05 | 0.00 | -0.10 | -0.27 | -0.05 | -0.05 | -0.05 | -0.13 | 0.17 | 1.00 | | | | |
| 13 T1CR | -0.02 | 0.00 | 0.08 | 0.00 | 0.24 | 0.68 | 0.17 | 0.25 | 0.24 | 0.15 | -0.52 | -0.78 | 1.00 | | | |
| 14 REL | -0.01 | -0.01 | -0.09 | 0.00 | -0.12 | -0.15 | -0.06 | -0.06 | -0.11 | 0.07 | 0.16 | 0.09 | -0.08 | 1.00 | | |
| 15 LLP | 0.03 | 0.01 | 0.16 | 0.01 | 0.03 | -0.06 | 0.02 | 0.02 | -0.02 | -0.01 | 0.09 | 0.02 | -0.07 | 0.00 | 1.00 | |
| 16 CostEff | 0.10 | 0.02 | -0.17 | 0.00 | 0.11 | -0.06 | -0.29 | -0.27 | -0.26 | 0.18 | 0.13 | 0.14 | -0.13 | 0.01 | 0.04 | 1.00 |

## Table 3: Interest Expense-to-Total Deposit for all banks

Panel A of this table reports 90th percentile panel regression results over the period from 2001:Q1 to 2014:Q4 to test the impact of the changes in Basel III liquidity measures and its components on banks' debt funding costs proxied by the ratio of interest expense-to-total deposits. Control variables used are, banks' leverage, the ratios of tier 1 capital-to-risk weighted assets (T1CR), real estate loans-to-total loans (REL), loan loss provisions-to-total loans (LLP) and interest expense-to-interest income (CostEff). Quarterly data of U.S. commercial banks has been used. Time fixed effects are included in the regressions. P-values are computed using heteroskedasticity-robust standard errors and are presented in parentheses. *, **, and *** represent statistical significance at the 10%, 5%, and 1% level, respectively. The symbol Δ represents changes and is calculated as $\frac{X_t - X_{t-1}}{X_{t-1}}$. Panel B reports the 90th percentile simultaneous panel regression results to check reverse causality.

### Panel A

| | 1 | 3 | 4 | 5 | 2 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| | Δ IntExp | Δ IntExp | Δ IntExp | Δ IntExp | Δ IntExp | Δ IntExp | Δ IntExp |
| Δ LCR | 0.0001 | | | | | | |
| | (0.9718) | | | | | | |
| Δ Cash | | 0.0000 | | | | | |
| | | (0.2084) | | | | | |
| Δ Level1Asset | | | 0.0000 | | | | |
| | | | (0.8879) | | | | |
| Δ Level2Asset | | | | 0.0000 | | | |
| | | | | (0.6616) | | | |
| Δ NSFR | | | | | -0.4074*** | | |
| | | | | | (0.0000) | | |
| Δ ASF | | | | | | -0.0337*** | |
| | | | | | | (0.0000) | |
| Δ RSF | | | | | | | 0.6268*** |
| | | | | | | | (0.0000) |
| Leverage | -0.6099*** | -0.6098*** | -0.6099*** | -0.6098*** | -0.4662*** | -0.6108*** | -0.3614*** |
| | (0.0000) | (0.0000) | (0.0000) | (0.0000) | (0.0000) | (0.0000) | (0.0000) |
| T1CR | -0.0467*** | -0.0467*** | -0.0468*** | -0.0467*** | 0.0130*** | -0.0465*** | 0.0268*** |
| | (0.0000) | (0.0000) | (0.0000) | (0.0000) | (0.0042) | (0.0000) | (0.0000) |
| REL | -0.0092*** | -0.0092*** | -0.0092*** | -0.0092*** | -0.0122*** | -0.0091*** | -0.0129*** |
| | (0.0000) | (0.0000) | (0.0000) | (0.0000) | (0.0000) | (0.0000) | (0.0000) |
| LLP | 1.2290*** | 1.2285*** | 1.2286*** | 1.2285*** | 1.2727*** | 1.2315*** | 1.1422*** |
| | (0.0000) | (0.0000) | (0.0000) | (0.0000) | (0.0000) | (0.0000) | (0.0000) |
| CostEff | 0.0418*** | 0.0418*** | 0.0419*** | 0.0419*** | 0.0418*** | 0.0414*** | 0.0392*** |
| | (0.0000) | (0.0000) | (0.0000) | (0.0000) | (0.0000) | (0.0000) | (0.0000) |
| Constant | 0.9298*** | 0.9297*** | 0.9298*** | 0.9298*** | 0.7857*** | 0.9305*** | 0.6889*** |
| | (0.0000) | (0.0000) | (0.0000) | (0.0000) | (0.0000) | (0.0000) | (0.0000) |
| Time Fixed Effect | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 400,760 | 400,760 | 400,760 | 400,760 | 400,760 | 400,760 | 400,760 |

## Panel B

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| | Δ LCR | Δ Cash | Δ Level1Asset | Δ Level2Asset | Δ NSFR | Δ ASF | Δ RSF |
| Δ IntExp | -0.0004 | -0.0004 | -0.0004 | -0.0004 | -0.0001 | 0.0004 | 0.0995*** |
| | (0.9006) | (0.8906) | (0.8480) | (0.8827) | (0.9330) | (0.4932) | (0.0000) |
| Leverage | -1.2699*** | -0.8228*** | -1.1199*** | -1.1989*** | 0.2836*** | -0.0289*** | -0.4523*** |
| | (0.0000) | (0.0000) | (0.0000) | (0.0000) | (0.0000) | (0.0000) | (0.0000) |
| T1CR | -0.3078*** | -0.0147 | -0.3157*** | -0.2462*** | 0.1862*** | -0.0181*** | 0.0027 |
| | (0.0000) | (0.6861) | (0.0000) | (0.0000) | (0.0000) | (0.0000) | (0.5707) |
| REL | -0.1084*** | -0.0546*** | -0.0490*** | -0.0596*** | -0.0452*** | -0.0073*** | -0.0353*** |
| | (0.0000) | (0.0000) | (0.0000) | (0.0000) | (0.0000) | (0.0000) | (0.0000) |
| LLP | 3.6598*** | 3.9048*** | 4.0969*** | 3.3599*** | 0.5367*** | 0.1596*** | 0.3283*** |
| | (0.0000) | (0.0000) | (0.0000) | (0.0000) | (0.0000) | (0.0000) | (0.0000) |
| CostEff | 0.5123*** | 0.6602*** | 0.4115*** | 0.3236*** | -0.0237*** | 0.0203*** | -0.0061*** |
| | (0.0000) | (0.0000) | (0.0000) | (0.0000) | (0.0000) | (0.0000) | (0.0004) |
| Constant | 1.7002*** | 1.3699*** | 1.4904*** | 1.5567*** | -0.2003*** | 0.0452*** | 0.4448*** |
| | (0.0000) | (0.0000) | (0.0000) | (0.0000) | (0.0000) | (0.0000) | (0.0000) |
| Time Fixed Effect | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 400,760 | 400,760 | 400,760 | 400,760 | 400,760 | 400,760 | 400,760 |

**Table 4: Rate Sensitive Funding Costs for all banks**

Panel A of this table reports 90th percentile panel regression results over the period from 2001:Q1 to 2014:Q4 to test the impact of the changes in Basel III liquidity measures and its components on banks' debt funding costs proxied by the rate sensitive funding costs. $RSFC_t$ = $(\text{Rate Sensitive Funding Costs})_t$ = [$(\text{Interest Expense on Time Deposit})_t$ - $(\text{Interest Expense on Time Deposit})_{t-1}$] / $(\text{Time Deposits with a remaining maturity of 3 months or less})_{t-1}$. Control variables used are, banks' leverage, the ratios of tier 1 capital-to-risk weighted assets (T1CR), real estate loans-to-total loans (REL), loan loss provisions-to-total loans (LLP) and interest expense-to-interest income (CostEff). Quarterly data of U.S. commercial banks has been used. Time fixed effects are included in the regressions. P-values are computed using heteroskedasticity-robust standard errors and are presented in parentheses. *, **, and *** represent statistical significance at the 10%, 5%, and 1% level, respectively. The symbol Δ represents changes and is calculated as $\frac{X_t - X_{t-1}}{X_{t-1}}$. Panel B reports the 90th percentile simultaneous panel regression results to check reverse causality.

**Panel A**

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| | Δ RSFC | Δ RSFC | Δ RSFC | Δ RSFC | Δ RSFC | Δ RSFC | Δ RSFC |
| Δ LCR | 0.0012 | | | | | | |
| | (0.9338) | | | | | | |
| Δ Cash | | 0.0078 | | | | | |
| | | (0.3997) | | | | | |
| Δ Level1Asset | | | 0.0125 | | | | |
| | | | (0.2492) | | | | |
| Δ Level2Asset | | | | -0.0000 | | | |
| | | | | (0.7953) | | | |
| Δ NSFR | | | | | -0.0397*** | | |
| | | | | | (0.0002) | | |
| Δ ASF | | | | | | -0.0110 | |
| | | | | | | (0.5813) | |
| Δ RSF | | | | | | | 0.1937*** |
| | | | | | | | (0.0000) |
| Controls | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Time Fixed Effect | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 398,472 | 398,472 | 398,472 | 398,472 | 398,472 | 398,472 | 398,472 |

**Panel B**

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| | Δ LCR | Δ Cash | Δ Level1Asset | Δ Level2Asset | Δ NSFR | Δ ASF | Δ RSF |
| Δ RSFC | -0.0001* | -0.0001 | -0.0001 | -0.0000 | 0.0000 | 0.0000 | -0.0000* |
| | (0.0612) | (0.8322) | (0.1305) | (0.7538) | (0.6909) | (0.8670) | (0.0554) |
| Controls | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Time Fixed Effect | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 398,472 | 398,472 | 398,472 | 398,472 | 398,472 | 398,472 | 398,472 |

## Table 5: Net Interest Margin for all banks

Panel A of this table reports 90th percentile panel regression results over the period from 2001:Q1 to 2014:Q4 to test the impact of the changes in Basel III liquidity measures and its components on banks' financial performance proxied by the net interest margin. Control variables used are, banks' leverage, the ratios of tier 1 capital-to-risk weighted assets (T1CR), real estate loans-to-total loans (REL), loan loss provisions-to-total loans (LLP) and interest expense-to-interest income (CostEff). Quarterly data of U.S. commercial banks has been used. Time fixed effects are included in the regressions. P-values are computed using heteroskedasticity-robust standard errors and are presented in parentheses. *, **, and *** represent statistical significance at the 10%, 5%, and 1% level, respectively. The symbol Δ represents changes and is calculated as $\frac{X_t - X_{t-1}}{X_{t-1}}$. Panel B reports the 90th percentile simultaneous panel regression results to check reverse causality.

### Panel A

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| | Δ NIM | Δ NIM | Δ NIM | Δ NIM | Δ NIM | Δ NIM | Δ NIM |
| Δ LCR | 0.0067 | | | | | | |
| | (0.4216) | | | | | | |
| Δ Cash | | 0.0173*** | | | | | |
| | | (0.0000) | | | | | |
| Δ Level1Asset | | | 0.0147*** | | | | |
| | | | (0.0000) | | | | |
| Δ Level2Asset | | | | 0.0001*** | | | |
| | | | | (0.0000) | | | |
| Δ NSFR | | | | | 0.2078*** | | |
| | | | | | (0.0000) | | |
| Δ ASF | | | | | | 0.2177*** | |
| | | | | | | (0.0000) | |
| Δ RSF | | | | | | | -0.1047*** |
| | | | | | | | (0.0000) |
| Controls | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Time Fixed Effect | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 400,817 | 400,817 | 400,817 | 400,817 | 400,817 | 400,817 | 400,817 |

### Panel B

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| | Δ LCR | Δ Cash | Δ Level1Asset | Δ Level2Asset | Δ NSFR | Δ ASF | Δ RSF |
| Δ NIM | 0.0004 | 0.0000 | 0.0004 | 0.0004 | 0.0004 | 0.0000 | -0.0003 |
| | (0.9848) | (0.9981) | (0.9884) | (0.9841) | (0.9873) | (0.9696) | (0.9719) |
| Controls | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Time Fixed Effect | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 400,817 | 400,817 | 400,817 | 400,817 | 400,817 | 400,817 | 400,817 |

## Table 6: Return on Equity for all banks

Panel A of this table reports 90th percentile panel regression results over the period from 2001:Q1 to 2014:Q4 to test the impact of the changes in Basel III liquidity measures and its components on banks' financial performance proxied by the return on equity. Control variables used are, banks' leverage, the ratios of tier 1 capital-to-risk weighted assets (T1CR), real estate loans-to-total loans (REL), loan loss provisions-to-total loans (LLP) and interest expense-to-interest income (CostEff). Quarterly data of U.S. commercial banks has been used. Time fixed effects are included in the regressions. P-values are computed using heteroskedasticity-robust standard errors and are presented in parentheses. *, **, and *** represent statistical significance at the 10%, 5%, and 1% level, respectively. The symbol Δ represents changes and is calculated as $\frac{X_t - X_{t-1}}{X_{t-1}}$. Panel B reports the 90th percentile simultaneous panel regression results to check reverse causality.

### Panel A

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| | Δ ROE | Δ ROE | Δ ROE | Δ ROE | Δ ROE | Δ ROE | Δ ROE |
| Δ LCR | -0.0003 | | | | | | |
| | (0.9817) | | | | | | |
| Δ Cash | | 0.0011 | | | | | |
| | | (0.8959) | | | | | |
| Δ Level1Asset | | | 0.0056 | | | | |
| | | | (0.3660) | | | | |
| Δ Level2Asset | | | | 0.0003*** | | | |
| | | | | (0.0000) | | | |
| Δ NSFR | | | | | -0.0269 | | |
| | | | | | (0.2466) | | |
| Δ ASF | | | | | | 0.0137 | |
| | | | | | | (0.6946) | |
| Δ RSF | | | | | | | 0.1719*** |
| | | | | | | | (0.0000) |
| Controls | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Time Fixed Effect | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 400,632 | 400,632 | 400,632 | 400,632 | 400,632 | 400,632 | 400,632 |

### Panel B

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| | Δ LCR | Δ Cash | Δ Level1Asset | Δ Level2Asset | Δ NSFR | Δ ASF | Δ RSF |
| Δ ROE | -0.0000 | -0.0000 | -0.0000 | -0.0000 | -0.0000 | -0.0000 | -0.0000 |
| | (0.9742) | (0.9726) | (0.9711) | (0.9763) | (0.9119) | (0.9387) | (0.9791) |
| Controls | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Time Fixed Effect | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 400,632 | 400,632 | 400,632 | 400,632 | 400,632 | 400,632 | 400,632 |

## Table 7: Interest Expense-to-Deposit for large banks

This table reports 90th percentile panel regression results over the period from 2001:Q1 to 2014:Q4 to test the impact of the Basel III liquidity measures on the banks' debt funding costs proxied by Interest expense-to-total deposits for large banks. Big is an indicator variable taking on values of 1 for banks in the top decile by total asset value and zero otherwise. Interest expenses to total deposits ratio is a proxy of cost of debt of banks. Control variables used are, banks' leverage, the ratios of tier 1 capital-to-risk weighted assets (T1CR), real estate loans-to-total loans (REL), loan loss provisions-to-total loans (LLP) and interest expense-to-interest income (CostEff). Quarterly data of U.S. commercial banks has been used. Time fixed effects are included in the regressions. P-values are computed using heteroskedasticity-robust standard errors and are presented in parentheses. *, **, and *** represent statistical significance at the 10%, 5%, and 1% level, respectively. The symbol Δ represents changes and is calculated as $\frac{X_t - X_{t-1}}{X_{t-1}}$.

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| | Δ IntExp | Δ IntExp | Δ IntExp | Δ IntExp | Δ IntExp | Δ IntExp | Δ IntExp |
| Big | -0.0045*** | -0.0046*** | -0.0047*** | -0.0046*** | -0.0048*** | -0.0046*** | -0.0032*** |
| | (0.0000) | (0.0000) | (0.0000) | (0.0000) | (0.0000) | (0.0000) | (0.0000) |
| Δ LCR | 0.0000 | | | | | | |
| | (0.9990) | | | | | | |
| Δ LCR×Big | 0.0001 | | | | | | |
| | (0.9857) | | | | | | |
| Δ Cash | | -0.0005 | | | | | |
| | | (0.6630) | | | | | |
| Δ Cash×Big | | 0.0005 | | | | | |
| | | (0.6375) | | | | | |
| Δ Level1Asset | | | -0.0026*** | | | | |
| | | | (0.0000) | | | | |
| Δ Level1Asset×Big | | | 0.0031** | | | | |
| | | | (0.0107) | | | | |
| Δ Level2Asset | | | | 0.0000 | | | |
| | | | | (0.6641) | | | |
| Δ Level2Asset×Big | | | | 0.0002 | | | |
| | | | | (0.3815) | | | |
| Δ NSFR | | | | | -0.4197*** | | |
| | | | | | (0.0000) | | |
| Δ NSFR×Big | | | | | 0.1574*** | | |
| | | | | | (0.0000) | | |
| Δ ASF | | | | | | -0.0227*** | |
| | | | | | | (0.0000) | |
| Δ ASF×Big | | | | | | -0.0966*** | |
| | | | | | | (0.0000) | |
| Δ RSF | | | | | | | 0.6350*** |
| | | | | | | | (0.0000) |
| Δ RSF×Big | | | | | | | -0.1645*** |
| | | | | | | | (0.0000) |
| Controls | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Time Fixed Effect | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 400,760 | 400,760 | 400,760 | 400,760 | 400,760 | 400,760 | 400,760 |

## Table 8: Rate Sensitive Funding Costs for large banks

This table reports 90th percentile panel regression results over the period from 2001:Q1 to 2014:Q4 to test the impact of the Basel III liquidity measures on the banks' debt funding costs proxied by the rate sensitive funding costs for large banks. $RSFC_t$ = (Rate Sensitive Funding Costs)$_t$ = [(Interest Expense on Time Deposit)$_t$ - (Interest Expense on Time Deposit)$_{t-1}$] / (Time Deposits with a remaining maturity of 3 months or less)$_{t-1}$. Big is an indicator variable taking on values of 1 for banks in the top decile by total asset value and zero otherwise. Control variables used are, banks' leverage, the ratios of tier 1 capital-to-risk weighted assets (T1CR), real estate loans-to-total loans (REL), loan loss provisions-to-total loans (LLP) and interest expense-to-interest income (CostEff). Quarterly data of U.S. commercial banks has been used. Time fixed effects are included in the regressions. P-values are computed using heteroskedasticity-robust standard errors and are presented in parentheses. *, **, and *** represent statistical significance at the 10%, 5%, and 1% level, respectively. The symbol Δ represents changes and is calculated as $\frac{X_t - X_{t-1}}{X_{t-1}}$.

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| | Δ RSFC | Δ RSFC | Δ RSFC | Δ RSFC | Δ RSFC | Δ RSFC | Δ RSFC |
| Big | -0.0259*** | -0.0260*** | -0.0262*** | -0.0271*** | -0.0267*** | -0.0274*** | -0.0260*** |
| | (0.0000) | (0.0000) | (0.0000) | (0.0000) | (0.0000) | (0.0000) | (0.0000) |
| Δ LCR | 0.0202*** | | | | | | |
| | (0.0000) | | | | | | |
| Δ LCR×Big | -0.0203* | | | | | | |
| | (0.0784) | | | | | | |
| Δ Cash | | 0.0154** | | | | | |
| | | (0.0280) | | | | | |
| Δ Cash×Big | | -0.0158** | | | | | |
| | | (0.0242) | | | | | |
| Δ Level1Asset | | | 0.0230*** | | | | |
| | | | (0.0000) | | | | |
| Δ Level1Asset×Big | | | -0.0234*** | | | | |
| | | | (0.0000) | | | | |
| Δ Level2Asset | | | | -0.0000 | | | |
| | | | | (0.9650) | | | |
| Δ Level2Asset×Big | | | | -0.0003 | | | |
| | | | | (0.7296) | | | |
| Δ NSFR | | | | | -0.0553*** | | |
| | | | | | (0.0000) | | |
| Δ NSFR×Big | | | | | 0.1947*** | | |
| | | | | | (0.0002) | | |
| Δ ASF | | | | | | -0.0166 | |
| | | | | | | (0.4540) | |
| Δ ASF×Big | | | | | | 0.1281* | |
| | | | | | | (0.0861) | |
| Δ RSF | | | | | | | 0.1909*** |
| | | | | | | | (0.0000) |
| Δ RSF×Big | | | | | | | -0.0490 |
| | | | | | | | (0.3343) |
| Controls | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Time Fixed Effect | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 398,472 | 398,472 | 398,472 | 398,472 | 398,472 | 398,472 | 398,472 |

## Table 9: Net Interest Margin for large banks

This table reports 90th percentile panel regression results over the period from 2001:Q1 to 2014:Q4 to test the impact of the Basel III liquidity measures on the banks' financial performance proxied by net interest margin for large banks. Big is an indicator variable taking on values of 1 for banks in the top decile by total asset value and zero otherwise. Control variables used are, banks' leverage, the ratios of tier 1 capital-to-risk weighted assets (T1CR), real estate loans-to-total loans (REL), loan loss provisions-to-total loans (LLP) and interest expense-to-interest income (CostEff). Quarterly data of U.S. commercial banks has been used. Time fixed effects are included in the regressions. P-values are computed using heteroskedasticity-robust standard errors and are presented in parentheses. *, **, and *** represent statistical significance at the 10%, 5%, and 1% level, respectively. The symbol Δ represents changes and is calculated as $\frac{X_t - X_{t-1}}{X_{t-1}}$.

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| | Δ NIM | Δ NIM | Δ NIM | Δ NIM | Δ NIM | Δ NIM | Δ NIM |
| Big | -0.0054*** | -0.0046*** | -0.0049*** | -0.0063*** | -0.0055*** | -0.0063*** | -0.0059*** |
| | (0.0000) | (0.0000) | (0.0000) | (0.0000) | (0.0000) | (0.0000) | (0.0000) |
| Δ LCR | 0.0125*** | | | | | | |
| | (0.0000) | | | | | | |
| Δ LCR×Big | -0.0123*** | | | | | | |
| | (0.0060) | | | | | | |
| Δ Cash | | 0.0214*** | | | | | |
| | | (0.0000) | | | | | |
| Δ Cash×Big | | -0.0193*** | | | | | |
| | | (0.0000) | | | | | |
| Δ Level1Asset | | | 0.0184*** | | | | |
| | | | (0.0000) | | | | |
| Δ Level1Asset×Big | | | -0.0176** | | | | |
| | | | (0.0164) | | | | |
| Δ Level2Asset | | | | 0.0000*** | | | |
| | | | | (0.0000) | | | |
| Δ Level2Asset×Big | | | | 0.0005*** | | | |
| | | | | (0.0000) | | | |
| Δ NSFR | | | | | 0.2071*** | | |
| | | | | | (0.0000) | | |
| Δ NSFR×Big | | | | | 0.0117 | | |
| | | | | | (0.4632) | | |
| Δ ASF | | | | | | 0.2134*** | |
| | | | | | | (0.0000) | |
| Δ ASF×Big | | | | | | 0.0429** | |
| | | | | | | (0.0166) | |
| Δ RSF | | | | | | | -0.1120*** |
| | | | | | | | (0.0000) |
| Δ RSF×Big | | | | | | | 0.0881*** |
| | | | | | | | (0.0000) |
| Controls | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Time Fixed Effect | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 400817 | 400817 | 400817 | 400817 | 400817 | 400817 | 400817 |

## Table 10: Return on Equity for large banks

This table reports 90th percentile panel regression results over the period from 2001:Q1 to 2014:Q4 to test the impact of the Basel III liquidity measures on the banks' financial performance proxied by return on equity for large banks. Big is an indicator variable taking on values of 1 for banks in the top decile by total asset value and zero otherwise. Control variables used are, banks' leverage, the ratios of tier 1 capital-to-risk weighted assets (T1CR), real estate loans-to-total loans (REL), loan loss provisions-to-total loans (LLP) and interest expense-to-interest income (CostEff). Quarterly data of U.S. commercial banks has been used. Time fixed effects are included in the regressions. P-values are computed using heteroskedasticity-robust standard errors and are presented in parentheses. *, **, and *** represent statistical significance at the 10%, 5%, and 1% level, respectively. The symbol Δ represents changes and is calculated as $\frac{X_t - X_{t-1}}{X_{t-1}}$.

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| | Δ ROE | Δ ROE | Δ ROE | Δ ROE | Δ ROE | Δ ROE | Δ ROE |
| Big | -0.0806*** | -0.0805*** | -0.0803*** | -0.0813*** | -0.0804*** | -0.0806*** | -0.0816*** |
| | (0.0000) | (0.0000) | (0.0000) | (0.0000) | (0.0000) | (0.0000) | (0.0000) |
| Δ LCR | 0.0115** | | | | | | |
| | (0.0208) | | | | | | |
| Δ LCR×Big | -0.0118 | | | | | | |
| | (0.5247) | | | | | | |
| Δ Cash | | 0.0083 | | | | | |
| | | (0.3801) | | | | | |
| Δ Cash×Big | | -0.0083 | | | | | |
| | | (0.3791) | | | | | |
| Δ Level1Asset | | | 0.0197*** | | | | |
| | | | (0.0002) | | | | |
| Δ Level1Asset×Big | | | -0.0207 | | | | |
| | | | (0.4549) | | | | |
| Δ Level2Asset | | | | 0.0003*** | | | |
| | | | | (0.0000) | | | |
| Δ Level2Asset×Big | | | | 0.0004 | | | |
| | | | | (0.1131) | | | |
| Δ NSFR | | | | | -0.0535** | | |
| | | | | | (0.0197) | | |
| Δ NSFR×Big | | | | | 0.4119*** | | |
| | | | | | (0.0000) | | |
| Δ ASF | | | | | | -0.0522 | |
| | | | | | | (0.2759) | |
| Δ ASF×Big | | | | | | 0.4025*** | |
| | | | | | | (0.0000) | |
| Δ RSF | | | | | | | 0.1845*** |
| | | | | | | | (0.0000) |
| Δ RSF×Big | | | | | | | -0.1363** |
| | | | | | | | (0.0124) |
| Controls | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Time Fixed Effect | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 400,632 | 400,632 | 400,632 | 400,632 | 400,632 | 400,632 | 400,632 |

## Table 11: Interest Expense-to-Deposit for high capital buffer banks

This table reports 90th percentile panel regression results over the period from 2001:Q1 to 2014:Q4 to test the impact of the Basel III liquidity measures on the banks' debt funding costs proxied by Interest expense-to-total deposits for the banks with high capital buffers. HCB is an indicator variable taking on values of 1 for banks in the top decile with highest capital buffers and zero otherwise. Control variables used are, banks' leverage, the ratios of tier 1 capital-to-risk weighted assets (T1CR), real estate loans-to-total loans (REL), loan loss provisions-to-total loans (LLP) and interest expense-to-interest income (CostEff). Quarterly data of U.S. commercial banks has been used. Time fixed effects are included in the regressions. P-values are computed using heteroskedasticity-robust standard errors and are presented in parentheses. *, **, and *** represent statistical significance at the 10%, 5%, and 1% level, respectively. The symbol Δ represents changes and is calculated as $\frac{X_t - X_{t-1}}{X_{t-1}}$.

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| | Δ IntExp | Δ IntExp | Δ IntExp | Δ IntExp | Δ IntExp | Δ IntExp | Δ IntExp |
| HCB | -0.0028 | -0.0028 | -0.0031* | -0.0029* | -0.0009 | -0.0015 | 0.0088*** |
| | (0.1027) | (0.1262) | (0.0744) | (0.0755) | (0.5964) | (0.3657) | (0.0000) |
| Δ LCR | -0.0000 | | | | | | |
| | (0.9941) | | | | | | |
| Δ LCR×HCB | 0.0183 | | | | | | |
| | (0.3206) | | | | | | |
| Δ Cash | | -0.0001* | | | | | |
| | | (0.0599) | | | | | |
| Δ Cash×HCB | | 0.0017 | | | | | |
| | | (0.8966) | | | | | |
| Δ Level1Asset | | | -0.0001 | | | | |
| | | | (0.8721) | | | | |
| Δ Level1Asset×HCB | | | 0.0052 | | | | |
| | | | (0.7763) | | | | |
| Δ Level2Asset | | | | 0.0000 | | | |
| | | | | (0.7704) | | | |
| Δ Level2Asset×HCB | | | | 0.0002 | | | |
| | | | | (0.8932) | | | |
| Δ NSFR | | | | | -0.3793*** | | |
| | | | | | (0.0000) | | |
| Δ NSFR×HCB | | | | | -0.1997*** | | |
| | | | | | (0.0000) | | |
| Δ ASF | | | | | | -0.0188*** | |
| | | | | | | (0.0000) | |
| Δ ASF×HCB | | | | | | -0.2995*** | |
| | | | | | | (0.0000) | |
| Δ RSF | | | | | | | 0.5611*** |
| | | | | | | | (0.0000) |
| Δ RSF×HCB | | | | | | | 0.3589*** |
| | | | | | | | (0.0000) |
| Controls | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Time Fixed Effect | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 400,760 | 400,760 | 400,760 | 400,760 | 400,760 | 400,760 | 400,760 |

## Table 12: Rate Sensitive Funding Costs for high capital buffer banks

This table reports 90th percentile panel regression results over the period from 2001:Q1 to 2014:Q4 to test the impact of the Basel III liquidity measures on the banks' debt funding costs proxied by the rate sensitive funding costs for the banks with high capital buffers. $RSFC_t$ = (Rate Sensitive Funding Costs)$_t$ = [(Interest Expense on Time Deposit)$_t$ - (Interest Expense on Time Deposit)$_{t-1}$] / (Time Deposits with a remaining maturity of 3 months or less)$_{t-1}$. HCB is an indicator variable taking on values of 1 for banks in the top decile with highest capital buffers and zero otherwise. Control variables used are, banks' leverage, the ratios of tier 1 capital-to-risk weighted assets (T1CR), real estate loans-to-total loans (REL), loan loss provisions-to-total loans (LLP) and interest expense-to-interest income (CostEff). Quarterly data of U.S. commercial banks has been used. Time fixed effects are included in the regressions. P-values are computed using heteroskedasticity-robust standard errors and are presented in parentheses. *, **, and *** represent statistical significance at the 10%, 5%, and 1% level, respectively. The symbol Δ represents changes and is calculated as $\frac{X_t - X_{t-1}}{X_{t-1}}$.

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| | Δ RSFC | Δ RSFC | Δ RSFC | Δ RSFC | Δ RSFC | Δ RSFC | Δ RSFC |
| HCB | 0.0008 | 0.0019 | 0.0004 | 0.0003 | -0.0033 | 0.0031 | 0.0020 |
| | (0.9039) | (0.7762) | (0.9494) | (0.9612) | (0.5690) | (0.6148) | (0.7416) |
| Δ LCR | 0.0004 | | | | | | |
| | (0.8115) | | | | | | |
| Δ LCR×HCB | 0.0286 | | | | | | |
| | (0.7268) | | | | | | |
| Δ Cash | | 0.0083 | | | | | |
| | | (0.2604) | | | | | |
| Δ Cash×HCB | | -0.0028 | | | | | |
| | | (0.9358) | | | | | |
| Δ Level1Asset | | | 0.0116*** | | | | |
| | | | (0.0002) | | | | |
| Δ Level1Asset×HCB | | | 0.0140 | | | | |
| | | | (0.9187) | | | | |
| Δ Level2Asset | | | | 0.0000 | | | |
| | | | | (0.9847) | | | |
| Δ Level2Asset×HCB | | | | -0.0001 | | | |
| | | | | (0.9574) | | | |
| Δ NSFR | | | | | 0.0089 | | |
| | | | | | (0.3965) | | |
| Δ NSFR×HCB | | | | | -0.2586*** | | |
| | | | | | (0.0000) | | |
| Δ ASF | | | | | | 0.0562*** | |
| | | | | | | (0.0033) | |
| Δ ASF×HCB | | | | | | -1.2121*** | |
| | | | | | | (0.0000) | |
| Δ RSF | | | | | | | 0.0947*** |
| | | | | | | | (0.0000) |
| Δ RSF×HCB | | | | | | | 0.4959*** |
| | | | | | | | (0.0000) |
| Controls | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Time Fixed Effect | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 398,472 | 398,472 | 398,472 | 398,472 | 398,472 | 398,472 | 398,472 |

## Table 13: Net Interest Margin for high capital buffer banks

This table reports 90th percentile panel regression results over the period from 2001:Q1 to 2014:Q4 to test the impact of the Basel III liquidity measures on the banks' financial performance proxied by net interest margin for the banks with high capital buffers. HCB is an indicator variable taking on values of 1 for banks in the top decile with highest capital buffers and zero otherwise. Control variables used are, banks' leverage, the ratios of tier 1 capital-to-risk weighted assets (T1CR), real estate loans-to-total loans (REL), loan loss provisions-to-total loans (LLP) and interest expense-to-interest income (CostEff). Quarterly data of U.S. commercial banks has been used. Time fixed effects are included in the regressions. P-values are computed using heteroskedasticity-robust standard errors and are presented in parentheses. *, **, and *** represent statistical significance at the 10%, 5%, and 1% level, respectively. The symbol Δ represents changes and is calculated as $\frac{X_t - X_{t-1}}{X_{t-1}}$.

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| | Δ NIM | Δ NIM | Δ NIM | Δ NIM | Δ NIM | Δ NIM | Δ NIM |
| HCB | -0.0044*** | -0.0032** | -0.0031** | -0.0040*** | -0.0033** | -0.0036** | -0.0020 |
| | (0.0023) | (0.0138) | (0.0287) | (0.0030) | (0.0210) | (0.0113) | (0.1966) |
| Δ LCR | 0.0057 | | | | | | |
| | (0.5208) | | | | | | |
| Δ LCR×HCB | 0.0111 | | | | | | |
| | (0.3883) | | | | | | |
| Δ Cash | | 0.0169*** | | | | | |
| | | (0.0000) | | | | | |
| Δ Cash×HCB | | 0.0033 | | | | | |
| | | (0.8540) | | | | | |
| Δ Level1Asset | | | 0.0146*** | | | | |
| | | | (0.0000) | | | | |
| Δ Level1Asset×HCB | | | 0.0011 | | | | |
| | | | (0.9571) | | | | |
| Δ Level2Asset | | | | 0.0001*** | | | |
| | | | | (0.0064) | | | |
| Δ Level2Asset×HCB | | | | 0.0001 | | | |
| | | | | (0.8861) | | | |
| Δ NSFR | | | | | 0.2163*** | | |
| | | | | | (0.0000) | | |
| Δ NSFR×HCB | | | | | -0.0596*** | | |
| | | | | | (0.0000) | | |
| Δ ASF | | | | | | 0.2305*** | |
| | | | | | | (0.0000) | |
| Δ ASF×HCB | | | | | | -0.2104*** | |
| | | | | | | (0.0000) | |
| Δ RSF | | | | | | | -0.1392*** |
| | | | | | | | (0.0000) |
| Δ RSF×HCB | | | | | | | 0.1797*** |
| | | | | | | | (0.0000) |
| Controls | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Time Fixed Effect | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 400817 | 400817 | 400817 | 400817 | 400817 | 400817 | 400817 |

## Table 14: Return on Equity for high capital buffer banks

This table reports 90th percentile panel regression results over the period from 2001:Q1 to 2014:Q4 to test the impact of the Basel III liquidity measures on the banks' financial performance proxied by return on equity for the banks with high capital buffers. HCB is an indicator variable taking on values of 1 for banks in the top decile with highest capital buffers and zero otherwise. Control variables used are, banks' leverage, the ratios of tier 1 capital-to-risk weighted assets (T1CR), real estate loans-to-total loans (REL), loan loss provisions-to-total loans (LLP) and interest expense-to-interest income (CostEff). Quarterly data of U.S. commercial banks has been used. Time fixed effects are included in the regressions. P-values are computed using heteroskedasticity-robust standard errors and are presented in parentheses. *, **, and *** represent statistical significance at the 10%, 5%, and 1% level, respectively. The symbol Δ represents changes and is calculated as $\frac{X_t - X_{t-1}}{X_{t-1}}$.

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| | Δ ROE | Δ ROE | Δ ROE | Δ ROE | Δ ROE | Δ ROE | Δ ROE |
| HCB | -0.0094 | -0.0080 | -0.0096 | -0.0082 | -0.0082 | -0.0088 | -0.0109 |
| | (0.2264) | (0.2989) | (0.2059) | (0.2948) | (0.2089) | (0.2326) | (0.1431) |
| Δ LCR | -0.0003 | | | | | | |
| | (0.9914) | | | | | | |
| Δ LCR×HCB | 0.0132 | | | | | | |
| | (0.7740) | | | | | | |
| Δ Cash | | 0.0010 | | | | | |
| | | (0.9401) | | | | | |
| Δ Cash×HCB | | -0.0016 | | | | | |
| | | (0.9380) | | | | | |
| Δ Level1Asset | | | 0.0057 | | | | |
| | | | (0.1189) | | | | |
| Δ Level1Asset×HCB | | | 0.0007 | | | | |
| | | | (0.9851) | | | | |
| Δ Level2Asset | | | | 0.0003** | | | |
| | | | | (0.0102) | | | |
| Δ Level2Asset×HCB | | | | -0.0003 | | | |
| | | | | (0.7684) | | | |
| Δ NSFR | | | | | -0.0880*** | | |
| | | | | | (0.0001) | | |
| Δ NSFR×HCB | | | | | 0.2924*** | | |
| | | | | | (0.0000) | | |
| Δ ASF | | | | | | -0.0032 | |
| | | | | | | (0.9428) | |
| Δ ASF×HCB | | | | | | 0.3666** | |
| | | | | | | (0.0178) | |
| Δ RSF | | | | | | | 0.2252*** |
| | | | | | | | (0.0000) |
| Δ RSF×HCB | | | | | | | -0.1448*** |
| | | | | | | | (0.0006) |
| Controls | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Time Fixed Effect | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 400,632 | 400,632 | 400,632 | 400,632 | 400,632 | 400,632 | 400,632 |

## Appendix A Variable Names and Construction of Variables

| Variable | Construction | Data Source |
|---|---|---|
| IntExp | Interest Expense / Total Deposits | Federal Reserve Bank |
| RSFC | (Rate Sensitive Funding Costs)$_t$= [(Interest Expense on Time Deposit)$_t$ - (Interest Expense on Time Deposit)$_{t-1}$]/(Time Deposits with a remaining maturity of 3 months or less)$_{t-1}$. | Federal Reserve Bank |
| NIM | Net Interest Margin=Net Interest Income / Total Earning Assets | Federal Reserve Bank |
| ROE | Return on Equity=Net Income / Total Equity | Federal Reserve Bank |
| ROA | Return on Assets=Net Income / Total Assets | Federal Reserve Bank |
| LCR | Liquidity Coverage Ratio | Federal Reserve Bank |
| NSFR | Net Stable Funding Ratio | Federal Reserve Bank |
| Cash | Cash / Total Assets | Federal Reserve Bank |
| Level1Asset | Level1Assets / Total assets | Federal Reserve Bank |
| Level2Asset | Level2Assets / Total Assets | Federal Reserve Bank |
| ASF | Available Stable Funding / Total Assets | Federal Reserve Bank |
| RSF | Required Stable Funding / Total assets | Federal Reserve Bank |
| Leverage | Total Liabilities / Total Assets | Federal Reserve Bank |
| T1CR | T1CR is the ratio of tier 1 capital (shareholders capital, reserves, and hybrid capital to certain limits) divided by risk-weighted assets. This is reported by each bank. | Federal Reserve Bank |
| REL | Real Estate Loans / Total Loans | Federal Reserve Bank |
| LLP | Loan Loss Provision/ Total Loans | Federal Reserve Bank |
| CostEff | Cost Efficiency = Total Interest Expense/Total Interest Income | Federal Reserve Bank |
| HCB | Capital Buffer=(Actual Regulatory Capital – Risk-Weighted Assets*0.08) / Risk-Weighted Assets. HCB is an indicator variable with 1 for the highest decile capital buffer Commercial Banks and 0 otherwise | Federal Reserve Bank |
| Big | Indicator variable with 1 for the biggest decile Commercial Banks and 0 otherwise | Federal Reserve Bank |

## Appendix B Summary of liquidity coverage ratio calculation

| | |
|---|---|
| **Panel 1: Stock of High Quality liquidity assets** | |
| A. Level1Assets | 100% |
| Cash | |
| Securities in 0% risk weight category | |
| Reverse Repos in 0% risk weight category | |
| B. Level2Assets | 85% |
| Securities in 0% risk weight category | |
| Reverse Repos in 20% and 100% risk weight category | |
| **Panel 2: Cash Outflows** | |
| Stable retail transaction deposits | 3% |
| Stable small time deposits with a remaining maturity of one month or less | |
| Stable retail savings deposit | |
| Stable foreign deposits with a remaining maturity of one month or less | 5% |
| Less stable retail transaction deposits | 10% |
| Less stable small time deposits with a remaining maturity of one month or less | |
| Less stable retail savings deposits | |
| Less stable foreign deposits with a remaining maturity of one month or less | 25% |
| Stable wholesale transaction deposits | 5% |
| Less stable wholesale transaction deposits | 25% |
| Stable wholesale saving deposits | 20% |
| Stable large time deposits with a remaining maturity of one month or less | |
| Less stable wholesale saving deposits | 40% |
| Less stable large time deposits with a remaining maturity of one month or less | |
| Securities lent in 20% risk weight category | 15% |
| Securities lent in 50% and 100% risk weight category | 100% |
| Other liabilities | |
| Negative fair value Derivatives | |
| Unused commitments of home-equity line of credit | 5% |
| Unused commitments of credit cards | |
| Unused commitments of commercial real estate | 10% |
| Unused commitments for securities underwriting | |
| Other unused commitment | |
| Letters of credit | 5% |
| **Panel 3: Cash Inflows** | |
| 50% of loans with a remaining maturity less than one month | 100% |
| Positive fair value of Derivatives | |

## Appendix C Summary of net stable funding ratio calculation

| | |
|---|---|
| **Available Stable Funding (Sources)** | |
| Tier 1 Capital | 100% |
| Tier 2 capital | |
| Time deposits with a remaining maturity of over one year | |
| Other borrowed money with a remaining maturity of over one year | |
| Stable retail transaction deposits | 95% |
| Small time deposits with a remaining maturity of less than one year | |
| Stable Retail Savings deposit | |
| Less Stable retail transaction deposits | 90% |
| Less Stable Retail Savings deposits | |
| Wholesale transaction deposits | 50% |
| Wholesale Savings deposits | |
| Large time deposits with a remaining maturity of less than one year | |
| Foreign deposits | |
| Other borrowed money with a remaining maturity of less than one year | |
| Transaction deposits of U.S. government | |
| Transaction deposits of states and political subdivisions in the United States | |
| Transaction deposits of foreign governments and official institutions | |
| **Required Stable Funding (Uses)** | |
| Unused commitments | 5% |
| Letters of credit | |
| Securities in 0% risk weight category | |
| Securities in 20% risk weight category | 20% |
| Securities in 50% risk weight category | 50% |
| Loans in 0% risk weight category | |
| Trading assets in 0% risk category | |
| Other assets in 0% risk category | |
| Loans in 20% risk weight category | 65% |
| Trading assets in 20% risk category | |
| Other assets in 20% risk category | |
| Loans in 50% risk weight category | 85% |
| Trading assets in 50% risk category | |
| Other assets in 50% risk category | |
| Securities in 100% risk weight category and no risk weight category | 100% |
| Loans in 100% risk weight category and no risk weight category | |
| Trading assets in 100% risk category and no risk weight category | |
| Other assets in 100% risk category and no risk weight category | |

## Appendix D Major assumptions used in calculating liquidity coverage ratio and net stable funding ratio

1) Insured deposits are stable deposits and uninsured deposits are less stable deposits. U.S. commercial banks only report the total uninsured deposits in their call reports. We assume the uninsured deposits in each category of deposits are proportional to the size of that category.

2) We assume the maturity schedule of assets and liabilities is evenly distributed so that the amount of loans with a remaining maturity of less than one month equals one-twelfth of the amount of loans with a remaining maturity within one year.

3) We assume savings and transaction deposits are equally divided into wholesale and retail deposits.

## Appendix E Summary Statistics of LCR and NSFR of U.S. Commercial Banks

### Panel A: LCR (%)

| Year | N | Mean | Median | 5th Percentile | 10th Percentile | 90th Percentile | 95th Percentile |
|---|---|---|---|---|---|---|---|
| 2001 | 9,410 | 402.90% | 302.04% | 99.41% | 127.15% | 777.93% | 1025.99% |
| 2002 | 9,509 | 314.24% | 224.56% | 73.29% | 93.04% | 624.00% | 834.05% |
| 2003 | 9,611 | 298.66% | 207.75% | 64.21% | 83.68% | 596.46% | 824.53% |
| 2004 | 9,732 | 260.28% | 170.80% | 51.45% | 67.13% | 537.26% | 770.00% |
| 2005 | 9,916 | 241.58% | 158.49% | 50.31% | 64.87% | 494.42% | 710.69% |
| 2006 | 10,111 | 304.27% | 200.98% | 59.23% | 78.62% | 613.84% | 893.27% |
| 2007 | 10,287 | 265.46% | 170.45% | 47.48% | 62.89% | 538.20% | 810.09% |
| 2008 | 10,363 | 303.73% | 193.11% | 50.58% | 67.59% | 646.18% | 928.48% |
| 2009 | 10,378 | 413.63% | 280.88% | 60.57% | 84.70% | 857.74% | 1182.65% |
| 2010 | 10,386 | 236.24% | 154.91% | 29.00% | 42.60% | 505.42% | 703.37% |
| 2011 | 10,389 | 254.52% | 174.29% | 35.09% | 51.01% | 528.13% | 729.30% |
| 2012 | 10,389 | 269.16% | 187.74% | 37.74% | 53.92% | 568.25% | 755.68% |
| 2013 | 10,389 | 253.79% | 174.80% | 34.28% | 49.16% | 540.38% | 739.43% |
| 2014 | 10,390 | 232.92% | 156.14% | 31.90% | 44.67% | 506.76% | 687.81% |

### Panel B: NSFR (%)

| Year | N | Mean | Median | 5th Percentile | 10th Percentile | 90th Percentile | 95th Percentile |
|---|---|---|---|---|---|---|---|
| 2001 | 9,410 | 115.07% | 108.97% | 87.41% | 91.92% | 143.46% | 162.82% |
| 2002 | 9,509 | 114.88% | 108.42% | 87.10% | 91.08% | 144.45% | 164.16% |
| 2003 | 9,611 | 116.15% | 109.18% | 86.86% | 90.80% | 147.89% | 169.09% |
| 2004 | 9,732 | 114.03% | 106.76% | 84.41% | 88.53% | 146.59% | 168.19% |
| 2005 | 9,916 | 112.34% | 104.58% | 83.39% | 87.44% | 143.77% | 164.24% |
| 2006 | 10,111 | 110.90% | 102.92% | 82.06% | 86.15% | 140.88% | 163.38% |
| 2007 | 10,287 | 108.98% | 101.41% | 80.61% | 84.83% | 138.28% | 159.15% |
| 2008 | 10,363 | 107.64% | 100.33% | 80.67% | 84.60% | 137.89% | 155.77% |
| 2009 | 10,378 | 108.25% | 101.54% | 83.17% | 86.71% | 135.68% | 154.44% |
| 2010 | 10,386 | 110.49% | 104.01% | 85.79% | 89.31% | 137.94% | 156.03% |
| 2011 | 10,389 | 114.08% | 107.24% | 87.71% | 91.44% | 143.86% | 163.09% |
| 2012 | 10,389 | 116.90% | 109.47% | 88.35% | 92.07% | 148.62% | 170.11% |
| 2013 | 10,389 | 117.47% | 109.63% | 87.65% | 91.36% | 151.33% | 173.82% |
| 2014 | 10,390 | 115.42% | 107.29% | 86.04% | 89.57% | 149.86% | 170.70% |