Bank capital and liquidity creation

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Abstract

Recent theory papers by Diamond and Rajan (2000, 2001) and others suggest that banks with higher capital ratios may create less liquidity because capital diminishes financial fragility and/or "crowds out" deposits. Other contributions suggest the opposite outcome: banks with higher capital ratios may create more liquidity because capital gives them greater capacity to absorb the risks associated with liquidity creation. We construct liquidity creation measures for U.S. banks from 1993-2003 and test these opposing theoretical predictions. Our calculations suggest that the industry created over $1.5 trillion in liquidity as of year-end 2003, and this amount has grown over time. For large banks, which account for most of the industry's assets, we find a statistically significant positive relationship between capital and liquidity creation. For small banks, which comprise the vast majority of the observations, the relationship is significantly negative. Simulation of 1 percentage point higher lagged capital ratios for all banks yields a predicted greater aggregate liquidity creation of 2.0% ($30.6 billion), as the positive effect for large banks overwhelms the negative effect for small banks. However, the positive effect at the industry level may be eliminated under alternative assumptions.

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1. Introduction

According to the modern theory of financial intermediation, an important role of banks in the economy is to create liquidity by funding illiquid loans with liquid demand deposits (e.g. Diamond 1984, Ramakrishnan and Thakor 1984). More generally, banks create liquidity because they transform less liquid assets into more liquid liabilities. Kashyap, Rajan, and Stein (2002) suggest that banks may also create significant liquidity off the balance sheet through loan commitments and similar claims to future liquid funds.

Some recent contributions suggest that bank capital may impede this liquidity creation process because bank capital diminishes the financial fragility that facilitates the liquidity creation process (e.g., Diamond and Rajan 2000, 2001), or may "crowd out" deposits (e.g., Gorton and Winton 2000). An alternative viewpoint is that higher capital improves banks' ability to create liquidity. Liquidity creation exposes banks to risk – the more liquidity is created, the greater are the likelihood and severity of losses associated with having to dispose of illiquid assets to meet the liquidity demands of customers (Diamond and Dybvig 1983, Allen and Santomero 1998, Allen and Gale 2004). A well-known role of bank capital is to absorb risk and expand banks' risk-bearing capacity (e.g., Bhattacharya and Thakor 1993, Repullo 2004, Von Thadden 2004), so higher capital ratios may allow banks to create more liquidity. Thus, the "financial fragility-crowding out" hypothesis and the "risk absorption" hypothesis provide two diametrically opposite predictions about the impact of bank capital on liquidity creation.

The potential effects of bank capital on liquidity creation raise important research and policy issues. The research issues include the question of why banks generally have the lowest capital ratios of any industry; and why banks tend to fund loans with demandable deposits, creating potentially fragile institutions that are subject to runs. Key policy issues include possible unintended consequences of minimum capital requirements that may suppress the liquidity creation process; and the extent to which prudential supervision and regulation should be used to protect banks from failure versus allowing for the potential disciplining benefits from financial fragility.

Despite these research and policy concerns, we are not aware of any comprehensive empirical measurement of liquidity creation by the banking industry. As well, only a relatively small number of papers have tested the recent theories or examined the empirical relationship between bank capital and some of the components of liquidity creation. Thus, the sign and magnitude of the relationship between bank capital and liquidity creation remain largely unresolved. The goal of this paper is to shed new light on these issues by developing measures of bank liquidity creation, and using these measures to investigate the net effect of bank capital on liquidity creation. That is, we examine whether the effect associated with the financial fragility-crowding out hypothesis versus the effect associated with the risk absorption hypothesis empirically dominates.

This net effect may depend on both bank size and the level of bank capitalization. For example, the financial fragility-crowding out effect may be relatively strong for small banks because they tend to raise funding locally, whereas large banks more often access capital markets, so that it is less likely that capital crowds out deposits for large banks. In contrast, the risk absorption effect may be relatively strong for large banks because these institutions are subject to more regulatory and market discipline. Combining these relative strengths suggests that the financial fragility-crowding out effect may more likely empirically dominate for small banks while the risk absorption effect may more likely dominate for large banks. Similarly, the risk absorption effect may be relatively strong for banks with low capital ratios of any size because these banks have thin buffers to absorb risks and tend to face more regulatory, market, and/or owner pressures to control risk taking. We are not aware of any reason why the financial fragility-crowding out effect should vary significantly with the capital ratio. It may therefore be more likely that the risk absorption effect would empirically dominate the financial fragility-crowding out effect at low capital ratios than at high capital ratios.

We use annual data on virtually all U.S. banks over 1993-2003, a total of 84,080 bank-year observations. This time period covers a number of macroeconomic, financial, and monetary policy conditions, and avoids major changes in regulatory capital requirements that may temporarily confound the relationship between capital and liquidity creation. We test the relationship between bank capital ratios and several measures of liquidity creation based on both balance-sheet and off-balance-sheet activities.

We classify bank assets, liabilities, equity, and off-balance sheet activities into liquid, semi-liquid, and illiquid categories based on the ease and cost with which customers can demand liquid funds and the ease and cost with which banks can dispose of their obligations to meet these liquidity demands. We classify these activities primarily by product category ("cat") and in some cases by maturity ("mat"). In constructing the liquidity creation measures, we alternatively include off-balance sheet activities at full value ("fat") or exclude them entirely ("nonfat"). We thus construct liquidity creation measures based on the four combinations, "cat fat," "mat fat," "cat nonfat," and "mat nonfat." We also include a liquidity measure based on the implied credit risks of assets and off-balance sheet activities captured by the Basel I risk-based capital ratios ("rat"). As explained below, "cat fat" is our preferred measure.

Our calculations suggest that banks created about $1.554 trillion in liquidity as of year-end 2003 based on the "cat fat" measure. This is approximately equal to 22% of bank gross total assets or GTA (total assets plus allowance for loan and lease losses and the allocated transfer risk reserve) and about two and a half times the overall level of bank equity capital. Thus, by our estimates, the industry creates approximately $2.5 of liquidity per $1 of capital. The data also suggest that overall bank liquidity creation grew by more than 50% in real terms between 1993 and 2003.

We regress the liquidity creation measures for each bank-year observation on the bank's equity capital ratio and a number of control variables to test the net effect of the two hypotheses on the relationship between capital and liquidity creation. We use lagged values of capital and the other exogenous variables to mitigate potential endogeneity problems. We run the tests separately for large banks with GTA over $1 billion, and for small banks with GTA of $1 billion or less (all financial values measured in real 2003 dollars). The separate tests allow for the possibility noted above that the hypotheses may affect large and small banks differently. The large banks have about 80% of industry assets, but comprise only about 5% of the sample observations.[1]

For large banks, we find the relationship between capital and liquidity creation to be positive and statistically significant, consistent with empirical dominance of the risk absorption effect over the financial fragility-crowding out effect. Examination of the individual components of liquidity creation reveals that a higher capital ratio is associated with more illiquid assets such as business loans, more illiquid financial guarantees such as loan commitments, and fewer liquid assets such as securities. These positive effects on liquidity creation are partially offset by a limited crowding out effect on the liability side of the balance sheet, as institutions with higher capital ratios have somewhat lower liquid liability ratios.

In sharp contrast to the large-bank results, we find a negative, statistically significant effect of capital on liquidity creation for small banks, consistent with dominance of the financial fragility-crowding out effect over the risk absorption effect for these institutions. Examination of the liquidity creation components suggests that the negative effect occurs on both sides of the balance sheet. Similar to the large banks, there is some crowding out of liquid liabilities. However, unlike the large banks, the small banks with higher capital ratios do not have more illiquid assets and tend to have more, rather than fewer, liquid assets, reducing liquidity creation. Off-balance sheet activities positively affect liquidity creation, but the impact is relatively minor for small banks.

When we separate large and small banks based on capitalization, we find that the positive relationship between capital and liquidity creation holds for low-, medium- and high-capital large banks, but is only statistically significant for low-capital large banks. For small banks, the negative effect of capital on liquidity creation holds for medium- and high-capital institutions, while the relationship is positive but insignificant for low-capital institutions. Both findings are consistent with the suggestion above that the risk absorption effect may more likely dominate the financial fragility-crowding out effect for banks with lower capital ratios in each size category.

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[1] A preliminary analysis combining large and small banks gave similar findings as our reported small-bank results, which is not surprising, given that the small banks make up 95% of the observations.

Changes in capital may have a positive or negative effect on liquidity creation at the industry level, depending on which banks experience the changes. To examine this issue and evaluate the economic significance of our findings more generally, we simulate how a 1 percentage point higher lagged capital ratio for all large and small banks affects liquidity creation. The results suggest a positive effect of capital on liquidity creation for large banks that overwhelms the negative effect for small banks. Using data for 2003, we find that large banks have a predicted $35.1 billion additional liquidity creation, as opposed to a predicted decrease of $4.5 billion for small banks, yielding a net effect of about $30.6 billion or 2.0% additional liquidity creation. However, we observe that banks in the sample on average do not fully maintain a higher lagged capital ratio in the current period. A second simulation shows that if the higher capital ratio is fully maintained over time, the positive effect on liquidity creation of capital at the industry level disappears, although the findings of a positive effect for large banks and a negative effect for small banks remain.

Our approach differs significantly from the existing empirical literature. We believe that we are the first to provide comprehensive measures of liquidity creation for the U.S. banking industry. The prior literature has excluded some important components of liquidity creation, such as off-balance sheet activities, and/or excluded major segments of the industry, such as small banks. Some studies test various implications of the new theories, but do not focus on the effect of capital on liquidity creation. Others test the effects of bank capital on some components of liquidity creation, particularly during the credit crunch of the early 1990s. However, the unusual combination of economic events and changes in capital requirements at that time make it difficult to separate the causes and effects. We believe that our approach – which 1) uses more complete measures of liquidity creation; 2) tests the effects of bank capital on total liquidity creation measures and their components; 3) tests whether banks of different sizes and levels of the capital ratio have positive or negative associations between capital and liquidity creation; and 4) runs the tests over a broad set of business cycle conditions without major changes in capital requirements – may shed new light on the important research and policy issues.

The rest of the paper is organized as follows. Section 2 reviews the related literature, including both the recent theories and the available empirical evidence. Section 3 describes the data. Sections 4 and 5 discuss our regression and simulation results, respectively. Section 6 concludes.

2. The literature on capital and liquidity creation

2.1. The recent theories

The theoretical literature appears to produce two opposing predictions on the link between capital and liquidity creation. One set of theories – which we refer to collectively as the financial fragility-crowding out hypothesis – predicts that higher capital reduces liquidity creation. Another set of contributions – which we refer to as the risk absorption hypothesis – suggests that capital positively affects liquidity creation. We discuss these contributions in turn.

The financial fragility-crowding out hypothesis

Diamond and Rajan (2000, 2001) model a relationship bank that raises funds from investors to provide financing to an entrepreneur. The entrepreneur may withhold effort, which reduces the amount of bank financing attainable. More importantly, the bank may also withhold effort, which limits the bank's ability to raise financing. A deposit contract mitigates the bank's holdup problem – because depositors can run on the bank if the bank threatens to withhold effort – and therefore maximizes liquidity creation. Providers of capital cannot run on the bank, which limits their willingness to provide funds, and hence reduces liquidity creation. Thus, the higher a bank's capital ratio, the less liquidity it will create.

Diamond and Rajan's model builds on Calomiris and Kahn's (1991) argument that the ability of uninsured depositors to run on the bank in the event of expected wealth expropriation by bank managers is an important disciplining mechanism. A related idea is proposed by Flannery (1994), who provides a rationale for maturity mismatching that does not focus on liquidity creation. Flannery's model focuses on the disciplining effect of depositors' ability to withdraw their funds on demand, and thus prevent the bank from expropriating depositor wealth through excessively risky investments.

Gorton and Winton (2000) show how a higher capital ratio may reduce liquidity creation through the crowding out of deposits. They argue that deposits are more effective liquidity hedges for investors than investments in bank equity capital. Thus, higher capital ratios shift investors' funds from relatively liquid bank deposits to relatively illiquid bank capital, reducing overall liquidity for investors.[2]

The risk absorption hypothesis

An alternative viewpoint is that higher capital enhances banks' ability to create liquidity. This insight is based on two strands of the literature. One strand consists of papers (e.g. Diamond and Dybvig 1983, Allen and Santomero 1998, Allen and Gale 2004) that argue that liquidity creation exposes banks to risk. The more liquidity that is created, the greater is the likelihood and severity of losses associated with having to dispose of illiquid assets to meet the liquidity demands of customers.

Another strand consists of papers (e.g., Bhattacharya and Thakor 1993, Repullo 2004, Von Thadden 2004) that posit that bank capital absorbs risk and expands banks' risk-bearing capacity. Combining these two strands yields the prediction that higher capital ratios may allow banks to create more liquidity.

To conclude this discussion, we point out one additional contribution of some of the recent theories. The standard view of liquidity creation is that banks create liquidity by transforming illiquid assets into liquid liabilities. Diamond and Rajan (2000, 2001) and Gorton and Winton (2000) show, however, that banks can create more or less liquidity by simply changing their funding mix on the liability side. Thakor (1996), which is not a paper on liquidity creation per se, shows that capital may also affect banks' asset portfolio composition, thereby affecting liquidity creation through a change in

[2] Gorton and Winton's analysis suggests that even if equity holders did not reduce funding to the bank in Diamond-Rajan, there would be less liquidity creation with a higher capital ratio.

the asset mix. Our measures of liquidity creation incorporate these insights – they explicitly recognize that liquidity creation by banks occurs through changes in the mixes on both sides of the balance sheet as well as off-balance sheet activities.[3]

2.2 Empirical evidence

Deep and Schaefer (2004) measure liquidity creation by the 200 largest U.S. banks from 1997 to 2001. They define the liquidity transformation gap or LT gap as (liquid liabilities – liquid assets) / total assets. They consider all loans with maturity of one year or less to be liquid, and they explicitly exclude loan commitments and other off-balance sheet activities because of their contingent nature. They find that the LT gap is about 20% of total assets on average for their sample of large banks. The authors conclude that these banks do not appear to create much liquidity, and run some tests to explain this finding, examining the roles of insured deposits, credit risk, and loan commitments. They do not examine the relationship between bank capital and liquidity creation.

The LT gap is an intuitive step forward, but we do not believe it is sufficiently comprehensive. To highlight a few key differences between their approach and ours, our preferred "cat fat" liquidity creation measure classifies loans and other bank activities by category (rather than by maturity) and includes off-balance sheet activities at full value. We consider business loans to be illiquid because banks generally cannot easily dispose of them to meet liquidity demands of other customers, but we treat residential mortgages and consumer loans to be semi-liquid because these loans can often be securitized and sold to meet demands for liquid funds. We also include loan commitments and other off-balance sheet activities as creating liquidity, consistent with the arguments in Kashyap, Rajan, and Stein (2002) and others. In our less-preferred liquidity measures, we try classifying loans by maturity ("mat") and excluding off-balance sheet activities ("nonfat") to determine the effects of these assumptions. As discussed below, the LT gap is conceptually close to

[3] Thakor (1996) shows that risk-based capital requirements may lead to a portfolio reallocation from loans to marketable securities, which would be recognized as a reduction in liquidity creation by our measures.

our "mat nonfat" measure.

Gatev, Schuermann, and Strahan (2004) and Gatev and Strahan (forthcoming) find that banks have a comparative advantage in hedging liquidity risk in the economy because banks experience deposit inflows following a market crisis or liquidity shock that allow them to have more funds to provide the additional loans drawn down under commitments at such times. These studies do not focus on the role of bank capital and they do not examine the effects of bank capital on loan commitments. However, they do include the capital ratios in regressions of some liquidity categories, yielding ambiguous predictions related to the effects of capital on liquidity creation. For example, Gatev and Strahan find that a higher bank capital ratio tends to be followed by greater loans and deposits (which may increase liquidity creation) and greater liquid assets and nondeposit liabilities (which may reduce liquidity creation). Kashyap, Rajan, and Stein (2002) also provide empirical evidence of synergies between commitment lending and deposits, consistent with their model, but do not test the effects of bank capital on liquidity creation.

The credit crunch literature tests a number of hypotheses about bank capital and one type of liquidity creation, usually business lending or real estate lending, during the early 1990s when bank lending declined significantly. Several studies find that the decline in bank capital ratios arising from loan losses in the late 1980s and early 1990s contributed significantly to the reduction in lending (e.g. Peek and Rosengren 1995). This is consistent with a positive relationship between capital and liquidity creation during distress. In 1990, U.S. regulators also imposed new leverage requirements, mandating a minimum capital requirement as a percentage of assets, with the percentage based on examination ratings and other factors. The evidence suggests that the associated shortfall in required capital created by these requirements contributed to the decline in lending as well (e.g. Berger and Udell 1994, Hancock, Laing, and Wilcox 1995, Peek and Rosengren 1995), again consistent with the hypothesis of a positive effect of bank capital on liquidity creation during times of distress. Finally, a number of studies test the effects of the Basel I risk-based capital standards, which went into partial effect in 1990 and into full effect in 1992. Although there is not complete consensus, most of the studies do not support risk-based capital as a major contributor to the lending slowdown (e.g. Berger and Udell 1994). Unfortunately, the unusual combination of these three major changes in bank capital that occurred concurrently during a recession make it difficult to parse the different effects and to draw general conclusions.

Other studies of bank lending behavior over different time periods include capital ratios, but focus on other issues. For example, Berger and Udell (2004) study procyclical lending and find positive, statistically significant effects of equity/GTA on the annual growth of business loans for U.S. banks over the 1980-2000 period. Holod and Peek (2004) examine monetary policy effects and find that the capital ratio has significant positive effects on loan growth for U.S. banks over 1986 - 2003. Gambacorta and Mistrulli (2004) use Italian data over 1992-2001 and find that the impact of monetary policy and GDP shocks on bank lending depends on bank capitalization.

Thus, the existing empirical literature sheds relatively little light on the relationship between bank capital and liquidity creation. Some of the studies test the liquidity creation theories, but do not focus on the role of bank capital. Others include capital in regressions, but specify only limited components of liquidity creation, and often under unusual circumstances. Our empirical analysis uses a significantly different approach.

3. Data

In this section, we explain how we construct our liquidity creation measures and describe our data sample. We also discuss the capital ratio and other exogenous variables used in the regressions to test the effects of capital on liquidity creation.

3.1 Measures of liquidity creation

We construct the liquidity creation measures using a two-step procedure. First, we classify all balance sheet and off-balance sheet activities as liquid, semi-liquid, or illiquid. In the second step, we create alternative liquidity creation measures by combining these liquid, semi-liquid and illiquid categories in different ways.

In the first step, we classify bank activities using financial statement information from Call Reports. These reports contain information on two key characteristics that impact the liquidity of individual balance sheet and off-balance sheet items: product category and maturity. Ideally, we would classify activities as liquid, semi-liquid, or illiquid by combining these two characteristics. As noted above, business loans are generally less liquid than residential mortgages and consumer loans, as the latter can often be more easily securitized and sold to meet liquid demands. Within each of these loan categories, long-term loans are also generally less liquid than short-term loans because the expected loan repayments will provide liquid funds later. However, Call Reports provide information on the loan categories and on maturity regardless of category, but not on maturity by category. We therefore at times classify loans entirely by category ("cat") or entirely by maturity ("mat"), although we regard the loan categories as more informative and therefore preferred. All other assets, liabilities, and off-balance sheet activities are classified entirely by category. We now discuss these classifications in turn. A detailed overview is in Table 1.

<u>Classifying assets as liquid, semi-liquid, or illiquid based on:</u>

- *category ("cat"):* 'Illiquid assets' include business loans and leases plus other assets such as premises and investments in unconsolidated subsidiaries. These items typically can not be sold quickly without incurring a major loss. 'Semi-liquid' assets include loans to consumers that are relatively easy to securitize, and loans to depositories and governments that are likely to be comparatively easy to sell or otherwise disposed of because the counterparties are relatively large and informationally transparent. 'Liquid assets' consist of cash, securities, and other marketable assets that the bank can use to meet liquidity needs quickly without incurring major losses.
- *maturity ("mat"):* As noted, we have maturity information only for loans as a whole. For the "mat" measures, we classify all short-term loans of up to one year as 'semi-liquid' because the

bank can dispose of these within a year; and all long-term loans of over one year as 'illiquid.' We do not classify securities based on maturity because they can generally be easily sold regardless of maturity.

Classifying liabilities and equity as liquid, semi-liquid, or illiquid based on:

- *category ("cat"):* 'Liquid liabilities' include funds that can be quickly withdrawn by customers, such as transactions deposits and overnight federal funds purchased. 'Semi-liquid liabilities' include other deposits that can be withdrawn with slightly more difficulty or penalty. They also include 'other borrowed money,' which contains other short- and medium-maturities with terms longer than overnight, such as term federal funds, repurchase agreements, and borrowings from Federal Reserve Banks and Federal Home Loan Banks. 'Illiquid liabilities' include debt that generally cannot be withdrawn easily or quickly. We classify 'Equity' as illiquid. Although the equity of some banks is publicly traded, investors cannot demand liquid funds from the bank.[4]
- *maturity ("mat"):* We do not create separate classifications by maturity for liabilities and equity, but our categories in most cases are consistent with maturity differences. For example, overnight funds are classified as liquid liabilities and longer-term liabilities and equity (which has very long maturity) are classified as either semi-liquid or illiquid.

Classifying off-balance sheet financial guarantees as liquid, semi-liquid, or illiquid based on:

- *category ("cat"):* 'Illiquid financial guarantees' include loan commitments and commercial letters of credit – instruments that cannot be easily sold or participated. 'Semi-liquid financial guarantees' consist of net standby letters of credit (i.e., the amount outstanding and unused minus the amount conveyed to others) and net securities lent (i.e., the amount lent minus the amount borrowed) that potentially can be sold or participated. 'Liquid financial guarantees' include net participations acquired from other institutions (i.e., the amount acquired minus the amount conveyed to others).

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[4] Thus, while traded equity may be liquid from an individual investor's point of view, such liquidity is created by the capital market, not by the bank.

- *maturity ("mat"):* We do not divide loan commitments by maturity (although such data are available) because commitment customers can demand immediate funds essentially as easily as transactions depositors, regardless of maturity.

Classifying off-balance sheet derivatives as liquid, semi-liquid, or illiquid based on:

- *category ("cat"):* We distinguish between net credit derivatives (i.e., the amount guaranteed minus the beneficiary amount) and financial derivatives. We classify both as 'liquid' because they can be sold easily, but as shown in Step 2 below, we assign these activities different weights in constructing the liquidity creation measures.[5]
- *maturity ("mat"):* Although maturity information is available for derivatives, we do not use these data because derivatives can be easily sold regardless of maturity.

In the second step, we construct the liquidity creation measures by applying different weights to the groups of activities using the formulas shown in the second panel of Table 1. To illustrate, we focus on the "cat fat" formula.

Banks create liquidity when they transform less liquid assets into more liquid liabilities. For illiquid assets and liquid liabilities, we apply a weight of ½ in the formulas, so that liquidity creation totals 1 when a dollar of liquid liabilities, such as transactions deposits, is used to finance a dollar of illiquid assets, such as business loans. Intuitively, the weight of ½ applies to each, since the amount of liquidity created is only "half" determined by the source or use of the funds alone – both are needed to create liquidity. Following similar logic, we apply a weight of -½ to liquid assets, illiquid liabilities, and equity, so that liquidity creation totals -1 when a dollar of illiquid liabilities or equity is used to finance a dollar of liquid assets, such as treasury securities, in effect removing one dollar of liquidity from the nonbank public by replacing liquid treasuries with illiquid liabilities or bank equity. We apply the intermediate weight of 0 to semi-liquid assets and liabilities. Thus, the use of one dollar

[5] Data on credit derivatives are not separately available for 1993-1996, but are included elsewhere on the Call Report for these years.

of time deposits to fund one dollar of residential mortgages would yield no net liquidity creation, since the ease with which the time depositors may access their funds early and demand liquidity roughly equals the ease with which the bank can securitize and sell the mortgage to provide the funds.

Banks also create liquidity by providing off-balance sheet claims to future liquid funds. We apply a weight of ½ to illiquid financial guarantees, which is primarily composed of loan commitments. As discussed, these commitments provide liquidity in a functionally similar way to transactions deposits, which also are assigned a ½ weight.[6] We apply weights of 0 and -½ to semi-liquid and liquid financial guarantees, respectively, given that these obligations can be sold to raise funds with roughly the same ease as semi-liquid and liquid assets, respectively.

The derivatives, all of which are liquid, receive two different treatments. We apply a weight of ½ to the notional amount of net credit derivatives, given that they expose the bank to credit risks similar to business loans. The current credit exposure amount for financial derivatives is assigned a weight of 0, because these items approximately half of the time provide claims to future liquid funds for the counterparties, and the other half provide claims to future liquid funds from the counterparties, depending on the movements of market prices.[7]

The "mat fat," "cat nonfat," and "mat nonfat" formulas differ from the "cat fat" formula only in whether loans are divided by maturity instead of category ("mat" in place of "cat") and in whether off-balance sheet activities are excluded ("nonfat" in place of "fat"). As noted above, our preferred measure is "cat fat." We prefer the "cat" treatment primarily because we believe that the difference in liquidity between business loans that cannot be easily disposed of and residential mortgages and

[6] We recognize that off-balance sheet guarantees have more contingencies than transactions deposits (e.g., the bank may not provide funds by invoking a material adverse change clause, and there is no government back up like federal deposit insurance), but commitments also provide guarantees of future contract terms (e.g., interest rate protection).

[7] For example, an interest rate swap for which market interest rates have moved in a favorable direction for the bank since issuance is similar to a liquid asset that can be sold easily to raise funds, and should theoretically be assigned a weight of -½. If market interest rates have moved in the opposite direction, the swap is similar to a liquid liability with a weight of ½ because the bank would have to pay to remove the obligation. Since we cannot distinguish these cases from the available data, we assign the neutral value of 0 to all of the financial derivatives. In practice, the error created is likely very small, as the current credit exposure amounts of financial derivatives are small relative to the totals from the other parts of the portfolio.

between loans under and over one year maturity. We prefer the "fat" treatment primarily because the largest off-balance sheet item, loan commitments, provides substantial liquidity similar to deposits and banks cannot generally easily dispose of these obligations.[8]

We also construct a fifth overall liquidity creation measure using the Basel Accord risk-based capital ratio ("rat") that is based on the implied credit risk of the bank by applying the risk weights of each category of assets and the credit-equivalent amounts of off-balance sheet activities.[9] This measure does not take into account how the bank is funded through liabilities and equity or the ease with which the bank can dispose of its obligations.

3.2 Sample description

Our sample includes annual data as of December 31 on almost all commercial banks from 1993 to 2003. To ensure that our sample only contains 'true,' viable commercial banks, we impose the following restrictions. We exclude a bank if it 1) has no loans outstanding; 2) has no commercial real estate or commercial and industrial loans outstanding; 3) has zero deposits; 4) has zero or negative equity capital in the current or lagged year; 5) is very small (average lagged GTA below $25 million);[10] 6) has unused commitments exceeding four times GTA; 7) resembles a thrift (residential real estate loans exceeding 50% of GTA); or 8) is classified by the Federal Reserve as a credit card

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[8] Deep and Schaefer's (2004) LT gap measure is conceptually close to our "mat nonfat" measure and can be viewed as a special case of it. If we classified all assets and liabilities as either liquid or illiquid (none as semi-liquid) using maturities, left out all off-balance sheet activities, and used assets (A) rather than GTA as Deep and Schaefer do, our "mat nonfat" formula reduces to their formula. Our formula becomes [½*illiquid assets – ½* liquid assets + ½* liquid liabilities – ½*illiquid liabilities – ½*equity] / A = [½*(A – liquid assets) – ½*liquid assets + ½*(liquid liabilities) – ½*(assets – liquid liabilities)] / TA = [liquid liabilities – liquid assets] / A, which is Deep and Schaefer's LT gap measure.

[9] Before 2001, not all banks were required to report the credit-equivalent amounts. When these data are missing, we use a special Federal Reserve Board program to reconstruct these numbers based on other Call Report information.

[10] Banks with lagged average GTA below $25 million are not likely to be viable commercial banks in equilibrium. This exclusion reduced the sample size by 12,870 bank-year observations (from 96,950 to 84,080), but does not materially affect our findings. Inclusion of these banks would increase liquidity creation of small banks by only 0.63% ($0.0014 trillion) in 2003 (based on our "cat fat" measure), and leaves our regression results qualitatively unchanged.

bank or has consumer loans exceeding 50% of GTA.[11] We also eliminate 0.7% of all bank-year observations because some of the exogenous variables used in our regression analysis are missing.

As discussed, we run separate analyses for large banks with GTA over $1 billion and small banks with GTA of $1 billion or less to allow for the possibility that the hypotheses may affect large and small banks differently. Our sample contains 84,080 bank-year observations: 3,937 bank-year observations for large banks, and 80,143 for small banks. Table 2 shows summary statistics on our liquidity creation measures (left panel) and their components (right panel).

Based on our preferred "cat fat" measure, banks created liquidity of $1.554 trillion as of year-end 2003. This equals 22% of industry GTA and represents about $2.5 of liquidity per $1 of equity capital. Large banks created approximately 85% of industry liquidity. Overall liquidity creation increased by over 50% in real 2003 dollars from 1993 to 2003.

Turning briefly to the other liquidity creation measures, the data show much less measured liquidity creation for the "cat nonfat" measure – which is the same as "cat fat" except for the exclusion of off-balance sheet activities. Measured liquidity creation falls by over $1 trillion – down to only 5% of GTA – and measured liquidity creation for large banks drops to only 3% of GTA, highlighting the importance of including off-balance sheet activities. The "mat fat" measure differs from our preferred "cat fat" measure by using loan maturities in place of categories to classify loans as either illiquid or semi-liquid assets. Treating all loans with maturity of at least one year as illiquid assets increases measured liquidity creation substantially from 22% to 27% of GTA. Our preferred "cat fat" measure treats many of these loans, such as residential mortgages, as semi-liquid with a 0 weight because they can be securitized. The "mat nonfat" measure, which uses loan maturities and excludes off-balance sheet activities, yields an estimated liquidity creation of 10% of GTA. The "rat" measure yields liquidity creation of 71% of GTA, but is not comparable to the others because it does not account for how the bank is funded through liabilities and equity.

[11] The Federal Reserve Board defines a credit card bank as having 1) 50 percent or more of its total assets in the form of loans to individuals, 2) 90 percent or more of its loans to individuals in the form of credit card outstandings, and 3) $200 million or more in loans to individuals.

The right panel of Table 2 shows the different components of liquidity creation for 2003, including their dollar amounts, weights, and contributions to all the liquidity creation measures (except "rat"). The data show, for instance, the importance of off-balance sheet activities. Weighted illiquid financial guarantees alone total 17% of GTA, which explains why excluding off-balance sheet activities causes liquidity creation to drop from 22% of GTA ("cat fat") to 5% of GTA ("cat nonfat"). Illiquid assets measured by either the "cat" or "mat" metrics make comparable or even larger contributions to measured liquidity creation than illiquid financial guarantees. Because the formulas include both positive and negative weights, individual components may exceed total liquidity creation.

3.3 Exogenous variables

Table 3 gives descriptions and summary statistics for all the exogenous variables employed in the regressions. For each bank, we include a measure of its capital ratio, its size, its bank holding company status, and its merger and acquisition history, if any. We also include bank fixed effects (shown at the bottom of the table) to account for average differences over time across banks that are not captured by the other exogenous variables and to reduce correlations across error terms. We exclude any variables measuring the proportions of the bank's portfolio in assets, liabilities, and off-balance sheet activities, given that these are endogenous indicators of how the bank allocates its portfolio to create liquidity. All financial values are expressed in real 2003 dollars using the implicit GDP price deflator.

The other exogenous variables include a number of controls for competition and economic conditions in the local markets in which the bank has branch offices. Many bank services that are associated with liquidity creation – particularly consumer and small business deposits and loans – are competed for on a local basis, so it is important to account for differences in local conditions. The local market is defined as the Metropolitan Statistical Area (MSA) or non-MSA county in which the offices are located. For banks with offices in more than one local market, we use the weighted averages across these markets, using the proportion of the bank's deposits in each of these markets as the weights.[12] The regressions also include time fixed effects that control for average differences in liquidity creation across years that are not captured by the other exogenous variables.

All of the exogenous variables are lagged values averaged over the three years prior to observation of the dependent variables. The lags are designed to reduce potential endogeneity problems, as the future cannot cause the past. The use of three-year averages, rather than a single lagged year also reduces the effects of short-term fluctuations and problems with the use of accounting data. As well, portfolio changes take time to occur and likely reflect decisions made on the basis of historical experience, so three years of data may more accurately reflect the inputs into liquidity creation decisions. All of the lagged values are merger-adjusted – we collect information on a bank's prior mergers and use combined historical values as shown in Table 3.

Turning to the individual variables, the key exogenous variable in all regressions is the capital ratio. For most of the analysis, we use EQRAT, the ratio of equity to GTA. Equity is the most straightforward, narrow definition of capital as funds that cannot be easily withdrawn. GTA is the simplest measure of bank size, although it excludes the contribution to size of off-balance sheet activities. GTA includes the allowance for loan and lease losses and the allocated transfer risk reserve – two reserves held for potential credit losses – so that the full value of the loans financed and liquidity created by the bank on the asset side are included.

For robustness checks, we also try replacing EQRAT with one of two alternative capital ratios. TOTCAP_GTA alters the numerator of the ratio to be total capital based on the Basel I capital standards. Total capital includes equity plus limited amounts of other financial instruments, such as long-term subordinated debt (see table footnotes). TOTRWRAT also alters the denominator of the ratio to be risk-weighted assets under Basel I, which includes weighted values of assets and off-balance sheet activities based on their perceived credit risk. One motivation for these alternative

[12] We use shares of deposits because this is the only banking service for which geographic location is publicly available.

ratios is to see if there is a different effect of regulatory capital from conventional equity capital on the liquidity creation process. A second motivation is to allow for a broader definition of capital in line with some of the theoretical studies. For example, Diamond and Rajan (2000, 2001) indicate that capital in their analysis may be interpreted as either equity or long-term debt, sources of funds that cannot run on the bank. Interpretation of these regression results when TOTRWRAT is specified is problematic because the risk-weighted assets denominator is itself an indicator of liquidity creation, creating an endogeneity problem and bias toward finding a negative effect. Nonetheless, we include this capital ratio for completeness and comparison purposes.[13]

We include the natural log of bank size, Ln(GTA), in every regression, as well as running the regressions by size class. The natural log is used for all of the continuous variables that may take on large values to avoid potential specification distortions, given that the dependent variables measuring portfolio composition are virtually all in the [0,1] interval (except for some off-balance sheet items).

We control for the bank's bank holding company (BHC) status with dummies for whether the bank is in a BHC and whether it is in a multibank holding company (MBHC), D-BHC and D-MBHC, respectively. BHCs and other banks in the same BHC may serve as internal capital markets to provide capital in times of stress. This view is supported by both regulation and the literature.[14]

We also include controls for the bank's merger and acquisition (M&A) history, if any. The D-BANK-MERGE and D-DELTA-OWN dummies indicate whether a bank was involved in a merger or acquisition over the past three years, where a merger is defined as the combination of bank charters into an institution with a single set of books, and an acquisition is defined as a case in which the bank's top-tier holding company changed with no change in charter status. Controlling for M&As is

[13] Before 1996, banks were not required to report total capital or the total risk-based capital ratio, and from 1996-2000, banks with total assets less than $1 billion were not required to report these items if their total capital exceeded 8% of adjusted total assets. We estimate the missing numbers using a special Federal Reserve program based on other Call Report information.

[14] U.S. regulations require BHCs to be a source of strength for the banks they own and require other banks in the same BHC to cross-guarantee the other bank affiliates. Empirical research finds for example that that bank loan growth depends on the BHC (e.g., Houston, James, and Marcus 1997) and that banks in distress are more likely to receive equity injections if they are in a MBHC (e.g., Ashcraft 2004).

important because banks often significantly alter their lending behavior following such events.

Turning next to the control variables for local market competition, we include HERF, the Herfindahl index of concentration for the market or markets in which the bank is present. We base HERF on the market shares of both banks and thrift institutions, given that thrifts compete vigorously with banks for deposits, an important component of liquidity creation. We also include SHARE-L, the local market share of large institutions to allow for the possibility that banks of different size may compete differently.

Finally, the control variables for local market economic conditions include the log of population POP, the log of population density DENSITY, and income growth INC-GROWTH. We generally expect more competition in larger and denser markets, and we expect more liquidity creation in markets with higher income growth.

4. Regression results

To examine whether the financial fragility-crowding out effect versus the risk absorption effect empirically dominates, we regress our measures of liquidity creation on the equity capital ratio and control variables using the panel data sets on large and small banks from 1993-2003. The dependent variables are the five liquidity creation measures divided by GTA. The normalization by GTA is necessary to make the dependent variables meaningful and comparable across banks and to avoid giving undue weight to the largest institutions. Use of the liquidity creation measures without normalization would primarily amount to a regression of bank size on capital and other exogenous variables because banks differ so greatly in size (even within the large-bank and small-bank size classes). Notably, our findings are essentially static associations between bank equity capital ratios and liquidity creation per dollar of GTA, and do not take into account potential dynamic changes in the dollar size of the bank's portfolio when capital changes over time or differentiate how the effects of capital changes may differ according to the source of these changes.

Table 4 contains the regression results for large banks with GTA exceeding $1 billion. The first five columns in Panel A give the most basic results. Each normalized liquidity creation measure is regressed on the bank's three-year historical average equity capital ratio, controlling only for bank size as measured by Ln(GTA) and the bank and time fixed effects. The last five columns in Panel A show the results of the full specification that includes the remaining exogenous bank and market control variables. The findings from the partial and full specifications do not differ in any material way. The results suggest a positive relationship between capital and liquidity creation. The coefficients on the equity capital ratio are positive and statistically significant at the 1% level for our preferred "cat fat" measure. The magnitude of the coefficient in the full specification, 0.586, suggests that a 1 percentage point higher equity capital ratio for the prior three years (i.e., an increase in EQRAT of 0.01) is predicted to create additional liquidity of well over half of a percentage point of a large bank's GTA, which appears to be a substantial effect. We evaluate the importance of this magnitude further below when we simulate the effects of higher lagged equity capital ratios on liquidity creation at the industry level.

The results in Table 4, Panel A also suggest that the finding of a positive, significant effect of capital on liquidity creation holds for all the "fat" and "rat" measures of liquidity creation that include off-balance sheet activities, but not for the "nonfat" measures. Thus, the positive association between capital and liquidity creation for large banks is robust with respect to the "cat" versus "mat" versus "rat" measurement methods, but is not robust with respect to the "fat" versus "nonfat" methods. These findings suggest that off-balance sheet activities constitute an important part of the measured effect of capital on liquidity creation for large banks. The EQRAT coefficients in the "cat" and "mat" specifications are not very different from one another, suggesting that use of maturities in place of categories for loans has relatively little impact on the measured effects of capital. The magnitudes of the "rat" coefficients are not comparable to the others. The findings from the regressions in Panel A are indicative of net dominance of the risk absorption effect, and are consistent with the suggestion discussed above that the risk absorption hypothesis may have a greater net effect on large banks than the financial fragility-crowding out hypothesis.

To explain the relationship between capital and liquidity creation in greater detail, we examine the individual components of the liquidity creation measures. We regress each of the components of the preferred "cat fat" measure (normalized by GTA) on the capital ratio and the control variables. Panel B shows the coefficients on EQRAT from these regressions. All of the exogenous variables from the full specification are included in these regressions, but the coefficients on the control variables are not shown in the interest of parsimony.

Before evaluating the coefficients in Panel B, we note some simple identities that hold regarding the coefficients on the capital ratio in these equations. First, the coefficients on EQRAT in the three asset equations and the four coefficients in the liabilities and equity equations must each total to zero. This is because the sums of the dependent variables in both cases identically equal 1 due to the normalization by GTA (i.e., illiquid assets/GTA + semi-liquid assets/GTA + liquid assets/GTA = GTA/GTA, and similarly for liabilities plus equity). Second, the weighted sums of the coefficients on EQRAT using the appropriate ½, 0, and -½ weights identically equal the 0.586 coefficient on EQRAT in the full "cat fat" specification in Panel A. This is because the "cat fat" liquidity creation variable in Panel A is the weighted sum of the dependent variables in Panel B (i.e., ½ • 0.247 + 0 • 0.014 + -½ • 0.261 + ½ • -0.222 + … = 0.586).

The results in Panel B suggest that capital positively influences liquidity creation on the asset side of the balance sheet as well as off the balance sheet. Higher levels of capital are associated with significantly more illiquid assets (which are primarily business loans) and significantly fewer liquid assets (primarily securities), and more illiquid financial guarantees (primarily loan commitments). The coefficients suggest that the largest single estimated effect on liquidity creation operates through illiquid financial guarantees. The coefficient of 1.397 on illiquid financial guarantees contributes 0.698 toward the 0.586 coefficient on total liquidity creation in Panel A, and actually exceeds the total positive effect of capital, confirming our earlier observation that the exclusion of illiquid financial guarantees alone is sufficient to wipe out the entire net positive effect of capital on liquidity creation for large banks.

The positive effects of bank capital from assets and off-balance sheet activities are partially offset by capital crowding out deposits on the liability side of the balance sheet, which we define operationally as a higher equity capital ratio associated with a lower liquid liabilities ratio. The crowding out effect is limited in two ways. First, the coefficient of 0.513 in the equity regression in Panel B suggests that, given the other exogenous variables, large banks tend to maintain only about half of any change in the equity capital ratio between the three lagged years over which EQRAT is measured and the current year. Second, the coefficient of -0.222 in the liquid liabilities regression suggests that less than half of the higher equity capital ratio is compensated for with a lower liquid liabilities ratio.

Panel C shows results for low-, medium- and high-capital large banks (mean EQRAT of 0.06, 0.08, and 0.10, respectively) based on the bottom, middle and top thirds of the distribution of EQRAT. Again, only the EQRAT coefficients are shown, but the full specification is used. The relationship between capital and liquidity creation is positive for low-, medium- and high-capital large banks (coefficients on EQRAT of 1.596, 0.118, and 0.599, respectively), but is statistically significant only for low-capital large banks. This indicates dominance of the risk absorption effect for low-capital large banks, and is consistent with the suggestion discussed above that the risk absorption effect may be strong relative to the financial fragility-crowding out effect for banks of a given size with low capital ratios.

Table 5 shows the results for small banks with GTA ≤ $1 billion. The results in Panel A suggest that small banks with higher capital ratios create less liquidity, in sharp contrast to the positive effect of capital found for the large banks. All of the coefficients on the capital ratio are negative and significant at the 1% level, yielding a fairly clear result that is robust across the liquidity creation measures and between the partial and full specifications of the control variables. The magnitude of the coefficient on the "cat fat" measure in the full specification, 0.369, suggests that small banks with a 0.01 higher EQRAT create less liquidity by about 1/3 of 1 percentage point of their GTA. As for the large banks, the magnitudes of the measured effects of capital on liquidity creation are similar for the "cat" and "mat" measures for small banks. However, a key difference for small banks is that the "fat" and "nonfat" magnitudes are also similar. The inclusion of off-balance sheet activities makes little difference to the measured effects of capital on liquidity creation, likely reflecting the much smaller role of these activities for small institutions. The negative effect for small banks and positive effect for large banks in the prior table are consistent with the suggestion discussed above that the financial fragility-crowding out hypothesis may have a relatively stronger net effect on small banks than the risk absorption hypothesis and vice versa for large banks.

Panel B reveals that, similar to the large banks, there is a limited crowding out effect on the liability side of the balance sheet for small banks. The coefficient of -0.252 in the liquid liabilities equation is similar to that for the large banks. However, the coefficient of 0.359 in the equity equation suggests that small banks maintain less of the change in equity. The crowding out effect is the largest estimated effect on liquidity creation for small banks. The coefficients of -0.252 and 0.359 for the liquid liabilities and equity components of liquidity creation, respectively, together contribute -0.306 toward the -0.369 effect on total liquidity creation in Panel A.

Unlike the large banks, there is a negative effect on liquidity creation on the asset side of the balance sheet as small banks move away from semi-liquid assets (primarily consumer loans) and into liquid assets (primarily securities), leaving illiquid assets (primarily business loans) virtually unchanged. These two negative effects on the balance sheet dwarf the relatively small positive effect capital has off the balance sheet through illiquid financial guarantees (primarily loan commitments).

Panel C indicates that the negative relationship between capital and liquidity creation holds for medium- and high-capital small banks (mean EQRAT of 0.09 and 0.13, respectively), but not for low-capital small banks (mean EQRAT of 0.07). The relationship is positive but statistically insignificant for low-capital small institutions. As was the case for the large banks with different levels of the capital ratio above, this finding is consistent with the possibility that the risk absorption effect may be strong relative to the financial fragility-crowding out effect for low-capital institutions of a given size.

As additional robustness checks, we replace EQRAT with one of two alternative capital ratios: TOTCAP_GTA (total capital based on the Basel I capital standards divided by GTA) and TOTRWRAT (total capital divided by risk-weighted assets under Basel I). The results are available upon request and are not shown for brevity's sake. The results based on TOTCAP_GTA are qualitatively similar to our main results – the relationship between capital and liquidity creation is positive and significant for large banks, and negative and significant for small banks. For both size classes, the observed patterns for low-, medium- and high-capital banks are also comparable to our reported findings. The results based on TOTRWRAT are quite different – a negative relationship exists between capital and liquidity creation for both large and small banks, and this relationship also holds for low-, medium- and high-capital banks within each size group. However, as discussed above, interpretation of the regression using TOTRWRAT is problematic because the risk-weighted assets denominator is an indicator of liquidity creation, creating an endogeneity problem and negatively biased coefficient on this variable.

5. Simulation results

Our regression findings of a positive effect of capital on liquidity creation for large banks and a negative effect for small banks suggest that the effect of changes in capital at the industry level depend on which banks experience the changes. To analyze this issue and investigate economic significance of the results at the industry level, we simulate the effects on liquidity creation of 1 percentage point higher lagged capital ratios for all banks for 2003. That is, we add 0.01 to each bank's EQRAT and sum the changes in predicted liquidity creation (based on our preferred "cat fat" measure) for all the individual large and small banks. We do this by multiplying 0.01 by the estimated coefficient on EQRAT from Panel A of Tables 4 and 5 (0.586 for large banks and -0.369 for small banks) and then multiply by each bank's year-end 2003 GTA. The results shown in the left panel of Table 6 suggest a strong positive effect on liquidity creation for large banks that overwhelms a weak negative effect for small banks. The predicted increase for large banks is $35.1 billion (2.6% of total liquidity created by large banks), as opposed to a predicted decrease of $4.5 billion for small banks (2.0% decline), for an overall industry increase of $30.6 billion or 2.0% of industry liquidity creation for year-end 2003. These findings suggest a generally positive effect of higher capital on liquidity creation at the industry level unless the higher capital were concentrated in small banks.

We also conduct a second simulation under alternative assumptions. As noted above, banks maintain only a fraction of a higher lagged equity capital ratio in the current period (0.513 for large banks and 0.369 for small banks). While we believe that our empirical model is correctly specified using lagged values, it may be argued that the effects associated with the hypotheses should be assessed based on current, rather than lagged values of capital. To accommodate this within the context of our empirical model, our second simulation again evaluates the effects of 1 percentage point higher lagged capital ratios, but imposes the assumptions that banks fully maintain the higher capital ratios in the current period and that they adjust their liabilities proportionately.

For this second simulation, we use the estimated EQRAT coefficients from the individual liquidity creation component regressions from Panels B of Tables 4 and 5 except that we modify the coefficients in the equity and liability equations (we leave the coefficients in the asset and off-balance sheet regressions unchanged). For large banks, we replace the 0.513 coefficient in the equity equation in Panel B of Table 4 with 1.000 to simulate full maintenance of the higher capital ratios, and we divide the -0.222, -0.278, and -0.013 coefficients in the liability components regressions by 0.513, essentially doubling the changes in each of the liability components to match the approximate doubling of the equity change. This preserves the inherent property that the coefficients in the liabilities and equity equations sum to 0. Similarly, for small banks, we replace the 0.359 coefficient in the equity equation in Panel B of Table 5 with 1.000, and divide the corresponding coefficients in the liability components regressions by 0.359.

The results of this second simulation are shown in the right panel of Table 6. The predicted increase in liquidity creation for large banks is less than half of that for our main simulation, \$14.2 billion instead of \$35.1 billion, and the decrease is more than doubled for small banks, -\$11.2 billion in place of -\$4.5 billion, yielding a total of only \$3.1 billion or a 0.2% overall increase in liquidity creation for the industry. These findings suggest no change in our conclusions about the net dominance of the risk absorption effect for large banks or the net dominance of the financial fragility-crowding out effect for small banks. However, the findings here do suggest that the generally positive effect of capital on liquidity creation at the industry level is essentially eliminated if we assume that banks fully maintain the higher capital ratio in the current period and that they adjust their liabilities proportionately.

6. Conclusion

The theoretical literature yields conflicting predictions regarding the relationship between bank capital and liquidity creation. Some contributions argue that higher capital may suppress liquidity creation by reducing financial fragility and/or crowding out liquid deposits. Others suggest that banks with higher capital may create more liquidity because capital gives them greater capacity to absorb the risks associated with liquidity creation. The net effect of the "financial fragility-crowding out" hypothesis versus "risk absorption" hypothesis on liquidity creation raise a number of significant research and policy questions. Despite these issues, the extant empirical literature provides no comprehensive measures of liquidity creation to our knowledge and very little evidence on the sign and magnitude of the relationship between bank capital and liquidity creation.

We construct five measures of liquidity creation by U.S. banks over 1993-2003, and test the relationship between bank capital and these measures. We classify bank activities into liquid, semi-liquid, and illiquid categories based on the ease and cost with which customers can demand and banks can supply liquid funds. Our preferred "cat fat" measure classifies activities primarily by product category ("cat") and includes all bank assets and liabilities and measures off-balance sheet activities at full value ("fat"). Alternative measures considered classify bank loans by maturity ("mat") and/or exclude off-balance sheet activities ("nonfat"), or are based on the Basel I risk-based capital ratios ("rat"). We prefer categorizing loans by category ("cat"), classifying business loans of any maturity as illiquid because they generally cannot be disposed to meet liquidity needs and classifying residential mortgages and consumer loans of any maturity as semi-liquid because they can often be securitized to raise liquid funds. We prefer including off-balance sheet activities ("fat") based in part on arguments put forth in the literature that loan commitments create liquidity similarly to demand deposits. Loan commitments and other off-balance sheet activities account for a significant portion of banking industry liquidity creation by our measure. Our calculations suggest that banks created $1.554 trillion in liquidity at year-end 2003 based on our preferred "cat fat" measure, and that the amount grew by over 50 percent in real terms over the prior decade.

We find very different relationships between capital and liquidity creation for large and small banks. For large banks (GTA over $1 billion), which hold the vast majority of industry assets, the observed relationship between bank capital and liquidity creation is positive and statistically significant, consistent with dominance of the risk absorption effect. The positive, significant effect is robust with respect to using the "cat" versus "mat" versus "rat" measurement methods, but is not robust for "nonfat" methods that exclude off-balance sheet activities, an important part of liquidity creation for large banks. Analysis of the components of liquidity creation suggests that the positive relationship occurs primarily because large banks with higher capital ratios tend to have more illiquid assets (primarily business loans) and illiquid financial guarantees (primarily loan commitments), as well as fewer liquid assets (primarily securities). These positive effects on liquidity creation are partially offset by a limited crowding out effect on the liability side in which higher capital ratios are associated with fewer liquid liabilities (mainly deposits).

For small banks (GTA not exceeding $1 billion), which comprise the vast majority of the observations, the estimated relationship between capital and liquidity creation is negative and statistically significant, consistent with empirical dominance of the financial fragility-crowding out effect. The negative, significant effect is robust across all five liquidity creation measures. For these institutions, the data suggest that the negative relationship between capital and liquidity creation stems mainly from the crowding out of deposits on the liability side of the balance sheet.

When we examine large and small banks with different capital ratios, we find that the positive relationship between capital and liquidity creation holds for large banks regardless of their capitalization, although it is only statistically significant for low-capital large banks. For small banks, the association is negative and statistically significant for medium- and high-capital small banks, but it is positive and insignificant for low-capital small banks. All of these findings for the different levels of the capital ratio as well as the findings for large versus small banks are consistent with suggestions discussed earlier – the risk absorption effect may be relatively strong for large banks and for banks with low capital ratios in any size class, while the financial fragility-crowding out effect may be relatively strong for small banks and for banks with high capital ratios within a size class.

We conduct two simulations of the net effect of capital on liquidity creation at the industry level. In our main simulation, 1 percentage point higher lagged capital ratios for all banks yields additional liquidity creation of $30.6 billion or 2.0% in 2003, as an estimated increase of $35.1 billion for large banks overwhelms a reduction of $4.5 billion for small banks. This suggests a generally positive effect of higher capital on liquidity creation at the industry level unless the higher capital were concentrated in small banks.

In our second simulation, we impose the assumptions that banks fully maintain the higher lagged capital ratios in the current period instead of maintaining only a fraction thereof as they did in the sample, and that they adjust their liabilities proportionately. This effectively allows us to evaluate the net effect of capital on liquidity creation based on current, rather than lagged values of capital, while remaining within the context of our regression model based on lagged values. We again find a net dominance of the risk absorption effect for large banks and a net dominance of the financial fragility-crowding out effect for small banks. However, the positive effect of capital on liquidity creation at the industry level is essentially eliminated under these alternative assumptions.

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Table 1: Liquidity classification of bank activities and construction of five liquidity creation measures
This table explains our liquidity creation classification methodology in two steps.

STEP 1: We classify assets, liabilities plus equity, and off-balance sheet activities by category ("CAT"); or we classify loans by maturity and all other activities by category ("MAT")

ASSETS:

Illiquid assets (weight = ½)		Semi-liquid assets (weight = 0)		Liquid assets (weight = - ½)
(CAT)	**(MAT)**	**(CAT)**	**(MAT)**	**(CAT = MAT)**
Commercial real estate loans (CRE)	Loans and leases with a remaining maturity > 1 year	Residential real estate loans (RRE)	Loans and leases with a remaining maturity <= 1 year	Cash and due from other institutions
Loans to finance agricultural production		Consumer loans		ALL securities (regardless of maturity)
Commercial and industrial loans (C&I)		Loans to depository institutions		Trading assets
Other loans and lease financing receivables		Loans to state and local governments		Fed funds sold
(CAT = MAT)				
Other real estate owned (OREO)		Loans to foreign governments		
Customers' liability on bankers acceptances				
Investment in unconsolidated subsidiaries				
Intangible assets				
Premises				
Other assets				

LIABILITIES PLUS EQUITY:

Liquid liabilities (weight = ½)	Semi-liquid liabilities (weight = 0)	Illiquid liabilities plus equity (weight = - ½)
(CAT = MAT)	**(CAT = MAT)**	**(CAT = MAT)**
Transactions deposits (domestic)	Savings deposits (domestic)	Bank's liability on bankers acceptances
Overnight federal funds purchased	Time deposits (domestic)	Subordinated debt
Trading liabilities	Foreign deposits	Other liabilities
	Other borrowed money	Equity

OFF-BALANCE SHEET: FINANCIAL GUARANTEES:

Illiquid financial guarantees (weight = ½)	Semi-liquid financial guarantees (weight = 0)	Liquid financial guarantees (weight = - ½)
(CAT = MAT)	**(CAT = MAT)**	**(CAT = MAT)**
Unused commitments	Net standby letters of credit	Net participations acquired
Commercial and similar letters of credit	Net securities lent	
All other off-balance sheet liabilities		

OFF-BALANCE SHEET: DERIVATIVES:

Liquid credit derivatives (weight = ½)	Liquid financial derivatives (weight = 0)	
(CAT = MAT)	**(CAT = MAT)**	
Net credit derivatives	Interest rate derivatives	
	Foreign exchange derivatives	
	Equity and commodity derivatives	

STEP 2: We use the classification formulated in step 1 to create four liquidity creation measures and add a fifth measure based on risk-weighted assets

Note: In step 1, we classify all bank activities by category (“CAT”); or we classify loans by maturity (“MAT”) and all other activities by category. If the two classifications are identical (i.e. if CAT = MAT), we drop the qualifier “cat” or “mat”. For example, for liquid assets, CAT = MAT, so we refer to liquid assets simply as liquid assets

CAT FAT =	+ ½ * illiquid assets (cat)	+ 0 * semi-liquid assets (cat)	– ½ * liquid assets
(preferred)	+ ½ * liquid liabilities	+ 0 * semi-liquid liabilities	– ½ * illiquid liabilities
			– ½ * equity
	+ ½ * illiquid financial guarantees	+ 0 * semi-liquid financial guarantees	– ½ * liquid financial guarantees
	+ ½ * liquid credit derivatives	+ 0 * liquid financial derivatives	
CAT NONFAT =	+ ½ * illiquid assets (cat)	+ 0 * semi-liquid assets (cat)	– ½ * liquid assets
	+ ½ * liquid liabilities	+ 0 * semi-liquid liabilities	– ½ * illiquid liabilities
			– ½ * equity
MAT FAT =	+ ½ * illiquid assets (mat)	+ 0 * semi-liquid assets (mat)	– ½ * liquid assets
	+ ½ * liquid liabilities	+ 0 * semi-liquid liabilities	– ½ * illiquid liabilities
			– ½ * equity
	+ ½ * illiquid financial guarantees	+ 0 * semi-liquid financial guarantees	– ½ * liquid financial guarantees
	+ ½ * liquid credit derivatives	+ 0 * liquid financial derivatives	
MAT NONFAT =	+ ½ * illiquid assets (mat)	+ 0 * semi-liquid assets (mat)	– ½ * liquid assets
	+ ½ * liquid liabilities	+ 0 * semi-liquid liabilities	– ½ * illiquid liabilities
			– ½ * equity

RAT =
+ 0.00 * assets plus credit-equivalent amount of off-balance sheet activities in the 0% risk weight category
+ 0.20 * assets plus credit-equivalent amount of off-balance sheet activities in the 20% risk weight category
+ 0.50 * assets plus credit-equivalent amount of off-balance sheet activities in the 50% risk weight category
+ 1.00 * assets plus credit-equivalent amount of off-balance sheet activities in the 100% risk weight category

= total risk-weighted assets

Table 2: Definitions and summary statistics for liquidity creation measures

This table shows liquidity creation of the banking sector in $ billion and as a fraction of GTA in 1993 and 2003 (the first and last year of our sample period). It shows the results for all five liquidity creation measures for all banks, large banks (GTA exceeding $1 billion), and small banks (GTA up to $1 billion). The right panel contains the components of liquidity creation for 2003. All financial values are expressed in real 2003 dollars using the implicit GDP price deflator.

CAT: all assets, liabilities, and off-balance sheet activities are classified based on product CATegory.
MAT: loans are classified based on MATurity, all other assets, liabilities, and off-balance sheet activities remain classified based on CATegory.
FAT: Financial guarantees and derivatives AT full value (i.e., off-balance sheet activities included).
NONFAT: Financial guarantees and derivatives AT 0 (i.e., off-balance sheet activities excluded).
RAT: implied credit risk of the bank's asset and off-balance sheet portfolio based on the risk-based capital RATio.

Liquidity creation for 1993 and 2003

		1993 liquidity creation			2003 liquidity creation		
		N	($ billion)	(fraction GTA)	N	($ billion)	(fraction GTA)
CAT FAT	All banks	9,070	948	0.21	6,959	1,554	0.22
(preferred)	Large	411	846	0.26	348	1,325	0.22
	Small	8,659	103	0.09	6,611	229	0.19
CAT NONFAT	All banks	9,070	347	0.29	6,959	334	0.05
	Large	411	300	0.34	348	183	0.03
	Small	8,659	47	0.17	6,611	151	0.12
MAT FAT	All banks	9,070	1,306	0.08	6,959	1,950	0.27
	Large	411	1,099	0.09	348	1,690	0.28
	Small	8,659	207	0.04	6,611	260	0.21
MAT NONFAT	All banks	9,070	705	0.16	6,959	730	0.10
	Large	411	554	0.17	348	548	0.09
	Small	8,659	151	0.13	6,611	182	0.15
RAT	All banks	9,070	3,126	0.70	6,959	5,122	0.71
	Large	411	2,426	0.75	348	4,287	0.72
	Small	8,659	701	0.59	6,611	836	0.69

Components of 2003 liquidity creation

		unweighted	weight	weighted	
		($ billion)		($ billion)	(fraction GTA)
Illiquid assets (cat)	All banks	2,752	0.5	1,376	0.19
	Large	2,199	0.5	1,100	0.18
	Small	553	0.5	277	0.23
Illiquid assets (mat)	All banks	3,544	0.5	1,772	0.25
	Large	2,929	0.5	1,464	0.24
	Small	615	0.5	308	0.25
Semi-liquid assets (cat)	All banks	1,905	0	0	0.00
	Large	1,625	0	0	0.00
	Small	280	0	0	0.00
Semi-liquid assets (mat)	All banks	1,110	0	0	0.00
	Large	892	0	0	0.00
	Small	218	0	0	0.00
Liquid assets	All banks	2,550	-0.5	-1,275	-0.18
	Large	2,165	-0.5	-1,083	-0.18
	Small	384	-0.5	-192	-0.16
Liquid liabilities	All banks	1,459	0.5	730	0.10
	Large	1,188	0.5	594	0.10
	Small	271	0.5	136	0.11
Semi-liquid liabilities	All banks	4,753	0	0	0.00
	Large	3,943	0	0	0.00
	Small	809	0	0	0.00
Illiquid liabilities	All banks	370	-0.5	-185	-0.03
	Large	350	-0.5	-175	-0.03
	Small	20	-0.5	-10	-0.01
Equity	All banks	624	-0.5	-312	-0.04
	Large	506	-0.5	-253	-0.04
	Small	118	-0.5	-59	-0.05
Illiquid financial guarantees	All banks	2,494	0.5	1,247	0.17
	Large	2,338	0.5	1,169	0.20
	Small	156	0.5	78	0.06
Semi-liquid financial guarantees	All banks	1,123	0	0	0.00
	Large	1,117	0	0	0.00
	Small	7	0	0	0.00
Liquid financial guarantees	All banks	-1	-0.5	0	-0.08
	Large	-1	-0.5	0	-0.09
	Small	0	-0.5	0	0.00
Liquid credit derivatives	All banks	-54	0.5	-27	0.08
	Large	-54	0.5	-27	0.09
	Small	0	0.5	0	0.00
Liquid financial derivatives	All banks	521	0	0	0.00
	Large	521	0	0	0.00
	Small	0	0	0	0.00

Table 3: Definitions and summary statistics for exogenous variables

All exogenous variables are three-year lagged averages (i.e. the average of three years prior to observation of the dependent variable). All of the lagged values are merger-adjusted – the bank capital ratio and size are pro-forma values, the bank holding company and mergers and acquisitions dummies simply take a value of 1 or 0 based on the combined experience of the merging banks in the case of mergers, and the local market competition and environment variables are weighted averages for the merging banks using their GTA values in constructing the weights. Sample period: 1993 – 2003. All financial values are expressed in real 2003 dollars using the implicit GDP price deflator.

Data sources: Bank Call reports, Bank Holding Company Y-9 reports, FDIC Summary of Deposits, NIC Database, Bureau of Economic Analysis, and U.S. Census Bureau.

Variable	Definition	Mean for all banks	Mean for large banks	Mean for small banks
Bank capital ratio				
EQRAT	Equity capital ratio: total equity capital as a proportion of GTA, where GTA equals total assets plus the allowance for loan and the lease losses and the allocated transfer risk reserve (a reserve for certain foreign loans).	0.10	0.08	0.10
TOTCAP_GTA	Total Tier 1 plus Tier 2 capital as a proportion of GTA.[15]	0.10	0.09	0.10
TOTRWRAT	Total risk-weighted capital ratio: total capital as a proportion of adjusted risk-weighted assets.[16]	0.18	0.13	0.18
Bank size				
Ln(GTA)	Log of GTA.	11.61	15.15	11.44
Bank holding company internal capital markets				
D-BHC	Dummy that equals 1 if the bank has been part of a Bank Holding Company (BHC) over the past 3 years.	0.78	0.93	0.78
D-MBHC	Dummy that equals 1 if the bank has been part of a Multi-Bank Holding Company (MBHC), i.e., a BHC with more than one bank, over the past 3 years.	0.44	0.87	0.42
Mergers and acquisitions (M&As)				
D-BANK-MERGE	Dummy that equals 1 if the bank was involved in one or more mergers over the past 3 years, combining the charters of two or more banks.	0.09	0.52	0.07
D-DELTA-OWN	Dummy that equals 1 if the bank was acquired in the last 3 years, indicated by a change in top-tier holding company with no change in charter.	0.09	0.08	0.09
Local Market Competition:				
HERF	A bank-level Herfindahl index based on bank and thrift deposits (the only variable for which geographic location is publicly available) only. We first establish the Herfindahl index of the markets in which the bank has deposits and then weight these market indices by the proportion of the bank's deposits in each of these markets.	0.21	0.16	0.21

[15] Total capital consists of Tier 1 core capital and Tier 2 supplementary capital based on the Basel I regulations. Tier1 capital is the sum of common equity, non-cumulative perpetual preferred stock, and minority interests in consolidated subsidiaries, minus all intangible assets other than mortgage servicing rights, minus identified losses, and minus investments in certain securities subsidiaries subject to 12 CFR 337.4. Tier 2 capital is the sum of the allowance for loan and lease losses (up to a maximum of 1.50% of gross risk-weighted assets through 12/30/92 and 1.25% of gross risk-weighted assets thereafter), cumulative perpetual preferred stock, long-term preferred stock (original maturity of at least 20 years), perpetual preferred stock, hybrid capital instruments including mandatory convertible debt securities, and term subordinated debt and intermediate-term preferred stock (original average maturity of five years or more). Tier 2 capital is limited to 100% of Tier 1 capital.

[16] Risk-weighted assets are based on the Basel I regulations and include weighted values of assets and off-balance sheet activities. Each balance sheet asset and credit-equivalent amount of off-balance sheet items is assigned to one of four risk categories (0%, 20%, 50%, or 100%) based on its perceived credit risk. The dollar amounts in each category are multiplied by the risk-weight assigned to that category and summed to measure risk-weighted assets. Any assets deducted from capital when computing the numerator of the capital ratio are also excluded from risk-weighted assets when computing the denominator.

Table 3: Definitions and summary statistics for exogenous variables – cont'd

Variable	Definition	Mean for all banks	Mean for large banks	Mean for small banks
SHARE-L	Share of market bank and thrift deposits held by large banks (GTA > $1B)	0.32	0.57	0.31
Local market economic environment				
POP	Natural log of weighted average population in all markets in which a bank has deposits, using the proportion of deposits held by a bank in each market as weights.	11.90	14.03	11.80
DENSITY	Weighted average population density (natural log of population per square mile) in all markets in which a bank has deposits, using the proportion of deposits held by a bank in each market as weights.	4.69	6.31	4.61
INC-GROWTH	Weighted average income growth in all markets in which a bank has deposits, using the proportion of deposits held by a bank in each market as weights.	0.05	0.05	0.05
Fixed effects:				
Time fixed effects	Set of dummies for all but one year.			
Bank fixed effects	Set of dummies for all but one bank.			

Table 4: Regression results for large banks (GTA exceeding $1 billion)

Panel A contains the results using the five liquidity creation measures as the dependent variable. Panel B shows the regression results using the individual liquidity creation components as the dependent variable. Panel C splits the large banks by capitalization. Panels B and C show only the coefficients on EQRAT in the interest of parsimony, although the regressions include all the exogenous variables from the full specification.

The liquidity creation measures are defined in Table 1, the exogenous variables in Table 3. The sample period is 1993-2003. All regressions are run with both time fixed effects (shown) and bank fixed effects (not shown). t-statistics are in parentheses. *, ** and *** denote significance at the 10%, 5% and 1% level, respectively.

PANEL A: Regression results using the five liquidity creation measures as the dependent variable

	cat fat (preferred)	**cat nonfat**	**mat fat**	**mat nonfat**	**rat**	**cat fat (preferred)**	**cat nonfat**	**mat fat**	**mat nonfat**	**rat**
EQRAT	0.624	-0.121	0.752	0.008	0.223	0.586	-0.107	0.680	-0.014	0.227
	*(3.47)****	*(1.46)*	*(3.99)****	*(0.08)*	*(2.43)***	*(3.25)****	*(1.30)*	*(3.59)****	*(0.15)*	*(2.47)***
Ln(GTA)	-0.021	-0.002	-0.012	0.008	0.001	-0.026	-0.005	-0.017	0.005	-0.002
	*(2.80)****	*(0.61)*	*(1.44)*	*(1.88)**	*(0.35)*	*(3.27)****	*(1.26)*	*(1.99)***	*(1.15)*	*(0.47)*
D-BHC						0.055	0.059	0.033	0.038	0.035
						*(1.99)***	*(4.69)****	*(1.15)*	*(2.59)****	*(2.52)***
D-MBHC						0.020	0.016	0.035	0.031	0.007
						(1.20)	*(2.16)***	*(2.00)***	*(3.57)****	*(0.82)*
D-BANK-MERGE						0.006	0.002	0.010	0.006	0.004
						(0.97)	*(0.65)*	*(1.66)**	*(2.02)***	*(1.27)*
D-DELTA-OWN						-0.014	-0.025	-0.003	-0.014	-0.018
						(1.39)	*(5.45)****	*(0.24)*	*(2.58)****	*(3.56)****
HERF						0.081	-0.008	0.376	0.286	-0.228
						(0.67)	*(0.15)*	*(2.97)****	*(4.49)****	*(3.70)****
SHARE-L						-0.066	-0.027	-0.074	-0.036	-0.008
						*(2.28)***	*(2.06)***	*(2.46)***	*(2.36)***	*(0.54)*
POP						0.044	0.015	0.039	0.010	0.027
						*(2.63)****	*(1.93)**	*(2.22)***	*(1.11)*	*(3.17)****
DENSITY						-0.054	-0.024	-0.047	-0.017	-0.036
						*(2.84)****	*(2.78)****	*(2.37)***	*(1.75)**	*(3.74)****
INC-GROWTH						0.304	-0.170	0.273	-0.201	0.088
						(1.23)	*(1.50)*	*(1.06)*	*(1.54)*	*(0.70)*
d94	0.024	0.012	0.031	0.018	0.015	0.028	0.011	0.035	0.018	0.015
	*(2.74)****	*(2.82)****	*(3.33)****	*(3.87)****	*(3.34)****	*(3.08)****	*(2.65)****	*(3.71)****	*(3.84)****	*(3.32)****
d95	0.017	0.003	0.025	0.010	0.030	0.021	0.003	0.030	0.012	0.030
	*(1.90)**	*(0.63)*	*(2.60)****	*(2.11)***	*(6.50)****	*(2.29)***	*(0.69)*	*(3.11)****	*(2.44)***	*(6.33)****
d96	0.015	0.001	-0.023	-0.038	0.044	0.022	0.001	-0.015	-0.035	0.043
	(1.59)	*(0.18)*	*(2.27)***	*(7.31)****	*(8.76)****	*(2.18)***	*(0.29)*	*(1.43)*	*(6.72)****	*(8.52)****
d97	0.014	-0.006	-0.026	-0.047	0.046	0.020	-0.005	-0.018	-0.043	0.046
	(1.38)	*(1.31)*	*(2.35)***	*(8.37)****	*(8.65)****	*(1.89)**	*(1.09)*	*(1.56)*	*(7.62)****	*(8.31)****
d98	0.019	-0.014	-0.028	-0.061	0.057	0.024	-0.013	-0.022	-0.058	0.057
	*(1.70)**	*(2.83)****	*(2.46)***	*(10.49)****	*(10.05)****	*(2.10)***	*(2.42)***	*(1.85)**	*(9.75)****	*(9.76)****
d99	0.027	-0.002	-0.020	-0.049	0.080	0.031	0.001	-0.016	-0.046	0.081
	*(2.41)***	*(0.38)*	*(1.66)**	*(8.14)****	*(13.74)****	*(2.61)****	*(0.21)*	*(1.26)*	*(7.26)****	*(13.12)****
d00	0.019	-0.003	-0.033	-0.055	0.085	0.025	0.000	-0.028	-0.053	0.087
	(1.59)	*(0.61)*	*(2.60)****	*(8.64)****	*(13.82)****	*(1.97)***	*(0.05)*	*(2.07)***	*(7.89)****	*(13.38)****
d01	0.011	-0.012	-0.050	-0.073	0.070	0.016	-0.007	-0.046	-0.070	0.073
	(0.88)	*(2.04)***	*(3.79)****	*(10.90)****	*(10.91)****	*(1.18)*	*(1.07)*	*(3.18)****	*(9.48)****	*(10.34)****
d02	-0.015	-0.033	-0.077	-0.095	0.051	-0.006	-0.031	-0.071	-0.096	0.054
	(1.11)	*(5.36)****	*(5.63)****	*(13.67)****	*(7.54)****	*(0.42)*	*(4.68)****	*(4.73)****	*(12.66)****	*(7.41)****
d03	-0.003	-0.024	-0.068	-0.089	0.058	0.012	-0.024	-0.056	-0.092	0.063
	(0.23)	*(3.69)****	*(4.68)****	*(12.00)****	*(8.07)****	*(0.73)*	*(3.28)****	*(3.41)****	*(11.02)****	*(7.87)****
Constant	0.468	0.131	0.415	0.078	0.615	0.199	0.068	0.146	0.016	0.509
	*(4.04)****	*(2.45)***	*(3.41)****	*(1.27)*	*(10.35)****	*(1.17)*	*(0.87)*	*(0.82)*	*(0.18)*	*(5.85)****
Observations	3937	3937	3937	3937	3937	3937	3937	3937	3937	3937
Adjusted R-squared	0.71	0.82	0.69	0.80	0.83	0.71	0.82	0.69	0.80	0.83

Table 4: Regression results for large banks (GTA exceeding $1 billion) – cont'd

PANEL B: Regression results using the individual liquidity creation components of our "cat fat" liquidity creation measure as the dependent variable (coefficients other than EQRAT not shown)

	Assets			Liabilities			Equity	Financial guarantees			Derivatives	
	illiquid (cat) ½	semi-liquid (cat) 0	liquid -½	liquid ½	semi-liquid 0	illiquid -½	equity -½	illiquid (cat) ½	semi-liquid (cat) 0	liquid -½	liquid financial deriv. ½	liquid credit deriv. 0
EQRAT	0.247	0.014	-0.261	-0.222	-0.278	-0.013	0.513	1.397	-0.340	0.001	-0.022	-0.009
	*(3.17)****	*(0.18)*	*(2.82)****	*(2.47)***	*(2.97)****	*(0.56)*	*(18.99)****	*(4.38)****	*(2.59)****	*(0.70)*	*(1.17)*	*(0.51)*
Observations	3937	3937	3937	3937	3937	3937	3937	3937	3937	3937	3937	2334
Adj. R-squared	0.87	0.84	0.81	0.75	0.74	0.71	0.70	0.51	0.68	0.21	0.56	0.34

PANEL C: Regression results for large banks split by capitalization with "cat fat" as the dependent variable (coefficients other than EQRAT not shown)

	All large banks	Low-capital large banks	Medium-capital large banks	High-capital large banks
Mean EQRAT	0.08	0.06	0.08	0.10
EQRAT	0.586	1.596	0.118	0.599
	*(3.25)****	*(2.40)***	*(0.12)*	*(1.49)*
Observations	3937	1315	1302	1320
Adjusted R-squared	0.71	0.85	0.84	0.63

Table 5: Regression results for small banks (GTA up to $1 billion)

Panel A contains the results using the five liquidity creation measures as the dependent variable. Panel B shows the regression results using the individual liquidity creation components as the dependent variable. Panel C splits the small banks by capitalization. Panels B and C show only the coefficients on EQRAT in the interest of parsimony, although the regressions include all the exogenous variables from the full specification.

The liquidity creation measures are defined in Table 1, the exogenous variables in Table 3. The sample period is 1993-2003. All regressions are run with both time fixed effects (shown) and bank fixed effects (not shown). t-statistics are in parentheses. *, ** and *** denote significance at the 10%, 5% and 1% level, respectively.

PANEL A: Regression results using the five liquidity creation measures as the dependent variable

	cat fat (preferred)	cat nonfat	mat fat	mat nonfat	rat	cat fat (preferred)	cat nonfat	mat fat	mat nonfat	rat
EQRAT	-0.354	-0.366	-0.409	-0.421	-0.066	-0.369	-0.378	-0.429	-0.438	-0.072
	*(23.44)****	*(26.79)****	*(24.68)****	*(27.20)****	*(5.08)****	*(24.40)****	*(27.72)****	*(25.83)****	*(28.33)****	*(5.51)****
Ln(GTA)	-0.003	-0.005	-0.032	-0.033	-0.002	-0.013	-0.013	-0.043	-0.044	-0.007
	*(2.58)****	*(4.27)****	*(22.99)****	*(25.89)****	*(2.19)***	*(9.51)****	*(11.31)****	*(29.55)****	*(32.38)****	*(6.14)****
D-BHC						0.019	0.019	0.024	0.024	0.013
						*(12.03)****	*(13.33)****	*(13.49)****	*(14.48)****	*(9.18)****
D-MBHC						0.019	0.018	0.020	0.019	0.007
						*(16.75)****	*(17.15)****	*(15.97)****	*(15.90)****	*(6.77)****
D-BANK-MERGE						0.009	0.009	0.015	0.015	0.005
						*(7.42)****	*(7.83)****	*(11.18)****	*(11.65)****	*(4.75)****
D-DELTA-OWN						-0.002	-0.003	-0.005	-0.006	-0.003
						*(2.19)***	*(2.90)****	*(4.48)****	*(5.23)****	*(3.18)****
HERF						0.030	0.026	0.026	0.022	0.000
						*(3.33)****	*(3.21)****	*(2.63)****	*(2.40)**	*(0.02)*
SHARE-L						0.015	0.011	0.020	0.016	0.012
						*(4.79)****	*(3.99)****	*(5.75)****	*(5.01)****	*(4.48)****
POP						0.006	0.007	0.013	0.014	0.000
						*(2.70)****	*(3.13)****	*(5.20)****	*(5.70)****	*(0.21)*
DENSITY						0.012	0.010	0.000	-0.001	0.011
						*(3.21)****	*(3.05)****	*(0.08)*	*(0.36)*	*(3.40)****
INC-GROWTH						0.059	0.016	-0.048	-0.091	0.017
						*(3.78)****	*(1.14)*	*(2.80)****	*(5.69)****	*(1.28)*
d94	0.029	0.026	0.037	0.034	0.019	0.029	0.026	0.036	0.033	0.018
	*(29.05)****	*(28.79)****	*(33.61)****	*(33.08)****	*(21.58)****	*(28.60)****	*(28.04)****	*(32.39)****	*(31.55)****	*(21.00)****
d95	0.023	0.019	0.033	0.029	0.023	0.021	0.017	0.031	0.026	0.022
	*(22.14)****	*(19.82)****	*(28.85)****	*(26.80)****	*(25.60)****	*(20.28)****	*(17.87)****	*(26.80)****	*(24.71)****	*(24.21)****
d96	0.040	0.033	0.021	0.014	0.035	0.038	0.031	0.017	0.010	0.034
	*(37.62)****	*(34.36)****	*(18.27)****	*(13.17)****	*(38.42)****	*(34.61)****	*(31.01)****	*(14.61)****	*(9.22)****	*(35.75)****
d97	0.054	0.045	0.036	0.027	0.049	0.050	0.041	0.031	0.023	0.046
	*(48.80)****	*(44.96)****	*(29.75)****	*(23.92)****	*(51.29)****	*(44.21)****	*(40.38)****	*(25.37)****	*(19.65)****	*(47.57)****
d98	0.057	0.045	0.040	0.028	0.051	0.051	0.040	0.034	0.022	0.047
	*(49.22)****	*(42.89)****	*(31.59)****	*(23.67)****	*(51.21)****	*(43.33)****	*(37.09)****	*(26.04)****	*(18.33)****	*(46.41)****
d99	0.085	0.071	0.076	0.062	0.076	0.079	0.065	0.070	0.056	0.072
	*(71.65)****	*(65.92)****	*(58.41)****	*(50.83)****	*(74.09)****	*(63.41)****	*(58.02)****	*(51.02)****	*(43.98)****	*(67.22)****
d00	0.091	0.077	0.083	0.069	0.089	0.084	0.071	0.075	0.062	0.085
	*(73.30)****	*(69.18)****	*(60.96)****	*(54.83)****	*(83.74)****	*(64.13)****	*(60.03)****	*(51.95)****	*(46.04)****	*(75.23)****
d01	0.097	0.082	0.086	0.072	0.089	0.089	0.075	0.077	0.063	0.084
	*(75.84)****	*(71.34)****	*(61.36)****	*(54.69)****	*(80.89)****	*(65.29)****	*(60.99)****	*(51.48)****	*(45.25)****	*(71.46)****
d02	0.099	0.084	0.087	0.072	0.088	0.091	0.076	0.077	0.062	0.083
	*(74.92)****	*(70.07)****	*(60.32)****	*(53.35)****	*(77.83)****	*(63.26)****	*(58.44)****	*(48.89)****	*(42.20)****	*(67.13)****
d03	0.113	0.094	0.098	0.080	0.092	0.106	0.087	0.087	0.068	0.087
	*(82.29)****	*(75.87)****	*(65.10)****	*(56.39)****	*(77.50)****	*(68.21)****	*(61.84)****	*(51.22)****	*(42.87)****	*(64.81)****
Constant	0.127	0.113	0.511	0.497	0.607	0.073	0.060	0.449	0.436	0.601
	*(8.62)****	*(8.49)****	*(31.50)****	*(32.85)****	*(47.79)****	*(3.53)****	*(3.22)****	*(19.73)****	*(20.55)****	*(33.56)****
Observations	80143	80143	80143	80143	80143	80143	80143	80143	80143	80143
Adjusted R-squared	0.85	0.83	0.80	0.78	0.79	0.85	0.84	0.81	0.79	0.79

Table 5: Regression results for small banks (GTA up to $1 billion) – cont'd

PANEL B: Regression results using the individual liquidity creation components of our "cat fat" liquidity creation measure as the dependent variable (coefficients other than EQRAT not shown)

	Assets			Liabilities			Equity	Financial guarantees			Derivatives	
	Illiquid (cat) ½	**semi-liquid (cat) 0**	**liquid -½**	**liquid ½**	**semi-liquid 0**	**illiquid -½**	**equity -½**	**illiquid (cat) ½**	**semi-liquid (cat) 0**	**liquid -½**	**liquid financial deriv. ½**	**liquid credit deriv. 0**
EQRAT	0.003	-0.162	0.16	-0.252	-0.096	-0.011	0.359	0.018	-0.001	0.001	0.000	0.001
	(0.21)	*(15.14)****	*(10.61)****	*(24.09)****	*(8.87)***	*(7.85)***	*(107.60)****	*(2.09)***	*(0.56)*	*(4.91)****	*(1.22)*	*(1.18)*
Observations	80143	80143	80143	80143	80143	80143	80143	80143	80143	80143	80143	47665
Adj. R-squared	0.88	0.87	0.81	0.78	0.77	0.68	0.81	0.81	0.51	0.05	.0.00	0.36

PANEL C: Regression results for small banks split by capitalization with "cat fat" as the dependent variable (coefficients other than EQRAT not shown)

	All small banks	**Low-capital small banks**	**Medium-capital small banks**	**High-capital small banks**
Mean EQRAT	0.10	0.07	0.09	0.13
EQRAT	-0.369	0.115	-0.333	-0.399
	*(24.40)****	*(1.29)*	*(3.68)****	*(18.23)****
Observations	80143	26718	26704	26721
Adjusted R-squared	0.85	0.82	0.86	0.89

Table 6: Simulations of the change in liquidity creation from 1 percentage point higher lagged equity capital ratios

This table shows the simulated change in liquidity creation using our preferred "cat fat" measure for 2003 if all banks' lagged equity capital ratios were 1 percentage point higher. The panel on the left shows results from our main, unrestricted simulation: it uses the 0.586 coefficient on EQRAT estimated from the large-bank subsample for the large banks (Table 4, Panel A), and the -0.369 coefficient estimated from the small-bank subsample for the small banks (Table 5, Panel A), multiplies these coefficients by 0.01 times GTA for each bank, and then adds up the simulated effect on liquidity creation for large banks, small banks, and the banking industry. The panel on the right shows the results for our second simulation in which we impose the assumptions that banks maintain the higher equity capital ratios in the current period and adjust their liabilities proportionately. For large banks, we replace the 0.513 coefficient on equity in Table 5, Panel B by 1.000 and divide the -0.222, -0.100, and -0.391 coefficients in the liability component regressions by 0.513, and follow a similar procedure for small banks using the coefficients from Table 5 Panel B. We then add up these individual effects, multiply the resulting number by each bank's GTA, and sum over large banks, small banks, and the banking industry.

	Simulated change in liquidity creation from 1 percentage point higher lagged equity capital ratios			
	Main simulation		**Second simulation Imposing the assumptions that banks fully maintain the higher lagged equity capital ratios and adjust their liabilities proportionately**	
	($ billion)	**(% of year-end 2003 liquidity creation)**	**($ billion)**	**(% of year-end 2003 liquidity creation)**
Large banks	35.1	2.6%	14.2	1.1%
Small banks	-4.5	-2.0%	-11.2	-4.9%
All banks	30.6	2.0%	3.1	0.2%