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ABSTRACT

Does an intensification of competition among banks increase or decrease liquidity creation? By integrating the dynamic process of interstate bank deregulation that lowered barriers to competition across U.S. states over the 1980s and 1990s with the gravity model of the geographic expansion of banks, we construct time-varying measures of the competitive pressures facing each individual bank. We find that regulatory-induced competition reduced liquidity creation. Consistent with some theories, we also find that the liquidity-destroying effects of competition are mitigated among more profitable banks and heightened among smaller banks.

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1. INTRODUCTION

Liquidity creation is a vital service that banks provide to the economy. They create liquidity by using relatively liquid liabilities, such as demand deposits, to fund relatively illiquid assets, such as business loans. This simultaneously satisfies the demand for liquidity by savers and the demand for longer-term financing commitments by firms (Bryant, 1980; Diamond and Dybvig, 1983; Gatev and Strahan, 2006). Banks also create liquidity off the balance sheet by providing loan commitments and standby letters of credit that allow firms to develop and modify long-run investment strategies efficiently (Boot, Greenbaum, and Thakor 1993; Holmstrom and Tirole, 1998; Kashyap, Rajan, and Stein, 2002). By creating liquidity, theory suggests that banks improve the allocation of capital and accelerate economic growth (Bencivenga and Smith, 1991; Levine, 1991). Empirically, Berger and Sedunov (2016) find that the positive impact of liquidity creation on economic growth is larger than the growth effects of other services provided by banks.

Given the importance of liquidity creation, there is surprisingly little empirical work on the factors shaping liquidity creation. Indeed, it is only recently that Berger and Bouwman (2009) created the first comprehensive measures of liquidity creation, which include data on all asset-side, liability-side, and off-balance sheet activities for U.S. banks over the period from 1993 to 2003. With these data, they examine the connection between capital regulations and liquidity creation. Cornett, et al (2011), Berger, Makaew, and Turk-Ariss (2015), and Peydro, Polo, and Sette (2016) examine how liquidity creation changes when banks are under financial duress.

In this paper, we evaluate whether U.S. bank regulatory reforms that intensified competition among banks increased, decreased, or had no effect on liquidity creation. While researchers have actively studied the impact of regulatory-induced competition on bank risk-taking, efficiency, and valuations (e.g., Jayaratne and Strahan, 1998; Hellmann et al., 2000; Boyd and De Nicolo, 2005; Goetz, Laeven, and Levine, 2013, 2016; and Houston et al., 2010), we are unaware of any previous research on how competition shapes liquidity creation.

Theory offers differing perspectives on the impact of competition on bank liquidity creation. One strand of research suggests that competition reduces liquidity creation by

lowering the risk absorption capacity of banks. There are two building blocks to this view. First, by squeezing profit margins and depleting buffers against losses (Jayaratne and Strahan, 1998), competition can induce banks to reduce risk-taking (Boyd and De Nicolo, 2005; Peydro, Polo, and Sette 2016). Second, liquidity creation is risky, i.e., banks tend to suffer losses if they must quickly dispose of illiquid assets to meet the demands of those holding liquid liabilities (Allen and Santomero 1998; Allen and Gale 2004). Thus, competition can induce banks to lower their risks by reducing liquidity creation. A second strand of research suggests that competition will reduce liquidity creation by impeding relationship lending. This view begins by noting that competition can make it easier for firms to change banks, making it harder for banks to recoup the costs of building long-run relationships with firms (Petersen and Rajan, 1995; Black and Strahan, 2002; Cetorelli and Strahan, 2006). Furthermore, research finds that long-run bank-firms relationships can facilitate banks' acquisition of "soft" information about firms, including the liquidation value of firm assets (Berger et al., 2005; Berger and Udell, 1995; Diamond and Rajan, 2001). As a result, "relationship lenders" are in a position to create liquidity more effectively than other lenders. Under these conditions, competition can impede effective liquidity creation by reducing relationship lending.

Theory also suggests mechanisms through which competition can boost liquidity creation. First, competition tends to spur financial innovation and improve efficiency (Boot and Thakor, 2000; Black and Strahan, 2002; Laeven, Levine, and Michalopoulos, 2015). One dimension along which the bank might innovate is liquidity creation. Second, competition tends to make banks more transparent (Jiang, Levine and Lin, 2016), which can spur bank managers to devote more effort to screening potential borrowers and monitoring firms. In turn, improvements in credit allocation can encourage more bank lending and more liquidity creation. Thus theory provides differing views on the effect of competition on liquidity creation.

To assess the impact of competition on liquidity creation, we follow a two-step method for constructing time-varying measures of the competitive pressures facing each bank. First, as in Goetz, Laeven, and Levine (2013), we exploit the process of interstate bank deregulation that lowered barriers to competition between banks in different states. From the late-1970s

through 1995, states removed regulatory barriers to banks from other states entering their borders. States removed restrictions in a dynamic, state-specific process either by unilaterally opening their state borders and allowing out-of-state banks to enter or by signing reciprocal bilateral and multilateral agreements with other states. States started interstate bank deregulation in different years and followed different paths of deregulation as they signed agreements with different states in different years. The process ended with the passage of the Riegle-Neal Act of 1994, which effectively eliminated restrictions on interstate banking.

Second, we integrate this dynamic process of interstate bank deregulation with the "gravity model" of investment, as in Jiang, Levine, and Lin (2016). For any state *j*, the process of interstate bank deregulation provides time-varying information on the ability of banks from other states to enter and compete in state *j*. The gravity model differentiates among banks within state *j*. It predicts that the costs to banks in state *k* of establishing a subsidiary somewhere in state *j* are positively related to geographic distance. Thus, the integration of interstate bank deregulation and the gravity model predicts that when state *j* allows banks from state *k* to enter, this will intensify competition more among banks in state *j* that are closer to state *k* than among banks in state *j* that are farther away from *k*. Operationally, for each bank *i* in each period, we (1) identify those states whose banks can enter bank *i*'s state, and (2) weight each of those states by the inverse of its distance to bank *i*. This yields an inverse-distance measure of the regulatory-induced competitive environment facing each bank *i* in each period. We create two additional competition measures by further weighting by either the economic size of or the number of banks in each "foreign" state. Thus, by integrating the dynamic process of interstate bank deregulation with the predictions of the gravity model, we construct three time-varying, bank-specific measures of competition.

To measure liquidity creation, we use the four Berger and Bouwman (2009) measures of liquidity creations and extend them to cover our sample period. For the two category-based measures, each on- and off-balance sheet bank item was categorized as either liquid, semiliquid, or illiquid. For example, liquid items include short-term deposits, trading assets, securitizable loans, and commercial paper, while illiquid items include business loans, loan commitments, and letters of credit. Then, a weight of 0.5 was assigned to illiquid assets,

liquid liabilities, and illiquid off-balance sheet items and a weight of -0.5 was assigned to liquid assets, illiquid liabilities, and liquid off-balance sheet items. A weight of 0 was assigned to all semiliquid items. A bank's category-based liquidity creation measure was constructed as the value-weighted sum of those items. Following Berger and Bouwman (2009), we also use a category-based measure that excludes off-balance sheet items. For the two maturity-based measures of liquidity creation, the on- and off-balance sheets items were categorized as liquid or illiquid based on whether they mature in less than or more than one year and then follow the same weighting schedule for the category-based measures. Given data availability, we conduct the analyses over the period from 1984 through 2006 using annual data.

We use a difference-in-differences estimation strategy to identify the impact of competition on liquidity creation. The dependent variable is one of the liquidity creation measures, which is measured at the bank-year level. The key independent variable is a measure of the deregulation-induced competition pressures facing each bank in each year. We include state-year fixed effects to control for all time-varying state characteristics. We include bank fixed effects to control for all time invariant bank traits. Furthermore, we show that the results are robust to controlling for various time-varying bank-specific characteristics. In addition, a large body of existing research, as well as validity tests reported below, supports our estimation strategy. For example, research finds that interstate bank deregulation does not reflect bank performance (Jayaratne and Strahan, 1998; Goetz, Laeven, and Levine, 2013) or state economic performance (Jayaratne and Strahan, 1996; Beck, Levine, and Levkov, 2010). Moreover, we find that liquidity creation by banks in a state does not predict the timing of interstate bank deregulation and discover no evidence that differential pre-trends in liquidity creation across different states or banks account for the results.

We find that an intensification of competition in the banking industry materially reduces liquidity creation. This holds for each of the four measures of liquidity creation and for each of the three different measures of the deregulation-induced competitive pressures facing individual banks. The estimates indicate that the impact is economically large. For example, we find that a one-standard-deviation increase in the competitive pressures facing a bank is associated with a 3.5 percentage point reduction in liquidity creation, which is large

considering that the sample average level of liquidity creation is 20 percent of total assets. When applying this estimate to the average (median) bank in our sample, which has gross total assets of $104 million ($627 million), the 3.5 percentage point reduction in the ratio of liquidity creation to assets implies a loss of $3.6 million ($21.9 million) in liquidity creation by the average (median) bank. Although existing work advertises the beneficial effects of interstate bank deregulation and the corresponding intensification of competition, our research indicates that this process of deregulation reduced liquidity creation. We also explore the relation between the regulatory reform measures and the three components of the category-based liquidity creation measure: asset-side, liability-side, and off-balance sheet liquidity creation. We find that a drop in asset-side liquidity creation accounts for a large proportion of the negative effect of competition on liquidity creation.

We next push the analyses beyond our core question of assessing the net effect of competition on liquidity creation and explore two potential mechanisms through which competition can reduce liquidity creation. Specifically, one view is that by squeezing profit margins, competition reduces the willingness of banks to absorb more risk through liquidity creation and hence reduces liquidity creation. If competition affects liquidity creation through this profitability channel, then the negative impact of competition on liquidity creation should be smaller among more profitable banks that have a large risk-absorbing buffer that can better hedge liquidity risk. To test whether the data are consistent with this profitability channel, we examine whether the negative impact of competition on liquidity provision is smaller among more profitable banks. A second view is that by reducing the incentives of banks to establish long-term relationship with their customers, an intensification of competition impedes liquidity creation. If competition reduces liquidity creation through this relationship-lending channel, the negative effect of competition on liquidity creation should be stronger among banks that engage more intensively in relationship lending. To test this conjecture, we use small sized banks to proxy for relationship lenders.

We find evidence consistent with the view that a regulatory-induced intensification of competition reduces bank liquidity creation both by squeezing profit margins and by impeding relationship lending. Specifically, we find that more profitable banks, as measured

by net interest margins, experience a smaller reduction in liquidity creation in response to interstate bank deregulation. Similarly, we find that an intensification of competition reduces liquidity creation more among small banks. Taken together, this evidence on profitability and size are consistent with two views on how competition affects liquidity creation.

Our paper is organized as follows. Section 2 explains data and econometric methodology. Section 3 presents and discusses the empirical results. Section 4 concludes.

2. DATA AND METHODOLOGY

This section first discusses the data sources and sample of banks that we use to evaluate the impact of an intensification of competition on liquidity creation by banks. Second, we describe the construction of the key variables. Finally, we discuss our econometric strategy and provide tests of the validity of this strategy.

2.1 Data sources and sample of banks

We start with the population of commercial banks in the United States from 1984 through 2006. For each bank, the annual call report data are obtained from the Federal Reserve Bank of Chicago, which provides Condition and Income statements for all commercial banks regulated by the Federal Reserve System, Federal Deposit Insurance Corporation, and the Comptroller of Currency. We exclude a bank if it has no deposits, has zero or negative equity capital in the current or lagged year, has no commercial real estate or commercial and industrial loans outstanding, or has unused commitments exceeding four times its gross total assets. We also exclude banks that resemble thrifts, are classified by the Federal Reserve as credit card banks, or have consumer loans over 50% of gross total assets. We further exclude banks with average gross total assets below $25 million. Finally, we follow the literature and drop Delaware and South Dakota because they have special laws to encourage credit card banking. Our final sample contains 192,564 bank-year observations, from 15,081 banks during the period from 1984 to 2006.

2.2 Liquidity creation

We use the four Berger and Bouwman (2009) measures of liquidity creation. To construct their two category-based measures, they first classify each on- and off-balance sheet bank item as either liquid, semiliquid, or illiquid. Appendix Table 1 details how Berger and Bouwman (2009) define each on and off balance sheet item as liquid, semiliquid, and illiquid. Second, they assign a weight to each category. Specifically, a weight of 0.5 is assigned to illiquid assets, liquid liabilities, and illiquid off-balance sheet items; a weight of -0.5 is assigned to liquid assets, illiquid liabilities, and liquid off-balance sheet items; and a weight of 0 is assigned to all semiliquid items. These weights assume that $1 of liquidity is created (destroyed) when banks transform $1 of illiquid (liquid) assets or off-balance sheet items into $1 of liquid (illiquid) liabilities. Finally, they compute a bank's category-based liquidity creation measure, *Liquidity Creation (Category Based)*, as the weighted sum of the following items:

$$\begin{aligned} \textit{Liquidity Creation (Category Based)} = {} & \textit{Asset-side Liquidity Creation} + \\ & \textit{Liability-side Liquidity Creation} + \\ & \textit{Off-balance Sheet Liquidity Creation}, \end{aligned} \tag{1}$$

where

$$\textit{Asset-side Liquidity Creation} = [0.5*\textit{Illiquid Assets} + 0*\textit{Semiliquid Assets} - 0.5*\textit{Liquid Assets}]/\textit{Gross Total Assets},$$

$$\textit{Liability-side Liquidity Creation} = [0.5*\textit{Liquid Liabilities} + 0*\textit{Semiliquid Liabilities} - 0.5*\textit{Illiquid Liabilities}]/\textit{Gross Total Assets},$$

$$\begin{aligned} \textit{Off-balance Sheet Liquidity Creation} = {} & [0.5*\textit{Illiquid off-balance Sheet Items} + \\ & 0*\textit{Semiliquid Off-balance Sheet Items} - \\ & 0.5*\textit{Liquid Off-balance Sheet Items}]/\textit{Gross Total Assets}, \end{aligned}$$

where the bank-specific measures of on- and off-balance sheet subcomponents, such as illiquid assets, semiliquid assets, liquid liabilities, etc., are computed as dollar values. Furthermore, to make the measures comparable across banks, we normalize by the bank's gross total assets, which equals the sum of total assets, allowances for loan and lease losses, and the allocated transfer risk reserve (a reserve for certain foreign loans).

Besides *Liquidity Creation (Category Based),* we use three additional liquidity creation measures from Berger and Bouwman (2009). First, we include only on-balance sheet items

and call this measure, *Liquidity Creation (Category Based, excluding Off-balance Sheet)*. Second, we use two maturity-based measures of liquidity creation. The maturity-based measures classify on- and off-balance sheet items as illiquid or liquid by whether they mature in more or less than one year. Then, based on these maturity categories, we use the same process as above. That is, we (1) assign a weight of 0.5 to illiquid assets, liquid liabilities, and illiquid off-balance sheet items and a weight of -0.5 to liquid assets, illiquid liabilities, and liquid off-balance sheet items and (2) compute the two value weighted maturity-based measures: *Liquidity Creation (Maturity Based)* and *Liquidity Creation (Maturity Based, excluding Off-balance Sheet)*. We winsorize the four liquidity creation ratios at the 1% and 99% levels. Appendix Table 1 provides more details on these liquidity creation measures.

We follow Berger and Bouwman (2009) and focus on the *Liquidity Creation (Category Based)* for two main reasons. First, the liquidity of loans depends more on how easily and inexpensively they can be securitized or sold rather than how soon the loans mature. Second, off-balance sheet activities contribute materially to overall liquidity creation. As shown in Table 1, roughly 20 percent of the total liquidity creation in our sample comes from off-balance sheet items. As shown below, the results hold across the four liquidity creation measures.

2.3 Measuring competition using interstate deregulation

To measure exogenous changes in the competitive pressures facing each individual bank, we exploit the removal of regulatory impediments to interstate banking during the last quarter of the 20th century. By lowering regulatory barriers to banks headquartered in one state establishing subsidiaries in another state, interstate bank deregulation increased the contestability of banking markets, intensifying competition among banks. As a result of this competition, interstate bank deregulation reduced interest rates on loans and increased interest rates on deposits (Jayaratne and Strahan, 1998).

From the late-1970s through 1995, states engaged in a process of interstate bank deregulation, in which a state allowed banks from other states to acquire or establish subsidiary banks within its borders. States removed restrictions in a dynamic, state-specific

process either by unilaterally opening their state borders and allowing out-of-state banks to enter or by signing reciprocal bilateral and multilateral agreements with other states. States both started interstate bank deregulation in different years and followed different paths of deregulation as they signed agreements with different states in different years. The process of interstate bank deregulation ended with the passage of the Riegle-Neal Act of 1994, which effectively eliminated restrictions on interstate banking across the United States.

Following Jiang, Levine, and Lin (2016), we integrate the dynamic, state-specific process of interstate bank deregulation with the "gravity model" of investment to construct a time-varying measure of the competitive pressures facing each bank. In particular, for any state *j*, the interstate bank deregulation provides a state-time indicator of the ability of banks from other states to enter and compete in state *j*. The gravity model differentiates among banks with state *j*. It predicts that the costs to a bank in state *k* of establishing a subsidiary in state *j* are positively related to the distance between states *j* and *k*. Thus, the integration of interstate bank deregulation and the gravity model predicts that when state *j* allows banks from state *k* to enter, this will intensify competition more among banks in state *j* that are closer to state *k* than among banks in state *j* that are farther away from *k*. By integrating the dynamic process of interstate bank deregulation with the predictions of the gravity model, we construct time-varying, bank-specific measures of competition.

More specifically, we measure a bank's time-varying exposure to interstate deregulation in two steps. First, for each bank *i* located in home state *j* in year *t*, we identify all of the states (*k*'s) whose banks are allowed to enter bank *i*'s home state *j* in that year and compute the inverse of the distance between bank *i* and state *k*'s capital city (i. e. , $1/Distance_{ik}$).[1] Second, for each bank *i* in each year *t,* we calculate the summation of the inverse distance to states whose banks are allowed to enter bank *i*'s home state *j*, and then take the natural logarithm of this summation. This yields a measure of the competitive pressures facing each bank in each year. To put it formally, we calculate the following:

[1] Specifically, we measure distance from bank *i*'s county to the county of state *k*'s capital city. The county distance database is provided at: http://www.nber.org/data/ county-distance-database.html. As a robustness check, we examine the distance from bank *i* to the city in state *k* with the largest number of banks. As shown in Appendix Table 4, the results hold.

$$Bank\ Competition\ (Distance\ Weighted)_{ijt} = Ln \sum_i \frac{O_{jkt}}{Distance_{ik}} \quad (2)$$

where O_{jkt} equals one if banks from state *k* are allowed to enter state *j* in period *t* and zero otherwise.[2]

Furthermore, besides this basic measure (*Bank Competition (Distance Weighted)*), we create and examine two additional time-varying, bank-specific measures of competition. One measure weights the summation of inverse of distance by the number of banks in state *k* (*Bank Competition (Distance and # of Banks Weighted)*), while the other weights by the economic size of state *k* (*Bank Competition (Distance and GSP Weighted)*). More specifically, we compute the following:

$$Bank\ Competition\ (Distance\ and\ \#\ of\ Banks\ Weighted)_{ijt} = Ln \sum_i \frac{K_{kt} * O_{jkt}}{Distance_{ik}} \quad (3)$$

and

$$Bank\ Competition\ (Distance\ and\ GSP\ Weighted)_{ijt} = Ln \sum_i \frac{GSP_{kt} * O_{jkt}}{Distance_{ik}} \quad (4)$$

where K_{kt} represents the total number of banks in state *k* in period *t*, and GSP_{kt} represents gross state product of state *k* in period *t*.

2.4 Other control variables

To control for other factors that might be related to bank competition and liquidity creation, our regressions include a set of time-varying bank characteristics including the logarithm of bank size (*logSIZE*), *Capital Asset Ratio* measured as the book value of equity over total assets, and a dummy variable indicating whether a bank belongs to a multibank holding company (*Multibank Holding Company*). Table 1 provides summary statistics of the variables used in our analyses. The definitions of variables are presented in Appendix Table 1. The median commercial bank in our sample has gross total assets of $104 million (in 2014 dollars), while the average bank has assets of $627 million. Given the skewness in bank size,

[2] We set a value of 0.000001 to those cases where $Ln \sum_i \frac{O_{jkt}}{Distance_{ik}} = 0$.

we use the natural logarithm of bank size. The average *Capital Asset Ratio* is 0.09, and about 30% of the commercial banks belong to multi-bank holding companies.

2.5 Econometric Strategy

To evaluate the impact of bank competition on liquidity creation, we use a difference-in-differences (DID) methodology. Since the unit of analysis is at the bank-state-year level, we control for both state-time and bank fixed effects. The state-time fixed effects capture all time-varying state influences. Bank fixed effects capture all time-invariant bank characteristics.

We use the following ordinary least squares (OLS) regression specification:

$$Liqudity\ Creation_{ijt} = \alpha_{ijt} + \beta \cdot Bank\ Competition_{ijt} + \gamma' X_{ijt} + \delta_i + \delta_{jt} + e_{ijt}, \qquad (5)$$

where $Liqudity\ Creation_{ijt}$ is one of the measures of liquidity creation for bank *i* in state *j* in year *t*, $Bank\ Competition_{ijt}$ is one of the measures of the competitive pressures facing bank *i* in state *j* in year *t*, X_{ijt} is a vector of time-varying bank-specific characteristics (*logSIZE*, *Capital Asset Ratio*, and *Multibank Holding Company*), and δ_i and δ_{jt} are bank and state-year fixed effects respectively. In seeking to assess the impact of an intensification of competition on liquidity creation, we focus on estimating β. Since including endogenous bank-specific characteristics could interfere with drawing sharp inferences about β, we provide estimates both with and without the X_{ijt} control variables. We discuss and present a series of robustness tests below. Throughout the analyses, we report standard errors that are heteroskedasticity-consistent and two-way clustered at the state and year level. The results are robust to clustering at either the state or state-year levels.

2.6 Validation test

One concern with our identification strategy is that liquidity creation influences a state's decisions on interstate bank deregulation. For example, the lack of bank lending within a state may induce state officials to liberalize restrictions on interstate banking to boost lending. This would confound our ability to identify the impact of competition on liquidity creation.

To assess this concern, we follow Kroszner and Strahan (1999). To their empirical model of the timing of interstate bank deregulation, we include a measure of liquidity creation and examine whether lagged values of liquidity creation predict the timing of interstate banking reforms. Specifically, we calculate an aggregate index of liquidity created by banks within a state by weighting each bank's liquidity creation by its assets and test whether this index predicts when a state first started to liberalize its interstate banking restrictions. We experimented with different lags and report the results with lags of one to three years in Table 2. The dependent variable is the average across banks in a state-year of one of the three competition measures (i.e. *Bank Competition (Distance Weighted)*, *Bank Competition (Distance and # of Banks Weighted)*, and *Bank Competition (Distance and GSP Weighted)*). Furthermore, we control for a set of state characteristics used in Kroszner and Strahan's (1999) exploration of the determinants of interstate bank deregulation. These controls include gross state product per capita, state unemployment rate, the small firm share in the state, small bank share in the state, capital ratio of small banks relative to large ones, relative size of insurance in states where banks can sell insurance, relative size of insurance in states where banks cannot sell insurance, an indicator for unit banking law, an indicator for one party control in the state, and share of state government controlled by Democrats. In this way, we test whether liquidity creation predicts regulatory induced changes in the competitive pressures facing banks.

Table 2 shows that liquidity creation does not predict the timing of regulatory reforms. Table 2 provides only the results for the main liquidity measure (*Liquidity Creation (Category Based)*), while Appendix Table 2 shows that these results hold when examining the other three liquidity creation measures. Consistent with our identification strategy, there is no indication that liquidity creation predicts the timing of interstate deregulation.

3. EMPIRICAL RESULTS

This section presents results on the impact of a regulatory-induced intensification of competition on liquidity creation. We first provide the baseline results using measures of liquidity creation (the *Category Based* and *Category Based, excluding Off-balance Sheet*) and show that all of these results hold when using the maturity-based measures of liquidity creation. We then decompose and analyze the individual components of these measures—asset-side on-balance sheet liquidity creation, liability-side on-balance sheet liquidity creation, and off-balance sheet liquidity creation. We finish this section by conducting an exploratory examination of the theoretical mechanisms underlying the link between competition and liquidity creation.

3.1 The effect of bank competition on liquidity creation

Table 3 presents regression results based on equation (5), where the dependent variable is one of the category-based measures of liquidity creation and the main explanatory variable is one of the three time-varying, bank-specific measures of the competitive pressures facing each bank. In Panel A, we only control for state-year and bank fixed effects. In Panel B, we also control for bank-level controls (*logSIZE*, *Capital Asset Ratio*, and *Multibank Holding Company*). In columns (1) –(3) of Panels A and B, the dependent variable is *Liquidity Creation (Category Based)* and in columns (4) – (6) of both panels the dependent variable is *Liquidity Creation (Category Based, excluding Off-balance Sheet)*. Thus, Table 3 reports the results of twelve regressions.

The results presented in Table 3 indicate that interstate bank deregulation reduced liquidity creation by banks. Each of the three measures of regulatory-induced competition—*Bank Competition (Distance Weighted)*, *Bank Competition (Distance Weighted and # of Banks Weighted)*, and *Bank Competition (Distance Weighted and GSP Weighted)* enters negatively and significantly at the one percent significance level. This holds across both category-based measures of liquidity creation and when including or excluding the bank-level controls.

The estimated coefficients indicate that the impact of bank deregulation on liquidity creation is economically large. For example, consider the estimate from the regression in which the dependent variable is *Liquidity Creation (Category Based)*, the regulatory-induced competition measure is *Bank Competition (Distance Weighted)*, and the regression includes bank-level controls (column 1 of Panel B of Table 3). The coefficient estimate on competition (-0.0067) suggests that a one-standard-deviation increase (5.22) in *Bank Competition (Distance Weighted)* is associated with a reduction in *Liquidity Creation (Category Based)* of about 3.5 percentage points. This is a meaningful reduction, as the sample mean is 20 percent. When applying this estimate to the average (median) bank in our sample, which has gross total assets of $104 million ($627 million), the 3.5 percentage point reduction in the ratio of liquidity creation to assets implies a loss of $3.6 million ($21.9 million) in liquidity creation by the average (median) bank.

With respect to the bank-level control variables, the results in Panel B of Table 3 indicate that banks with a higher *Capital Asset Ratio* tend to create less liquidity. This is in accordance with the "financial fragility" view that additional bank capital makes the bank's capital structure less fragile so that banks are reluctant to commit to monitoring, which in turns impedes the bank's ability to create liquidity (Diamond and Rajan 2000, 2001). It is also consistent with the prediction of the capital "crowd out" theory that a higher capital ratio may reduce liquidity creation through crowding out deposits, since deposits are liquid and bank equity is illiquid (Gorton and Winton 2014). We also find that liquidity creation is positively related to *Multibank Holding Company*, suggesting that banks belonging to multiple BHCs create more liquidity. This finding is consistent with the argument that banks within the same BHC serve as an internal capital market to cross-provide liquidity in times of financial distress (Berger and Bouwman 2009), including distress triggered by competition.

We confirm the finding that interstate bank deregulation reduced liquidity creation when using the maturity-based measures of liquidity creation. As shown in Table 4, we confirm all of the result in Table 3 using *Liquidity Creation (Maturity Based)* and *Liquidity Creation (Maturity Based, excluding Off-balance Sheet)*. The results in Table 4 are remarkably similar to those reported in Table 3, both statistically and economically.

We next explore the relation between the regulatory reform measures and the three components of *Liquidity Creation (Category Based)*: asset-side, liability-side, and off-balance sheet liquidity creation. Table 1 shows that the majority of bank liquidity creation (per unit of asset) occurs through liability-side items. The means (standard deviations) of asset-side, liability-side, and off-balance sheet liquidity creation ratio are -0.02 (0.14), 0.18 (0.06), and 0.04 (0.04), respectively. Table 5 reports the results of using the asset-side, liability-side, and off-balance sheet liquidity creation measures as dependent variables in equation (5). For each of the three dependent variables, we separately examine the three regulatory-induced measures of competition. We report the results while including the bank-specific controls, but the results are robust to excluding them.

Overall, the findings in Table 5 indicate that the negative effect of regulatory-induced competition on liquidity creation is largely accounted for by the negative effect of competition on *asset-side* liquidity creation. As shown, the interstate deregulation indicators induced a large drop in asset-side liquidity creation, a small drop in off-balance sheet liquidity creation, and an increase in liability-side liquidity creation. In terms of magnitudes, a one-standard-deviation increase (5.22) in *Bank Competition (Distance Weighted)* (the first row) induces a reduction in asset-side liquidity creation of 3.7 (=0.0070*5.22) percentage points, an increase in liability-side liquid creation of 0.9 (=0.0018*5.22) percentage points, and a decline in off-balance sheet liquidity creation of 0.7 (=0.0014 *5.22) percentage points. Relative to their sample means, the effect of deregulation on asset-side liquidity creation is larger than the other components, and the effect on liability-side liquidity creation is nearly negligible.

We conclude this subsection by describing several additional robustness tests. First, since many corporate policies might be determined at the BHC level, we redo the regressions using data on BHCs, not on individual banks. The information on BHCs is obtained from the consolidated balance sheets and income statements for holding companies that are provided by the Federal Reserve Bank of Chicago since the 3rd quarter of 1986. We define a banking institution as an ultimate BHC if it owns, but is not owned by, other banking institutions, with at least 50% ownership of the subsidiaries' equity stake (Goetz, Laeven, and Levine 2013;

Jiang, Levine, and Lin 2016). We are able to identify 834 BHCs headquartered in the U.S. (excluding South Dakota and Delaware) between 1986 and 2006.

To construct BHC-level measures of liquidity creation, we aggregate the bank-level liquidity creation measures to the BHC level by weighting each bank's liquidity creation by its proportion of assets within the BHC. Specifically, we take each bank *i* located in state *j* within each BHC *c* headquartered in state *w* during period *t* and aggregate as follows:

$$Liquidity\ Creation_{cwt} = \sum_{i \in c} Liquidity\ Creation_{ijt} * P_{ict}, \tag{6}$$

where P_{ict} is the proportion of assets of each bank *i* within BHC *c* in period *t* relative to the total assets of BHC *c*, and state *w* and state *j* may or may not be the same.

We also compute the regulatory-induced competition measures at the BHC-level. We do this by aggregating the bank-level competition measures to the BHC level. Specifically, we first identify each bank *i* in state *j* that belongs to BHC *c* headquartered in state *w* in period *t* and we then calculate BHC *c*'s distance weighted regulatory-induced competition measure as follows:

$$\begin{aligned} &BHC\ Competition\ (Distance\ Weighted)_{cwt} \\ &= \sum_{i \in c} Bank\ Competition\ (Distance\ Weighted)_{ijt} * P_{ict}, \end{aligned} \tag{7}$$

We use the same method described in equation (7) to construct the other two BHC-specific competition measures: *BHC Competition (Distance and # of Banks Weighted)* and *BHC Competition (Distance and GSP Weighted)*. Appendix Table 3 presents the BHC-level analysis for both the category-based and maturity-based measures of liquidity creations. Consistent with the bank-level results, BHC-level competition enters negatively and significantly across all specifications.

The second sensitivity check examines an alternative measure of bank-specific competition. Our previous measure of bank competition is based on the distance from a bank to the county of a non-home state's capital city. As a robustness check, use the distance from

the bank to the county of the city with the greatest number of banks in the non-home state. Appendix Table 4 shows that all of the results hold.

Third, there might be concerns that the results are driven only by banks expanding through mergers and acquisitions or by being purchased by other banks. Thus, we redid the analyses while restricting the sample to only banks that are not part of any mergers or acquisitions. They are still subject to changes in competitive pressures, as their markets become more contestable due to bank deregulation. We find that all of the results hold, and hold with similar parameters estimates, when restricting the sample to these banks.

3.2 An exploration of two possible mechanisms

So far we have found that bank competition—as measured by interstate bank deregulation—reduces liquidity creation, but we have not explored the channels through which competition shapes liquidity creation. Although the primary objective of this research is simply to evaluate whether, on net, an intensification of competition among banks increases, decreases, or has no effect on liquidity creation, we now provide an exploratory examination of two potential channels: profitability and relationship lending.

One view is that by squeezing profit margins, competition reduces the willingness of banks to absorb more risk through liquidity creation and hence reduces liquidity creation. If competition affects liquidity creation through this channel, then the negative impact of competition on liquidity creation should be smaller among more profitable banks that can better absorb liquidity risk. Thus, we test this prediction.

To assess the profitability channel, we expand our baseline regression specification and include the interaction between *High Profit* and the regulatory-induced competition measures. To construct *High Profit*, we begin by calculating *Profitability*, which equals the net interest margin, i.e., the ratio of net interest income to total assets. We then set *High Profit* equal to one if in the initial sample period (1984-1986) *Profitability* is greater than the sample median.[3] The profitability view predicts a positive relation between liquidity creation and the

[3] All of the results hold if we instead set *High Profit* equal to one if a bank's profitability is greater than the sample median over the entire sample period and zero otherwise.

interaction between competition and profitability.

As shown in Table 6, the estimates are consistent with the profitability view, as the estimated coefficients on the interaction between competition and profitability enter positively and significantly in all specifications. We continue to find that the bank competition measures enter negatively and significantly. If one interprets *High Profit* as positively associated with the risk absorption capacity of banks, then our findings imply that competition reduces liquidity creation less when banks have a greater capacity to absorb risk.

A second view is that competition reduces liquidity creation by impeding relationship lending. This implies that the negative impact of competition on liquidity creation should be stronger among banks that rely more heavily on relationship lending. Based on Petersen and Rajan (1994), we use bank size to proxy for the bank's reliance on relationship lending given the absence of data tracking banks' lending records with customers. Petersen and Rajan (1994) document that relationship lending is more valuable to small firms. Thus, to proxy for relationship lenders, we use *Small Size*, which equals one if a bank's gross total assets are smaller than the sample median during the entire sample period, and zero otherwise. We include this proxy along with its interaction with the regulatory-induced competition measures. If this interaction term enters with a negative coefficient, it would suggest that in response to an intensification of competition, liquidity creation falls more among relationship lenders.

The estimates reported in Table 7 are consistent with the relationship lending effect. First, consistent with the earlier results, the regulatory-induced measures of competition enter negatively and significantly, confirming that interstate bank deregulation reduces liquidity creation. Second, the interaction term of interstate bank deregulation and S*mall Size* enters negatively and significantly (except for columns 4-6). This implies that regulatory-induced competition exerts a more pronounced negative effect on liquidity creation in small banks that are major relationship lenders.

4. CONCLUSION

Although it is widely recognized that liquidity creation is one of the major services provided by bank to the economy, there are only a few studies of the factors shaping bank liquidity creation and no previous studies of the impact of competition on liquidity creation. In this paper, we evaluate the impact of an intensification of competition among banks on liquidity creation. To do this, we employ a novel approach to measuring the time-varying competitive pressures facing each commercial bank in the United States over the period from 1984 through 2006.

The results are consistent with the view that an intensification of competition reduces liquidity creation. This finding of a “liquidity-destroying” effect of competition is robust to using different measures of liquidity creation, different measures of bank competition, the inclusion or exclusion of time-varying bank characteristics, and controlling for state-year and bank fixed effects. While research has identified many positive effects from competition, this paper suggests some trade-offs with respect to liquidity creation.

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Table 1. Summary Statistics

Bank-Specific Deregulation Measures

Variable	N	Mean	SD	P25	Median	P75	Min	Max
Bank Competition (Distance Weighted)	192564	-0.47	5.22	0.35	1.96	2.02	-13.82	2.12
Bank Competition (Distance and # of Banks Weighted)	192564	4.23	7.01	6.04	7.15	7.30	-13.82	7.77
Bank Competition (Distance and GSP Weighted)	192564	0.63	5.65	1.46	3.16	3.38	-13.82	3.72

Liquidity Creation Measures

Variable	N	Mean	SD	P25	Median	P75	Min	Max
Liquidity Creation (Category Based)	192564	0.20	0.18	0.08	0.20	0.32	-0.20	0.65
Liquidity Creation (Category Based, excluding Off-balance Sheet)	192564	0.16	0.15	0.06	0.16	0.26	-0.21	0.51
Liquidity Creation (Maturity Based)	192564	0.24	0.18	0.11	0.24	0.36	-0.18	0.70
Liquidity Creation (Maturity Based, excluding Off-balance Sheet)	192564	0.20	0.16	0.09	0.20	0.31	-0.20	0.58
Asset-side liquidity creation	192564	-0.02	0.14	-0.11	-0.02	0.08	-0.34	0.31
Liability-side liquidity creation	192564	0.18	0.06	0.13	0.17	0.22	0.03	0.35
Off-balance sheet liquidity creation	192564	0.04	0.04	0.01	0.03	0.06	0	0.20

Other Variables

Variable	N	Mean	SD	P25	Median	P75	Min	Max
logSIZE	192564	11.69	1.14	10.90	11.49	12.20	7.79	20.95
Capital Asset Ratio	192564	0.09	0.03	0.07	0.09	0.1	0	0.88
Multibank Holding Company	192564	0.30	0.46	0	0	1	0	1
Profitability	192564	0.04	0.01	0.03	0.04	0.04	0.02	0.06
High Profit	192564	0.43	0.50	0	0	1	0	1
Small Size	192564	0.31	0.46	0	0	1	0	1

Table 2. Validity Test - Banking Deregulations and Lagged Liquidity Creations

This table presents OLS regressions of bank regulatory reforms on lagged values of category based liquidity creation and other potential predictors of regulatory reforms. The sample consists of state-year observations from 1984 to 2006 and excludes states that deregulated in or before 1984. Definitions for the dependent variable bank competition measures are presented in Appendix Table 1. The variable *State Weighted Liquidity Creation (Category Based)* is calculated by the bank level liquidity creation measure *Liquidity Creation (Category Based)* aggregated to the state level and weighted by the proportion of the commercial bank's total assets held by its subsidiaries and branches in that state. Detained definition and classification of liquidity creation measures can be found in Appendix Table 1. Following Kroszner and Strahan (1999), the following control variables are included: GSP per capita, state level unemployment rate, small bank share of all banking assets, and capital ratio of small banks relative to large ones, relative size of insurance in states where banks may sell insurance (zero otherwise), relative size of insurance in states where banks may not sell insurance (zero otherwise), an indicator variable that equal to one if banks may sell insurance (zero otherwise), small firm (fewer than 20 employees) share of the number of firms in the state, unit banking law, share of state government controlled by Democrats, and an indicator that takes a value of one if the state is controlled by one party. We also include state dummy variables. Standard errors are adjusted for state-level clustering and appear in parentheses. *, **, and *** indicate significant at 1%, 5%, and 10%.

	(1)	(2)	(3)
Dep Var	Bank Competition (Distance Weighted)	Bank Competition (Distance and # of Banks Weighted)	Bank Competition (Distance and GSP Weighted)
State Weighted Liquidity Creation (Category Based) one year before interstate deregulation	1.1325	1.6169	1.3545
	(1.7960)	(2.4537)	(1.9138)
State Weighted Liquidity Creation (Category Based) two years before interstate deregulation	2.6901	3.3211	2.7999
	(2.0655)	(2.8084)	(2.2084)
State Weighted Liquidity Creation (Category Based) three years before interstate deregulation	-3.1792	-4.6928	-3.3562
	(3.0066)	(4.0893)	(3.2356)
Controls	Yes	Yes	Yes
N	637	637	637
R-sq	0.3807	0.3186	0.4020

Table 3. Competition and Category Based Liquidity Creation

Panel A. Without Any Bank Level Controls

This table presents results of the effects of banking deregulations on category based liquidity creation of commercial banks, without including any bank level control variables in the regressions. The sample consists of bank-year observations from 1984 through 2006. The dependent variables in columns 1-3 and 4-6 are *Liquidity Creation (Category Based)* and *Liquidity Creation (Category Based, excluding Off-balance Sheet)*, respectively. Detailed definition and classification for the liquidity creation measures can be found in Appendix Table 1. Standard errors are heteroskedasticity-consistent, two-way clustered at the state and year level, and reported in parentheses. *, **, and *** indicate significant at 10%, 5%, and 1%, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
DEP VAR	Liquidity Creation (Category Based)			Liquidity Creation (Category Based, excluding Off-balance Sheet)		
Bank Competition (Distance Weighted)	-0.0078***			-0.0064***		
	(0.0003)			(0.0004)		
Bank Competition (Distance and # of Banks Weighted)		-0.0057***			-0.0049***	
		(0.0001)			(0.0001)	
Bank Competition (Distance and GSP Weighted)			-0.0072***			-0.0058***
			(0.0003)			(0.0004)
State-Year fixed effects	yes	yes	yes	yes	yes	yes
Bank fixed effects	yes	yes	yes	yes	yes	yes
N	192564	192564	192564	192564	192564	192564
R-sq	0.8286	0.8286	0.8286	0.8109	0.8109	0.8109

Table 3. Competition and Category Based Liquidity Creation

Panel B. With Bank Level Controls

This table presents results of the effects of banking deregulations on category based liquidity creation of commercial banks. The sample consists of bank-year observations from 1984 through 2006. The dependent variables in columns 1-3 and 4-6 are *Liquidity Creation (Category Based)* and *Liquidity Creation (Category Based, excluding Off-balance Sheet)*, respectively. Detailed definition and classification for the liquidity creation measures can be found in Appendix Table 1. The control variable *logSIZE* is defined as the natural logarithm of gross total assets in thousand real 2014 U.S. dollars. *Capital Asset Ratio* is the ratio of book value of equity over total assets. Both *logSIZE* and *Capital Asset Ratio* are lagged one year prior to the observation of the dependent variable. *Multibank Holding Company* is an indicator variable that equals one if a bank has been part of a multibank holding company in the past three years, and zero if otherwise. Standard errors are heteroskedasticity-consistent, two-way clustered at the state and year level, and reported in parentheses. *, **, and *** indicate significant at 10%, 5%, and 1%, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
DEP VAR	Liquidity Creation (Category Based)			Liquidity Creation (Category Based, excluding Off-balance Sheet)		
Bank Competition (Distance Weighted)	-0.0067***			-0.0053***		
	(0.0005)			(0.0006)		
Bank Competition (Distance and # of Banks Weighted)		-0.0051***			-0.0042***	
		(0.0004)			(0.0004)	
Bank Competition (Distance and GSP Weighted)			-0.0060***			-0.0047***
			(0.0005)			(0.0006)
logSIZE	0.0126***	0.0126***	0.0126***	0.0036	0.0036	0.0036
	(0.0044)	(0.0044)	(0.0044)	(0.0039)	(0.0039)	(0.0039)
Capital Asset Ratio	-0.4434***	-0.4434***	-0.4434***	-0.4820***	-0.4820***	-0.4820***
	(0.0453)	(0.0453)	(0.0453)	(0.0404)	(0.0404)	(0.0404)
Multibank Holding Company	0.0224***	0.0224***	0.0224***	0.0186***	0.0186***	0.0186***
	(0.0022)	(0.0022)	(0.0022)	(0.0020)	(0.0020)	(0.0020)
State-Year fixed effects	yes	yes	yes	yes	yes	yes
Bank fixed effects	yes	yes	yes	yes	yes	yes
N	192564	192564	192564	192564	192564	192564
R-sq	0.8332	0.8332	0.8332	0.8163	0.8163	0.8163

Table 4. Competition and Maturity Based Liquidity Creation

Panel A. Without Any Bank Level Controls

This table presents results of the effects of banking deregulations on maturity-based liquidity creation of commercial banks, without including any bank level control variables in the regressions. The sample consists of bank-year observations from 1984 through 2006. The dependent variables in columns 1-3 and 4-6 are *Liquidity Creation (Maturity Based)* and *Liquidity Creation (Maturity Based, excluding Off-balance Sheet)*, respectively. Detailed definition and classification for the liquidity creation measures can be found in Appendix Table 1. Standard errors are heteroskedasticity-consistent, two-way clustered at the state and year level, and reported in parentheses. *, **, and *** indicate significant at 10%, 5%, and 1%, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
DEP VAR	Liquidity Creation (Maturity Based)			Liquidity Creation (Maturity Based, excluding Off-balance Sheet)		
Bank Competition (Distance Weighted)	-0.0071***			-0.0057***		
	(0.0007)			(0.0010)		
Bank Competition (Distance and # of Banks Weighted)		-0.0052***			-0.0043***	
		(0.0006)			(0.0007)	
Bank Competition (Distance and GSP Weighted)			-0.0064***			-0.0050***
			(0.0007)			(0.0009)
State-Year fixed effects	yes	yes	yes	yes	yes	yes
Bank fixed effects	yes	yes	yes	yes	yes	yes
N	192564	192564	192564	192564	192564	192564
R-sq	0.8115	0.8115	0.8115	0.7929	0.7929	0.7929

Table 4. Competition and Maturity Based Liquidity Creation

Panel B. With Bank Level Controls

This table presents results of the effects of banking deregulations on maturity based liquidity creation of commercial banks. The sample consists of bank-quarter observations from 1984 through 2006. The dependent variables in columns 1-3 and 4-6 are *Liquidity Creation (Maturity Based)* and *Liquidity Creation (Maturity Based, excluding Off-balance Sheet)*, respectively. Detailed definition and classification for the liquidity creation measures can be found in Appendix Table 1. The control variable *logSIZE* is defined as the natural logarithm of gross total assets in thousand real 2014 U.S. dollars. *Capital Asset Ratio* is the ratio of book value of equity over total assets. Both *logSIZE* and *Capital Asset Ratio* are lagged one year prior to the observation of the dependent variable. *Multibank Holding Company* is an indicator variable that equals one if a bank has been part of a multibank holding company in the past three years, and zero if otherwise. Standard errors are heteroskedasticity-consistent, two-way clustered at the state and year level, and reported in parentheses. *, **, and *** indicate significant at 10%, 5%, and 1%, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
DEP VAR	Liquidity Creation (Maturity Based)			Liquidity Creation (Maturity Based, excluding Off-balance Sheet)		
Bank Competition (Distance Weighted)	-0.0059***			-0.0045***		
	(0.0009)			(0.0012)		
Bank Competition (Distance and # of Banks Weighted)		-0.0045***			-0.0037***	
		(0.0006)			(0.0007)	
Bank Competition (Distance and GSP Weighted)			-0.0051***			-0.0038***
			(0.0010)			(0.0012)
logSIZE	0.0125**	0.0125**	0.0125**	0.0040	0.0040	0.0040
	(0.0044)	(0.0044)	(0.0044)	(0.0038)	(0.0038)	(0.0038)
Capital Asset Ratio	-0.4799***	-0.4799***	-0.4798***	-0.5161***	-0.5161***	-0.5161***
	(0.0529)	(0.0529)	(0.0529)	(0.0481)	(0.0481)	(0.0481)
Multibank Holding Company	0.0233***	0.0233***	0.0233***	0.0194***	0.0194***	0.0194***
	(0.0021)	(0.0021)	(0.0021)	(0.0019)	(0.0019)	(0.0019)
State-Year fixed effects	yes	yes	yes	yes	yes	yes
Bank fixed effects	yes	yes	yes	yes	yes	yes
N	192564	192564	192564	192564	192564	192564
R-sq	0.8165	0.8165	0.8165	0.7986	0.7986	0.7986

Table 5. Decomposition of Category Based Liquidity Creation

This table presents results of the effects of banking deregulations on asset-side, liability-side, and off-balance sheet category based liquidity creation of commercial banks. The sample consists of bank-year observations from 1984 through 2006. The dependent variables in columns 1-3, 4-6, and 7-9 are *Asset-side Liquidity Creation*, *Liability-side Liquidity Creation*, and *Off-balance Sheet Liquidity Creation*, respectively, where *Asset-side Liquidity Creation + Liability-side Liquidity Creation + Off-balance Sheet Liquidity Creation= Liquidity Creation (Category Based)*. Detailed definition and classification for the liquidity creation measures can be found in Appendix Table 1. The control variable *logSIZE* is defined as the natural logarithm of gross total assets in thousand real 2014 U.S. dollars. *Capital Asset Ratio* is the ratio of book value of equity over total assets. Both *logSIZE* and *Capital Asset Ratio* are lagged one year prior to the observation of the dependent variable. *Multibank Holding Company* is an indicator variable that equals one if a bank has been part of a multibank holding company in the past three years, and zero if otherwise. Standard errors are heteroskedasticity-consistent, two-way clustered at the state and year level, and reported in parentheses. *, **, and *** indicate significant at 10%, 5%, and 1%, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
DEP VAR	Asset-side Liquidity Creation			Liability-side Liquidity Creation			Off-balance Sheet Liquidity Creation		
Bank Competition (Distance Weighted)	-0.0070***			0.0018***			-0.0014**		
	(0.0007)			(0.0004)			(0.0005)		
Bank Competition (Distance and # of Banks Weighted)		-0.0057***			0.0015***			-0.0009***	
		(0.0006)			(0.0003)			(0.0002)	
Bank Competition (Distance and GSP Weighted)			-0.0062***			0.0016***			-0.0014***
			(0.0007)			(0.0003)			(0.0004)
logSIZE	0.0184***	0.0184***	0.0184***	-0.0154***	-0.0154***	-0.0154***	0.0083***	0.0083***	0.0083***
	(0.0037)	(0.0037)	(0.0037)	(0.0019)	(0.0019)	(0.0019)	(0.0010)	(0.0010)	(0.0010)
Capital Asset Ratio	-0.0938**	-0.0938**	-0.0938**	-0.3693***	-0.3693***	-0.3693***	0.0361***	0.0361***	0.0361***
	(0.0363)	(0.0363)	(0.0363)	(0.0226)	(0.0226)	(0.0226)	(0.0090)	(0.0090)	(0.0090)
Multibank Holding Company	0.0186***	0.0186***	0.0186***	-0.0002	-0.0002	-0.0002	0.0039***	0.0039***	0.0039***
	(0.0022)	(0.0022)	(0.0022)	(0.0008)	(0.0008)	(0.0008)	(0.0004)	(0.0004)	(0.0004)
State-Year fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes
Bank fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes
N	192564	192564	192564	192564	192564	192564	192564	192564	192564
R-sq	0.7938	0.7938	0.7938	0.8272	0.8272	0.8272	0.7783	0.7783	0.7783

Table 6. Profitability Effect

This table presents results of profitability effects of banking deregulations on liquidity creation. The sample consists of bank-year observations from 1984 through 2006. The dependent variables in columns 1-3, 4-6, 7-9, and 10-12 are *Liquidity Creation (Category Based)*, *Liquidity Creation (Category Based, excluding Off-balance Sheet)*, *Liquidity Creation (Maturity Based)*, and *Liquidity Creation (Maturity Based, excluding Off-balance Sheet)*, respectively. *Profitability* is defined as net interest income over total assets, and lagged one year prior to the observation of the dependent variable. *High Profit* is defined as a dummy that equal to one if in the initial period (1984-1986) a bank's median profitability is greater than the sample median profitability and zero otherwise. Other firm controls include *logSIZE*, *Capital Asset Ratio*, and *Multibank Holding Company*. Detailed definition for all the variables are presented in Appendix Table 1. Standard errors are heteroskedasticity-consistent, two-way clustered at the state and year level, and reported in parentheses. *, **, and *** indicate significant at 10%, 5%, and 1%, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
DEP VAR	Liquidity Creation (Category Based)			Liquidity Creation (Category Based, excluding Off-balance Sheet)			Liquidity Creation (Maturity Based)			Liquidity Creation (Maturity Based, excluding Off-balance Sheet)		
Bank Competition (Distance Weighted)	-0.0075***			-0.0061***			-0.0068***			-0.0053***		
	(0.0005)			(0.0006)			(0.0008)			(0.0010)		
Bank Competition (Distance and # of Banks Weighted)		-0.0057***			-0.0048***			-0.0051***			-0.0042***	
		(0.0004)			(0.0004)			(0.0006)			(0.0008)	
Bank Competition (Distance And GSP Weighted)			-0.0068***			-0.0054***			-0.0059***			-0.0045***
			(0.0005)			(0.0005)			(0.0008)			(0.0010)
Bank Competition (Distance Weighted) x High Profit	0.0007***			0.0006**			0.0009***			0.0007**		
	(0.0002)			(0.0002)			(0.0002)			(0.0003)		
Bank Competition (Distance and # of Banks Weighted) x High Profit		0.0006***			0.0005***			0.0006***			0.0005***	
		(0.0002)			(0.0002)			(0.0002)			(0.0002)	
Bank Competition (Distance and GSP Weighted) x High Profit			0.0007***			0.0006**			0.0008***			0.0007***
			(0.0002)			(0.0002)			(0.0002)			(0.0002)
Profitability	5.2539***	5.2507***	5.2541***	4.7451***	4.7436***	4.7450***	5.1916***	5.1854***	5.1924***	4.7148***	4.7104***	4.7153***
	(0.2135)	(0.2131)	(0.2138)	(0.2022)	(0.2020)	(0.2024)	(0.2233)	(0.2231)	(0.2235)	(0.2140)	(0.2140)	(0.2142)
Other bank controls	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
State-Year fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Bank fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
N	192564	192564	192564	192564	192564	192564	192564	192564	192564	192564	192564	192564
R-sq	0.8497	0.8497	0.8497	0.8349	0.8349	0.8349	0.8323	0.8323	0.8323	0.8155	0.8155	0.8155

Table 7. Size Effect

This table presents results of banking size effects associated with banking deregulations on liquidity creation. The sample consists of bank-year observations from 1984 through 2006. The dependent variables in columns 1-3, 4-6, 7-9, and 10-12 are *Liquidity Creation (Category Based)*, *Liquidity Creation (Category Based, excluding Off-balance Sheet)*, *Liquidity Creation (Maturity Based)*, and *Liquidity Creation (Maturity Based, excluding Off-balance Sheet)*, respectively. *Small Size* is an indicator that equal to one if a bank's gross total assets are smaller than the sample median over the entire period and zero otherwise. Other firm controls include *Capital Asset Ratio* and *Multibank Holding Company*. Detailed definition for all the variables are presented in Appendix Table 1. Standard errors are heteroskedasticity-consistent, two-way clustered at the state and year level, and reported in parentheses. *, **, and *** indicate significant at 10%, 5%, and 1%, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
DEP VAR	Liquidity Creation (Category Based)			Liquidity Creation (Category Based, excluding Off-balance Sheet)			Liquidity Creation (Maturity Based)			Liquidity Creation (Maturity Based, excluding Off-balance Sheet)		
Bank Competition (Distance Weighted)	-0.0067***			-0.0053***			-0.0059***			-0.0046***		
	(0.0005)			(0.0006)			(0.0009)			(0.0012)		
Bank Competition (Distance and # of Banks Weighted)		-0.0051***			-0.0042***			-0.0046***			-0.0037***	
		(0.0004)			(0.0004)			(0.0006)			(0.0007)	
Bank Competition (Distance And GSP Weighted)			-0.0060***			-0.0047***			-0.0052***			-0.0038***
			(0.0005)			(0.0006)			(0.0009)			(0.0012)
Bank Competition (Distance Weighted) x Small Size	-0.0009**			-0.0004			-0.0014***			-0.0009***		
	(0.0004)			(0.0003)			(0.0003)			(0.0003)		
Bank Competition (Distance and # of Banks Weighted) x Small Size		-0.0006**			-0.0002			-0.0009***			-0.0006**	
		(0.0002)			(0.0002)			(0.0003)			(0.0002)	
Bank Competition (Distance and GSP Weighted) x Small Size			-0.0009**			-0.0004			-0.0013***			-0.0008***
			(0.0004)			(0.0003)			(0.0003)			(0.0003)
logSIZE	0.0116**	0.0118**	0.0115**	0.0032	0.0033	0.0032	0.0110**	0.0113**	0.0110**	0.0030	0.0032	0.0030
	(0.0046)	(0.0046)	(0.0046)	(0.0040)	(0.0040)	(0.0040)	(0.0045)	(0.0045)	(0.0045)	(0.0039)	(0.0039)	(0.0039)
Other bank controls	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
State-Year fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Bank fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
N	192564	192564	192564	192564	192564	192564	192564	192564	192564	192564	192564	192564
R-sq	0.8333	0.8332	0.8333	0.8163	0.8163	0.8163	0.8168	0.8167	0.8168	0.7987	0.7987	0.7987

[APPENDIX TABLE]

Appendix Table 1. Variable Definition

Variable Name	Definition
Liquidity Creation Measures	
Liquidity Creation (Category Based)	The construction of this measure follows a three-step procedure: First, all bank balance sheet and off-balance sheet activities are classified as liquid, semiliquid, or illiquid. Second, assign a weight of½ to both illiquid assets and liquid liabilities and guarantees, and a weight of −½ to both liquid assets, equity, liquid guarantees and derivatives and illiquid liabilities. For the semiliquid assets, liabilities, and guarantees, an intermediate weight of 0 is assigned. Third, combine the activities as classified in the first step and as weighted in the second step to construct the liquidity creation measures. Detailed classification of liquid/illiquid assets/liabilities and equity/off-balance sheet activities can be found in definitions for asset-side, liability-side and off-balance sheet liquidity creations. *Liquidity Creation (Category Based)* is scaled by gross total assets, which equals total assets plus the allowance for loan and lease losses and the allocated transfer risk reserve (a reserve for certain foreign loans).
Liquidity Creation (Category Based, excluding Off-balance Sheet)	The construction of this measure follows a three-step procedure: First, all bank balance sheet activities are classified as liquid, semiliquid, or illiquid. Second, assign a weight of½ to both illiquid assets and liquid liabilities, and a weight of −½ to both liquid assets, equity, and illiquid liabilities. For the semiliquid assets and liabilities, an intermediate weight of 0 is assigned. Third, combine the activities as classified in the first step and as weighted in the second step to construct the LC2 liquidity creation measures. Detailed classification of liquid/illiquid assets/liabilities and equity/off-balance sheet activities can be found in definitions for asset-side, liability-side and off-balance sheet liquidity creations. *Liquidity Creation (Category Based, excluding Off-balance Sheet)* is scaled by gross total assets, which equals total assets plus the allowance for loan and lease losses and the allocated transfer risk reserve (a reserve for certain foreign loans).
Liquidity Creation (Maturity Based)	The construction of this measure follows the same procedure as of *Liquidity Creation (Category Based)*, except that when classify loans, it is classified by maturity instead of category. Details of loan classification can be found in definitions for asset-side, liability-side and off-balance sheet liquidity creations. *Liquidity Creation (Maturity Based)* is scaled by gross total assets, which equals total assets plus the allowance for loan and lease losses and the allocated transfer risk reserve (a reserve for certain foreign loans).
Liquidity Creation (Maturity Based, excluding Off-balance Sheet)	The construction of this measure follows the same procedure as of *Liquidity Creation (Category Based, excluding Off-balance sheet)*, except that when classify loans, it is classified by maturity instead of category. Details of loan classification can be found in definitions for asset-side, liability-side and off-balance sheet liquidity creations. *Liquidity Creation (Maturity Based, excluding Off-balance Sheet)* is scaled by gross total assets, which equals total assets plus the allowance for loan and lease losses and the allocated transfer risk reserve (a reserve for certain foreign loans).

Asset-side Liquidity Creation	= Illiquid Assets – Liquid Assets, where "Liquid Assets" include cash and due from other institutions, all securities regardless of maturity, trading assets, and federal funds sold, and "Illiquid Assets" include the following depending on different liquidity creation measures: (Category Based Liquidity Creations) commercial real estate loans, loans to finance agricultural production, commercial and industrial loans, other loans and lease financing receivables. (Maturity Based Liquidity Creations) all loans and leases with a remaining maturity longer than one year. (For both Category and Maturity Based Liquidity Creations) other real estate owned, customers' liability on banker's acceptances, investment in unconsolidated subsidiaries, intangible assets, premises, and other assets.
Liability-side Liquidity Creation	=Liquid Liabilities – Illiquid Liabilities, where "Illiquid Liabilities" include: transactions deposits, savings deposits, overnight federal funds purchased, and trading liabilities; and "Liquid Liabilities" include: bank's liability on bankers acceptances, subordinated debt, other liabilities, and equity.
Off-balance Sheet Liquidity Creation	=Illiquid Items – Liquid Items, where "Illiquid Items" include unused commitments, net standby letters of credit, commercial and similar letters of credit, and all other off-balance sheet liabilities; and "Liquid Items" include net participations acquired, interest rate derivatives, foreign exchange derivatives, and equity and commodity derivatives.
Competition Measures	
Bank Competition (Distance Weighted)	We calculate the interstate bank competitive pressure facing each commercial bank *i*, located in state *j* in period *t* as the summation of the inverse distance between bank *i* and each of the other state *k* that is allowed to enter in state *j* in period *t*. We take the natural logarithm of the sum of the weighted distance measures. The distance is measured from each commercial bank to the capital of every other state using the great-circle distances based on internal pointes in the geographic area from the commercial bank's county to the capital city county. The county distance database is downloaded and matched from the NBER database: http://www.nber.org/data/county-distance-database.html.
Bank Competition (Distance and # of Banks Weighted)	We calculate the interstate bank competitive pressure facing each commercial bank *i*, located in state *j* in period *t* as the summation of the inverse distance between bank *i* and each of the other state *k* that is allowed to enter in state *j* in period *t*. We further weight this regulatory environment index by the number of banks in the other state. We take the natural logarithm of the sum of the weighted distance measures. The distance is measured from each commercial bank to the capital of every other state using the great-circle distances based on internal pointes in the geographic area from the commercial bank's county to the capital city county. The county distance database is downloaded and matched from the NBER database: http://www.nber.org/data/county-distance-database.html.

Bank Competition (Distance and GSP Weighted)	We calculate the interstate bank competitive pressure facing each commercial bank *i*, located in state *j* in period *t* as the summation of the inverse distance between bank *i* and each of the other state *k* that is allowed to enter in state *j* in period *t*. We further weight this regulatory environment index by the economic size (GSP per capita in $10,000) of the other state. We take the natural logarithm of the sum of the weighted distance measures. The distance is measured from each commercial bank to the capital of every other state using the great-circle distances based on internal pointes in the geographic area from the commercial bank's county to the capital city county. The county distance database is downloaded and matched from the NBER database: http://www.nber.org/data/county-distance-database.html.
Bank Competition Alternative (Distance Weighted)	We calculate the interstate bank competitive pressure facing each commercial bank *i*, located in state *j* in period *t* as the summation of the inverse distance between bank *i* and each of the other state *k* that is allowed to enter in state *j* in period *t*. We take the natural logarithm of the sum of the weighted distance measures. The distance is measured from each commercial bank to the city with most banks of every other state using the great-circle distances based on internal pointes in the geographic area from the commercial bank's county to that city's county. The county distance database is downloaded and matched from the NBER database: http://www.nber.org/data/county-distance-database.html.
Bank Competition Alternative (Distance and # of Banks Weighted)	We calculate the interstate bank competitive pressure facing each commercial bank *i*, located in state *j* in period *t* as the summation of the inverse distance between bank *i* and each of the other state *k* that is allowed to enter in state *j* in period *t*. We further weight this regulatory environment index by the number of banks in the other state. We take the natural logarithm of the sum of the weighted distance measures. The distance is measured from each commercial bank to the city with most banks of every other state using the great-circle distances based on internal pointes in the geographic area from the commercial bank's county to that city county. The county distance database is downloaded and matched from the NBER database: http://www.nber.org/data/county-distance-database.html.
Bank Competition Alternative (Distance and GSP Weighted)	We calculate the competitive pressure facing each commercial bank *i*, located in state *j* in period *t* as the summation of the inverse distance between bank *i* and each of the other states that is allowed to enter state *j* in period *t*. We further weight this regulatory environment index by the economic size (GSP per capita in $10,000) of the other state. We take the natural logarithm of the sum of the weighted distance measures. The distance is measured from each commercial bank to the city with most banks of every other state using the great-circle distances based on internal pointes in the geographic area from the commercial bank's county to that city county. The county distance database is downloaded and matched from the NBER database: http://www.nber.org/data/county-distance-database.html

Control Variables

logSIZE	The natural logarithm of gross total assets in ‘000 $ in year *t-1*, where gross total assets equals total assets plus the allowance for loan and lease losses and the allocated transfer risk reserve (a reserve for certain foreign loans). Amounts are adjusted in real 2014 dollars using the implicit GDP price deflator.
Capital Asset Ratio	Ratio of book value of equity over total assets in year *t-1*.
Multibank Holding Company	Dummy =1 if a bank has been part of a multibank holding company in the any of the past three years, =0 if otherwise.
Profitability	Ratio of net interest income over total assets in year *t-1*.
High Profit	An indicator that equal to one if in the initial period (1984-1986) a bank’s median profitability is greater than the sample median profitability and zero otherwise.
Small Size	An indicator that equals one if a bank’s gross total assets are smaller than the sample median value over the entire sample period and zero otherwise.

Appendix Table 2. Validity Test - Banking Deregulations and Lagged Liquidity Creations: Using Other Liquidity Creation Measures

This table presents OLS regressions of bank regulatory reforms on lagged values of category based (excluding off-balance sheet) or maturity based liquidity creations and other potential predictors of regulatory reforms. The sample consists of state-year observations from 1984 to 2006 and excludes states that deregulated in or before 1984. Definitions for the dependent variable bank competition measures are presented in Appendix Table 1. The key explanatory variables in Panel A, B, and C, are *State Weighted Liquidity Creation (Category Based, excluding Off-balance Sheet)*, *State Weighted Liquidity Creation (Maturity Based)*, and *State Weighted Liquidity Creation (Maturity Based, excluding Off-balance Sheet)*, respectively. The *State Weighted Liquidity Creation* variables are calculated by the corresponding bank level liquidity creation measures aggregated to the state level and weighted by the proportion of the commercial bank's total assets held by its subsidiaries and branches in that state. Detained definition and classification of liquidity creation measures can be found in Appendix Table 1. Following Kroszner and Strahan (1999), the following control variables are included: GSP per capita, state level unemployment rate, small bank share of all banking assets, and capital ratio of small banks relative to large ones, relative size of insurance in states where banks may sell insurance (zero otherwise), relative size of insurance in states where banks may not sell insurance (zero otherwise), an indicator variable that equal to one if banks may sell insurance (zero otherwise), small firm (fewer than 20 employees) share of the number of firms in the state, unit banking law, share of state government controlled by Democrats, and an indicator that takes a value of one if the state is controlled by one party. We also include state dummy variables. Standard errors are adjusted for state-level clustering and appear in parentheses. *, **, and *** indicate significant at 1%, 5%, and 10%.

Panel A. Liquidity Creation (Category Based, excluding Off-balance Sheet)

	(1)	(2)	(3)
Dep Var	Bank Competition (Distance Weighted)	Bank Competition (Distance and # of Banks Weighted)	Bank Competition (Distance and GSP Weighted)
State Weighted Liquidity Creation (Category Based, excluding Off-balance Sheet) one year before interstate deregulation	0.9972	1.4438	1.3759
	(2.2298)	(2.8185)	(2.3731)
State Weighted Liquidity Creation (Category Based, excluding Off-balance Sheet) two years before interstate deregulation	4.7031	5.8712	4.9467
	(3.3222)	(4.4831)	(3.5630)
State Weighted Liquidity Creation (Category Based, excluding Off-balance Sheet) three years before interstate deregulation	-7.3976	-10.3597	-7.8182
	(5.0080)	(6.7243)	(5.3820)
Controls	Yes	Yes	Yes
N	637	637	637
R-sq	0.3840	0.3227	0.4050

Appendix Table 2. Validity Test - Banking Deregulations and Lagged Liquidity Creations: Using Other Liquidity Creation Measures (Cont'd)

Panel B. Liquidity Creation (Maturity Based)

	(1)	(2)	(3)
Dep Var	Bank Competition (Distance Weighted)	Bank Competition (Distance and # of Banks Weighted)	Bank Competition (Distance and GSP Weighted)
State Weighted Liquidity Creation (Maturity Based) one year before interstate deregulation	0.4520	0.8600	0.4261
	(1.3539)	(1.8785)	(1.4517)
State Weighted Liquidity Creation (Maturity Based) two years before interstate deregulation	2.0987	2.6958	2.1863
	(1.7380)	(2.4799)	(1.8720)
State Weighted Liquidity Creation (Maturity Based) three years before interstate deregulation	0.9827	0.7171	1.0110
	(1.2966)	(1.7878)	(1.3959)
Controls	Yes	Yes	Yes
N	637	637	637
R-sq	0.3925	0.3273	0.4121

Panel C. Liquidity Creation (Maturity Based, excluding Off-balance Sheet)

	(1)	(2)	(3)
Dep Var	Bank Competition (Distance Weighted)	Bank Competition (Distance and # of Banks Weighted)	Bank Competition (Distance and GSP Weighted)
State Weighted Liquidity Creation (Maturity Based, excluding Off-balance Sheet) one year before interstate deregulation	0.2999	0.5259	0.3097
	(1.3571)	(1.8575)	(1.4577)
State Weighted Liquidity Creation (Maturity Based, excluding Off-balance Sheet) two years before interstate deregulation	2.0100	2.5537	2.1145
	(1.6749)	(2.3792)	(1.8035)
State Weighted Liquidity Creation (Maturity Based, excluding Off-balance Sheet) three years before interstate deregulation	1.1898	0.9474	1.2195
	(0.9834)	(1.3346)	(1.0581)
Controls	Yes	Yes	Yes
N	637	637	637
R-sq	0.3910	0.3251	0.4111

Appendix Table 3. Competition and Liquidity Creation – BHC Level Analysis

Panel A. Dependent Variables: Category Based Liquidity Creations

This table presents results of the effects of banking deregulations on category based liquidity creation of bank holding companies (BHCs). The sample consists of BHC-year observations from the 3rd quarter of 1986 through 2006. The sample consists of bank-year observations from 1986 through 2006. The dependent variables in columns 1-3 and 4-6 are *Liquidity Creation (Category Based)* and *Liquidity Creation (Category Based, excluding Off-balance Sheet)*, respectively. These measures are calculated based on asset-weighted liquidity creation of commercial banks that belong to the BHC. Detailed definition and classification for the liquidity creation measures can be found in Appendix Table 1. *BHC Competition (Distance Weighted)*, *BHC Competition (Distance and # of Banks Weighted)*, and *BHC Competition (Distance and GSP Weighted)* are asset-weighted regulatory environment (*Bank Competition (Distance Weighted)*, *Bank Competition (Distance and # of Banks Weighted)*, *Bank Competition (Distance and GSP Weighted)*) facing each subsidiary (including the subsidiaries in the state of the BHC's headquarters) across all subsidiaries owned by the BHC. Other bank controls include *logSIZE*, *Capital Asset Ratio*, and *Multibank Holding Company*, where *Multibank Holding Company* is a dummy variable that equals one if a BHC is a multibank holding company, and zero otherwise. Definitions for all the other variables can be found in Appendix Table 1. Standard errors are heteroskedasticity-consistent, two-way clustered at the state and year level, and reported in parentheses. *, **, and *** indicate significant at 10%, 5%, and 1%, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
DEP VAR	Liquidity Creation (Category Based)			Liquidity Creation (Category Based, excluding Off-balance		
BHC Competition (Distance Weighted)	-0.0053***			-0.0058***		
	(0.0009)			(0.0008)		
BHC Competition (Distance and # of Banks Weighted)		-0.0044***			-0.0049***	
		(0.0007)			(0.0006)	
BHC Competition (Distance and GSP Weighted)			-0.0049***			-0.0053***
			(0.0008)			(0.0008)
Other bank controls	yes	yes	yes	yes	yes	yes
State-Year fixed effects	yes	yes	yes	yes	yes	yes
BHC fixed effects	yes	yes	yes	yes	yes	yes
N	4947	4947	4947	4947	4947	4947
R-sq	0.8703	0.8703	0.8703	0.8829	0.8829	0.8829

Appendix Table 3. Competition and Liquidity Creation – BHC Level Analysis

Panel B. Dependent Variable: Maturity Based Liquidity Creations

This table presents results of the effects of banking deregulations on maturity based liquidity creation of bank holding companies (BHCs). The sample consists of BHC-year observations from the 3rd quarter of 1986 through 2006. The dependent variables in columns 1-3 and 4-6 are *Liquidity Creation (Maturity Based)* and *Liquidity Creation (Maturity Based, excluding Off-balance Sheet)*, respectively. These measures are calculated based on asset-weighted liquidity creation of commercial banks that belong to the BHC. Detailed definition and classification for the liquidity creation measures can be found in Appendix Table 1. *BHC Competition (Distance Weighted)*, *BHC Competition (Distance and # of Banks Weighted)*, and *BHC Competition (Distance and GSP Weighted)* are asset-weighted regulatory environment (*Bank Competition (Distance Weighted)*, *Bank Competition (Distance and # of Banks Weighted)*, *Bank Competition (Distance and GSP Weighted)*) facing each subsidiary (including the subsidiaries in the state of the BHC's headquarters) across all subsidiaries owned by the BHC. Other bank controls include *logSIZE*, *Capital Asset Ratio*, and *Multibank Holding Company*, where *Multibank Holding Company* is a dummy variable that equals one if a BHC is a multibank holding company, and zero otherwise. Definitions for all the other variables can be found in Appendix Table 1. Standard errors are heteroskedasticity-consistent, two-way clustered at the state and year level, and reported in parentheses. *, **, and *** indicate significant at 10%, 5%, and 1%, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
DEP VAR	Liquidity Creation (Maturity Based)			Liquidity Creation (Maturity Based, excluding Off-balance Sheet)		
BHC Competition (Distance Weighted)	-0.0032***			-0.0034***		
	(0.0014)			(0.0012)		
BHC Competition (Distance and # of Banks Weighted)		-0.0027***			-0.0029***	
		(0.0010)			(0.0009)	
BHC Competition (Distance and GSP Weighted)			-0.0030***			-0.0031***
			(0.0012)			(0.0011)
Other bank controls	yes	yes	yes	yes	yes	yes
State-Year fixed effects	yes	yes	yes	yes	yes	yes
BHC fixed effects	yes	yes	yes	yes	yes	yes
N	4947	4947	4947	4947	4947	4947
R-sq	0.8040	0.8040	0.8040	0.8036	0.8036	0.8036

Appendix Table 4. Alternative Measures of Competition

Panel A. Dependent Variables: Category Based Liquidity Creations

This table presents results of the effects of banking deregulations on category based liquidity creation of commercial banks using alternative bank competition measures. The sample consists of bank-year observations from 1984 through 2006. Definitions for alternative bank competition measures are presented in Appendix Table 1. The dependent variables in columns 1-3 and 4-6 are *Liquidity Creation (Category Based)* and *Liquidity Creation (Category Based, excluding Off-balance Sheet)*, respectively. Other bank controls include *logSIZE*, *Capital Asset Ratio*, and *Multibank Holding Company*. Detailed definition and classification for all the variables can be found in Appendix Table 1. Standard errors are heteroskedasticity-consistent, two-way clustered at the state and year level, and reported in parentheses. *, **, and *** indicate significant at 10%, 5%, and 1%, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
DEP VAR	Liquidity Creation (Category Based)			Liquidity Creation (Category Based, excluding Off-balance Sheet)		
Bank Competition Alternative (Distance Weighted)	-0.0062***			-0.0045***		
	(0.0010)			(0.0015)		
Bank Competition Alternative (Distance and # of Banks Weighted)		-0.0049***			-0.0038***	
		(0.0006)			(0.0008)	
Bank Competition Alternative (Distance and GSP Weighted)			-0.0056***			-0.0040***
			(0.0009)			(0.0013)
Other bank controls	yes	yes	yes	yes	yes	yes
State-Year fixed effects	yes	yes	yes	yes	yes	yes
Bank fixed effects	yes	yes	yes	yes	yes	yes
N	192564	192564	192564	192564	192564	192564
R-sq	0.8332	0.8332	0.8332	0.8163	0.8163	0.8163

Appendix Table 4. Alternative Measure of Competition

Panel B. Dependent Variables: Maturity Based Liquidity Creations

This table presents results of the effects of banking deregulations on maturity based liquidity creation of commercial banks using alternative bank competition measures. The sample consists of bank-quarter observations from 1984 through 2006. The dependent variables in columns 1-3 and 4-6 are *Liquidity Creation (Maturity Based)* and *Liquidity Creation (Maturity Based, excluding Off-balance Sheet)*, respectively. Other bank controls include *logSIZE*, *Capital Asset Ratio*, and *Multibank Holding Company*. Detailed definition and classification for all the variables can be found in Appendix Table 1. Standard errors are heteroskedasticity-consistent, two-way clustered at the state and year level, and reported in parentheses. *, **, and *** indicate significant at 10%, 5%, and 1%, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
DEP VAR	Liquidity Creation (Maturity Based)			Liquidity Creation (Maturity Based, excluding Off-balance Sheet)		
Bank Competition Alternative	-0.0056***			-0.0039*		
(Distance Weighted)	(0.0013)			(0.0019)		
Bank Competition Alternative		-0.0043***			-0.0032**	
(Distance and # of Banks Weighted)		(0.0010)			(0.0013)	
Bank Competition Alternative			-0.0049***			-0.0033*
(Distance and GSP Weighted)			(0.0012)			(0.0017)
Other bank controls	yes	yes	yes	yes	yes	yes
State-Year fixed effects	yes	yes	yes	yes	yes	yes
Bank fixed effects	yes	yes	yes	yes	yes	yes
N	192564	192564	192564	192564	192564	192564
R-sq	0.8165	0.8165	0.8165	0.7986	0.7986	0.7986