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Bank Geographic Diversification and Sensitivity of Lending to Monetary Shocks

Micro-Evidence from U.S. County-Banking States

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ABSTRACT

This paper provides empirical evidence supporting the view that bank geographic diversification reduces the sensitivity of loan supply to monetary shocks, and hence, the efficacy of the bank lending channel of monetary policy transmission. The study covers 18 U.S. "county-banking states," where banks cannot set up *branches* outside their home counties, but some banks may benefit from geographic diversification through their holding company parents. Two types of banks coexist in local markets: "local banks" and "diversified banks" (i.e., local subsidiaries of multi-county holding companies). Bank-level lending data (1977-1986) reveal that the diversified banks' lending exhibits significantly *smaller* procyclicality across the course of a monetary cycle, even after controlling for differences in size, liquidity, capitalization ratio and potential for securitization. The study further shows that diversified banks (need to) build up smaller liquidity buffers than do local banks during monetary tightening, which may explain why their lending is less sensitive to restrictive monetary shocks. The local nature of lending in county-banking states allows us to control for local credit *demand* based on the prediction of the interest-rate channel that counties with higher manufacturing employment share should exhibit more procyclical demand for credit. It is also shown that in these counties during monetary tightening the disadvantage of local banks is less evident, because the depressed credit demand may reduce the relevance of supply-side constraints.

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1. Introduction

The paper studies how bank geographic diversification, or lack thereof, affects the sensitivity of bank loan supply to monetary shocks, and thus, the efficacy of the bank lending channel of the monetary policy transmission mechanism [1]. Theories provide competing hypotheses on whether bank market integration would lead to more stable or more volatile local lending in response to monetary shocks, and the net effects may depend on whether credit supply or demand (i.e. the financial sector or the real sector) is more sensitive to monetary shocks, and whether the economy is more credit-constrained during monetary recessions or expansions (see Section 1.1 for a detailed discussion; also, English (2002) has provided a comprehensive review of the recent debate on the link between financial consolidation and monetary policy effectiveness).

To shed light on the theoretic tensions, this study draws evidence from U.S. "county-banking states" in the late 1970s and early 1980s, where banks were not allowed to set up branches outside their home counties, but some of the banks could benefit from geographic diversification through the internal capital markets of their holding company parents that owned subsidiaries in multiple counties. In these U.S. states, information on local (county-level) lending volumes is publicly available because a bank holding company was not allowed to consolidate its subsidiary operations into one integrated entity. Exploiting this special regulatory setting and the disinflation monetary shocks in the early 1980s, these study then attempts to identify whether diversified banks (i.e., local subsidiaries of the multi-county holding companies) react differently (versus local banks) to national-level common monetary shocks, and whether geographic diversification dampens or amplifies such shocks.

[1] Empirical studies have shown that since the beginning of the 1980s the correlation between exogenous changes in the Fed funds rate and subsequent quarters' real GDP growth has reached near zero (Kuttner and Mosser, 2002; Boivin and Giannoni 2002; Taylor 1995), leading to the notion that monetary policy has become less effective. The results of this study provide one potential explanation: Increasing market integration in the banking sector that allows banks to diversify geographically may have reduced the sensitivity of bank lending to monetary shocks, and thus, have made the bank lending channel of monetary policy transmission less effective.

1.1. Hypotheses development: bank market integration and shock propagation

The bank holding companies that operate in multiple counties are geographically diversified, and thus, compared with local banks are less likely to be incapacitated by idiosyncratic local economic shocks.[2] Hankins (2006) for example show that bank mergers are motivated by the opportunity of operational hedging across regions. Subsidiaries belonging to the same holding company can provide mutual-insurance to each other, because it is convenient for the holding company to move loanable funds among subsidiaries to support those relatively short of liquidity (Holod and Peek, 2006). Therefore, subsidiaries of multi-county BHCs can be considered financially more robust than stand-alone local banks (Ashcraft, 2003)[3]. In this sense, bank geographic diversification can be considered also as a financial innovation that allows banks to hedge risks across regions. Also, the moral hazard problem typically seen in a government-run insurance system is minimized because of the common ownership structure and close monitoring within holding companies.

Nevertheless, the internal capital market of BHCs that operate across county or even state borders can have both exacerbating and dampening effects on the procyclicality of lending. Competing theories have made contrasting predictions on the direction of the effect, which depends mainly on whether supply of credit (the financial sector) or demand for credit (the real sector) financial sector or the real sector is more sensitive to monetary shocks (Morgan, Rime and Strahan, 2004).

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[2] For example, Chionsini, Foglia, and Reedtz (2003) based on confidential Italian data find that diversification of loan portfolio across sectors or geographic regions reduces credit risks (unexpected credit losses in a value-at-risk model) because of the diversification of idiosyncratic risks. Ogden, Rangan and Stanley (1989) find that geographic diversification can reduce a mortgage portfolio's foreclosure-risk exposure by 50% to 90%, when compared to geographically undiversified ones. Corgel and Gay (1987) show similar results. Based on Italian data, Acharya, Hasan and Saunders (2002) provide evidence that geographical diversification of loan portfolio results in an improvement in the risk-return trade-off but only for banks with low levels of risk. Finally, Berger and DeYoung (2001) show that efficiency costs are not necessarily associated with the geographic diversification of bank holding companies.

[3] Houston, James and Marcus (1997), Houston and James (1998) and Campello (2002) all provide empirical evidence that the internal capital market of BHCs is a source of support for subsidiaries, although Ashcraft (2003) shows that this support appeared only after the Fed's announcement of its source-of-strength doctrine in 1987.

If supply of credit responses more strongly to monetary shocks (because the financial health of small local banks is affected), then the holding-companies, with more diversified geographic exposure and greater access to wholesale funding, may be able to help their local subsidiaries smooth out the effects of monetary shocks by moving loanable funds through their internal markets to where credit is most needed but in short supply. When return on capital is higher in recession regions (because local banks facing capital and liquidity shocks reduce supply of credit), diversified banks, in pursuit of higher profit, can and are willing to pick up the lending slack and dampen local lending volatility. Stand-alone local banks, however, because of the lack of cheap liquidity and access to non-deposit wholesale funding in periods of tight money, may have to reduce support to borrowers, and as a result amplify the monetary shocks.[4] Studies have provided empirical evidence on the dampening role of bank market integration on volatility. For example, Ashcraft (2006) finds that response of aggregate lending to monetary policy is *weaker* in states where BHCs control more market shares than do stand-alone banks.[5]

However, if instead demand for credit is more sensitive to monetary shocks, then bank market integration and geographic diversification may exacerbate rather than dampen lending volatility. A multi-county BHC, because of its diverse geographic presence, will always tend to move loanable funds among its subsidiaries in pursue of maximized returns on capital. A typical two-county real business cycle (RBC) model (e.g., Backus, Kehoe and Kydland, 1995) will suggest that when a country (region) receives a negative shock in the real sector, the return of bank lending declines (for both local and diversified banks); and with capital mobility investment will tend to flow out of the country (region). After a contractionary monetary shock, multi-county BHCs may swiftly move loanable funds away from counties experiencing deeper recessions (if

[4] For example, Becker (2004) shows that local loan supply is determined mostly by local deposits; and this correlation is stronger in markets where banks are small and where intrastate branching is restricted.
[5] Some evidence is also available in an international context. Dages, Goldberg and Kinney (2000) find that foreign banks in Argentina and Mexico exhibit less cyclical lending than do local banks. Goldberg (2001) finds that lending by U.S. banks to emerging markets is not sensitive to local interest rates. Finally, using market-based volatility measures.

this is associated with lower returns to capital and more collateral damage) into counties in relatively better shape, and thus may amplify lending volatility of the corresponding local subsidiaries.[6] A local bank, however, has to stick with its customers through good times and bad (Strahan, 2006), which can dampen the shocks originating from the real sector.

Finally, the direction of the effect also depends on whether borrowers are inherently more financially constrained during contractions or expansions (Larrain, 2006). This may differ between manufacturing and other sectors. The manufacturing sector's demand for credit is more pro-cyclical because the demand for durable manufacturing goods is pro-cyclical; and monetary tightening through the interest-rate channel also directly reduces the manufacturing sector's desire for investment (Carlino and Defina, 1998; Peersman and Smets, 2005). Therefore, the advantage of diversified banks in supplying loans in periods of tight money (if supply of credit is the dominant source of shocks and constraints) may become less important in manufacturing-intensive counties. Conversely, in monetary expansions, as demand for manufactured goods increases, manufacturing firms may require more bank credit to expand; and holding companies may move loanable funds to manufacturing-intensive counties where credit is most needed. In this case, diversified banks may amplify economic volatility in the upturn too. In this study, because we can use local industrial structure (manufacturing versus others) as a proxy for the characteristics and mix of potential borrowers, we can shed some light on this mechanism.

1.2. The empirical design: Testing the hypotheses using county-banking states

Theories discussed in Section 1.1 offer competing hypotheses and the net effects of geographic diversification on lending's sensitivity could depend on many factors. Clear-cut empirical evidence is needed to solve the theoretic tension. The Group of Ten (2001), citing survey opinions of central bankers in industrial countries, argues that banking market consolidations have at most minor impact on the monetary policy transmission, but it also admits

[6] Lang and Nakamura (1995) and Bernanke, Gertler and Gilchrist (1996) both show that there is flight-to-quality after tightening of monetary policy, as banks allocate more credit to firms with fewer problems of asymmetric information.

that such consolidations were too recent a phenomenon for its effects to be evident. Historical experiences of the United States, however, can readily shed light on the question. Having started from a high level of bank market fragmentation historically, the gradual integration process is more evident and dramatic in the U.S. than in other countries.[7] Also, exploitation of variations *within* the U.S. can address many empirical challenges typically faced by cross-country studies on bank market integration.[8]

This paper exploits a unique historical feature of the U.S. banking system to provide disaggregated micro-evidence. Until the late 1980s, many U.S. states (accounting for 32.5% of the U.S. GDP as of 1985) still strictly restricted banks from branching across county boundaries. In these county-banking states, the banking market was local at the county level, and there were effectively countless small banking systems within the U.S., one per county, which nevertheless were exposed to identical monetary and exchange-rate shocks. A bank holding company (BHC), however, can diversify geographically by controlling bank subsidiaries in multiple counties. Benefiting from the internal capital market of their parents, these local subsidiaries are less isolated than are the local stand-alone banks.[9] Parent BHCs, however, were not allowed to consolidate subsidiaries into a single-operation network; instead, they needed to obtain a separate bank charter and report lending data separately for each subsidiary.

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[7] The banking sector in the United States has undergone and is still undergoing deregulation-induced consolidations. After the gradual removal of intrastate branching restrictions and the final passage of an interstate banking deregulation act, mergers and acquisition activities have increased sharply, which leads to consolidation and concentration of assets into multi-bank holding companies that own subsidiaries in diversified geographic areas.

[8] The measurement of international financial integration has been hampered by the lack of directly observable data on bilateral financial linkages. Also, variation in banking market concentration over time within most countries has been relatively small, and cross-sectional comparisons are difficult because of the significant differences in institutional environments across countries. Finally, central banks around the world may respond to development in their own economy by adjusting their operating procedures. Within the United States, however, county economies face similar legal and institutional environments; and they can be considered as small open economies exposed to identical monetary and exchange-rate shocks. Also, the county is an important economic unit in the U.S. Forni and Reichlin (1997), for example, find that county factors explain 31.3% of output fluctuations in the U.S., more important than state factors (23.2%). Therefore, comparative evidence drawn from U.S. counties is much more clear-cut and convincing than are cross-country results.

[9] The variation of local loan market share controlled by local banks (vs. diversified banks) can also be used as a measure of banking market segmentation (vs. integration).

Too often in similar studies on bank market integration we stop observing disaggregated local lending data subsequent to the legalization of formal branching expansion across county boundaries. But in these county-banking states--where the only form of geographic diversification is through holding company subsidiaries--we luckily have both of the necessary elements for micro-research: (a) the coexistence of diversified banks and local banks in the county-level market, which differ mainly in geographic exposure because of affiliation with multi-county BHCs, and (b) the availability of subsidiary-level *local* lending data because of the restrictions on formal branching (Blackwell, Brickley, and Weisbach, 1994).

Our study is similar to Campello (2002) in that we both use bank holding company affiliation status to distinguish two groups of banks. But our study contains important improvements. In county-banking states, the restrictions on cross-county branching had imposed an upper cap on the potential size of banks and bank subsidiaries operating there, depending on county economy size; and therefore, we are able to compare banks of not too difference size, because few banks in the county-banking states could grow to mega-size scale that could give themselves superior capital market access and make it problematic comparing them to the small banks. The regulatory barriers had also made the choice of "small bank" status relatively exogenous, because the small bank subsidiaries in our sample remained small because of the regulatory restrictions against folding them into a large integrated entity. In Campello (2002) or Kashyap and Stein (2000), however, "small bank" subsidiaries may stay small for some unobservable reasons that is difficult to control for.

The local nature of lending in county-banking states also helps us better disentangle the influence of credit supply and demand.[10] Ashcraft and Campello (2003), by comparing lending of

[10] Researchers usually study credit channels (either lending or balance sheet channels) using the data of banks and firms separately, because of the difficulty in matching the two sets of data. For the bank lending (narrow credit) channel, Kashyap and Stein (2000) study banks and show that less liquid banks reduce lending when the Fed tightens money. For the balance sheet (broad credit) channel, Gertler and Gilchrist (1993, 1994) find that small firms and more leveraged firms shed inventory and redundant labor during tight money periods, whereas such effects are not found in boom times or in large firms with access to the

subsidiaries belonging to the same bank holding company but operating in different geographic areas (states), show that local demand factors affect lending independent of the bank lending channel. We adopt a similar, but more refined approach, in that the exogenous component of the local credit demand can be reasonably inferred and approximated by the interaction between county-level industrial structure and national-level monetary-policy conditions, because the interest rate channel of monetary policy transmission predicts that counties with high manufacturing share would have more procyclical credit demand. Because of the special regulatory requirements, we know that in county-banking states lending recorded under a bank (subsidiary) is extended mostly to borrowers in the same county where the bank is headquartered. Also, subsidiaries of multi-county BHCs, although obtaining geographic diversification through their BHC parents, are on a stand-alone basis not in a very different size group than are local banks. Local subsidiaries operate relatively independently, and soft information also can be used actively in evaluating loan applications, as it is the case in stand-alone local banks.[11] Therefore, the difference of the borrower bases across large money center banks and community banks is unlikely to drive our results.

1.3. Main empirical findings: Diversification reduces sensitivity to shocks

This study draw on empirical evidence from U.S. county-banking states to shed light on the competing hypotheses offered by various theories (discussed in Section 1.1) regarding the link between bank market integration and bank lending's sensitivity to monetary shocks. This study finds that geographically diversified banks' lending is significantly less procyclical across the course of a monetary cycle. Such a result suggests that the supply of credit is indeed the main

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bond market. Bernanke and Gertler (1995) provide a good review of the literature on the credit channel of monetary policy transmission. In this study, thanks to the local nature of lending in county-banking states, we are able to approximate both borrower characteristics and credit demand faced by a bank and to explore the interaction between banks, firms and monetary policy shocks.

[11] As shown by Ashcraft (2006), based on data after 1993 (since which loan size data are available), the size mix of borrowers does not differ significantly across stand-alone banks and MBHC affiliates. However, DeYoung, Goldberg, and White (1999) find that small business lending is negative related to a bank's being part of a MBHC.

source of volatility induced by monetary shocks and that multi-bank holding companies operating across county borders may help smooth out the effects of monetary shocks for their subsidiaries (i.e., the "diversified banks").

The study further shows that diversified banks are able to hold a smaller amount of liquid assets during monetary tightening, which may explain why they can maintain a relatively stable lending volume than do local banks. Diversified banks' relatively less counter-cyclical liquidity positions indicate that monetary shocks have distributional impacts across banks: In periods of tight money, illiquid assets such as loans are shifted from the balance sheets of local banks to diversified banks that can better shoulder them, while local banks have to hoard liquidity.

Finally, the study finds that the difference in lending cyclicality between the two types of banks is smaller in counties that employ more manufacturing workers, because the manufacturing sector's demand for credit is more pro-cyclical than that of the service sector; and thus financial constraints may be less binding in periods of tight money in manufacturing-intensive counties. Better supply of credit as a result of bank geographic diversification (or poor supply of credit as a result of bank geographic segmentation), therefore, matters less in these locations in periods of tight money.

The rest of the paper is organized as follows. In Section 2, the empirical methodology is introduced in details. In Section 3, empirical results are reported and policy implications are drawn in Section 4.

2. Empirical Methodology

2.1. County-banking states

Researchers have been studying the credit channel of monetary policy transmission using bank- and firm-level data separately, because it is usually difficult to match banks with their borrowers. The breakdown of a bank's lending by borrowers or by local geographical units such

as a county is usually not disclosed to the public[12]. If we compare the lending volumes of two banks without observing their respective "local market," it is quite possible that the results obtained are driven by the heterogeneity of borrowers and loan demand faced by the two banks. We minimize the concern by restricting the sample to states and years where a bank was *not* allowed to branch outside its home county. In these states, we are confident that lending recorded under a bank or a bank subsidiary is most likely to be made to borrowers located within a certain county, for which we can approximate local credit demand. After statewide branching is allowed, county-level lending volumes become unobservable to researchers, because now the balance sheet of a bank may include operations in multiple counties.

Based on the historical information of banking regulations complied by Amel (1993), we identify the deregulation year when a state started to allow banks to formally branch across county boundaries.[13] Then we identify 18 states and 1,587 counties where, as of 1985, deregulations had *not* taken place and county-banking was still practiced. These include Arkansas, Colorado, Illinois, Indiana, Iowa, Kansas, Kentucky, Michigan, Minnesota, Montana, Nebraska, North Dakota, Oklahoma, Oregon, Tennessee, Texas, Wisconsin and Wyoming. Most of them are located in the Central United States, including almost all the Great Lakes, Plains and Rocky Mountain states. These county-banking states contributed to 32.5 % of the U.S. GDP in 1985.

[insert Table 1 about here]

As of 1985, none of these county-banking states allowed branch expansions across

[12] In the United States lending volume at bank level only, without geographic breakdown, is reported to the regulatory agencies; and information on how the lending is allocated geographically is not in the public domain.

[13] In many cases such limits were first amended to allow banks to branch into contiguous counties instead of statewide. Table 1 documents the dates when individual states legalized cross-county branching, as well as the dates when individual states started to allow the formation of multi-bank holding companies. In some states, formation of multi-bank holding companies was allowed throughout the sample period, whereas in others it was allowed only in the latter part of the period, as the deregulation timings vary.

county boundaries. In 1985, three states deregulated, and then another three followed in 1987. We therefore end the sample in 1986, in order to create a relatively balanced panel data set, although many states kept their county-banking laws intact till as late as 1994 (e.g., Arkansas). For a state that passed a law to allow branching across county boundaries in the middle of year t, we keep the state in the sample until year t−1. We begin the sample in 1977, for data availability reasons[14].

The study thus covers an interesting ten-year period from 1977 to 1986, a full monetary cycle that witnessed dramatic swings in policy stance unseen in the relatively calm 1990s. Further, oil price surged and collapsed during the period, implanting wedges between the economic fortunes of different states in the sample. Finally, the period largely escapes the wave of bank failure episodes in the late 1980s. The sample period thus can be used as an exogenous experiment for us to examine, in a relatively healthy and stable banking sector, the differential responses of bank lending behavior to a variety of relatively large monetary shocks, conditional on bank characteristic and local economic conditions.[15]

2.2. Empirical Model

A bank is defined as a "diversified bank" if it is a subsidiary of an ultimate bank holding company (BHC) that operates in multiple counties; otherwise it is defined as a "local bank." If the parent BHC operates within a single county only, its subsidiaries are considered not different from "local banks" and are defined as such. When a BHC controls multiple subsidiaries in the same county, we aggregate their lending volumes and attribute the total volume to a same "aggregated" diversified or local bank. This also helps us avoid the problem of adjusting for

[14] Banking data from the Federal Reserve Bank of Chicago are available since 1976, but industrial structure data from County Business Patterns (CBP) become available from year-end 1977. Note that one year is lost to form the annual difference growth-rate series.

[15] Furthermore, the period ends before the Fed announced the strength-of-support doctrine in 1987, which explicitly required holding-company parents to *unconditionally* prop up stressed subsidiaries. After 1987, even when a bank holding company does not gain extra strength through geographic diversification, it has to prop up subsidiaries in trouble, and thus, it becomes more difficult to tell whether it is geographic diversification of the holding company or simply the obligation to support that provides the cushion for the subsidiaries.

mergers and acquisitions[16]. In 1978, 7.8% of banks or bank subsidiaries in the sample can be considered as diversified banks, and the average geographic coverage of the 108 multi-county holding companies is 7 counties. The ratio rose to 20.0% in 1985, and the average geographic coverage of the 364 holding companies is 4.6 counties. The decline of average geographic coverage is mainly caused by the new formation of many two-county holding companies.

The regression models of this study rely on interaction terms to identify the effects of bank geographic diversification on the sensitivity of bank lending to monetary shocks. The interaction terms help shed light on the research hypotheses by differentiating between local banks and diversified banks, monetary tightening and loosening periods, and, between counties and time periods inherently more or less demanding for credit.

The baseline regression is specified as follows, where states are indexed by subscript i, years by t, and counties by k.

$$\Delta\left(Loan_{i,t}\right)=\beta_0+\overbrace{\beta_1\left(Diver_{i,t}\right)+\beta_2\left(Diver_{i,t}\times Money_t\right)}^{\text{Supply Side: Bank Lending Channel}}+\overbrace{\beta_3\left(Diver_{i,t}\times Money_t\times Manufacture_{k,t-1}\right)}^{\text{Interaction of Supply with Demand}}$$
$$+\overbrace{\gamma_1\left(Manufacture_{k,t-1}\times Money_t\right)+\gamma_2\left(Manufacture_{k,t-1}\right)}^{\text{Demand Side: Interest Rate Channel}}$$
$$+\overbrace{\delta_1\left(MarketShare_{i,t-1}\right)}^{\text{Convergence Effect}}+\overbrace{\delta_2\left(MarketConcentration_{k,t-1}\right)}^{\text{Local Market Competition}}+\overbrace{\sum State+\sum_t Year_t}^{\text{Fixed Effect}}+\overbrace{\varepsilon_{i,t}}^{\text{Clustered by County}\times\text{Year}}$$

Following Ashcraft (2006) we examine annual changes of the variables. Readers can refer to Ashcraft (2006, pp.760) for his detailed explanations on why annual changes data are preferred to higher frequency. Our empirical tests mainly rely on interaction terms (between monetary policy measure and certain variables of our interest); had we use quarterly data, we would have had to include in the regressions at least four lags of the monetary policy measure, each have had to be interacted with any one of the variables of interest. Furthermore, we are

[16] If a merger takes place within a county, then the adjustment we use is equivalent to that suggested by Peek and Rosengren (1995), in which merged banks are treated as a single bank throughout the sample (as if the merger had taken place at the beginning of the period). Note that a merger (in the sense that two entities are folded into one and one of them ceases to exist) across county borders was not allowed in county-banking states.

fortunate that the disinflation monetary shocks in the early 1980s were unusually large and could be clearly identified (in the sense that monetary policy stance in certain years was clearly restrictive than usual); and therefore, examining annual changes without going into the quarterly details can already capture cleanly the banks responses to large monetary shocks.

The dependent variable is the real annual growth rate of total loans[17] at bank i in year t, calculated by taking the December to December log difference of total loans outstanding and deflating it with the national consumer price index. The regression is estimated with Ordinary Least Square (OLS), on a sample of nearly 70,000 bank-year observations. The standard errors of the coefficients are adjusted for clustering of residuals by county × year, i.e., individual bank lending volume within a county in a certain year is not considered to be independent from each other.

Variable definition and sources are described in Section 2.3 and are also summarized in the paper's Appendix. Below we briefly explain the motivations behind the inclusion of the explanatory variables. The interaction terms need particular attention.

- **Dummy variable for diversified banks, or *"Diver"*:** this variable captures whether diversified banks' loan volumes grow faster than do local banks, regardless of monetary policy stance. Morgan and Samolyk (2003), for example, show that geographic diversification increases banks' capacity in lending (i.e., loan-to-asset ratio).
- **Diversified bank × Monetary policy stance, or *"Diver* × *Money":*** this interaction term helps identify whether lending by diversified banks, compared to that of local banks, is less sensitive to monetary policy shocks, as will be indicated by a negative coefficient.
- **Manufacturing share × Money policy stance, or *"Manufacture* × *Money":*** The fluctuations in lending volumes respond also to credit demand. This interaction term

[17] To create a consistent time series of loan growth, following Kashyap and Stein (2000) total loan is defined as RCFD1400 (Total loans and leases, gross) plus RCFD2165 (Lease financing receivables) prior to 1984, and RCFD1400 after. Growth rates (log difference) greater than 100% or smaller than -100% are truncated as outliers, which constitute only 0.72% of the original sample in numbers of observations.

between a county's manufacturing employment share and national monetary policy stance, can capture fluctuations in a county economy's *demand* for bank credit, resulting from the conventional interest rate channel of monetary policy transmission, which predicts that manufacturing sector is more sensitive to interest rate changes (Carlino and Defina, 1998; Peersman and Smets, 2005; Braun and Larrain, 2005). The coefficient should carry a positive sign if this hypothesis is true. In counties where manufacturing employment share is higher, expansionary monetary policy will create greater growth opportunities for local economy and greater demand for bank credit. Conversely, contractionary policy will lower demand for credit more in these counties. Whether the demand will be fully met and whether the growth potential can be fully achieved will then depend on the *supply* of credit by local banks.

- **Diversified bank × Money policy stance × Manufacturing share, or *"Diver × Money × Manufacture"*:** interpreted together with the coefficient on "Diversified bank × Money stance," the coefficient on this triple interaction term can tell us whether differential responses to monetary policy shocks across diversified and local banks also vary across counties with a different level of manufacturing employment ratio (and hence, different procyclicality of *demand* for bank credit). The coefficient should carry a positive sign if geographic diversification of banks matters less in manufacturing-intensive counties, where *demand* for credit is more pro-cyclical.

Several other variables also need some explanations. (**Lagged) market share:** Because of the convergence effect, banks with smaller initial local market share tend to expand faster. **(Lagged) share of manufacturing employment:** Counties with higher manufacturing share may demand more external finances, and thus bank lending may, on average, grow faster. **(Lagged)**

local bank market concentration: Competition among banks may affect volume of lending.[18] This is measured by the Herfindahl-Hirschman Index (HHI) of concentration.

The local banking market and industrial structure characteristics are lagged by one year to avoid endogeneity, whereas the contemporaneous measure of monetary stance (averaged over a year) is used. To capture state and time-specific effects, year and state dummy variables are included in the regression. In the regressions, measure of monetary policy stance is not directly included except when interacted with other variables, because the year dummy variables already capture year-specific factors, including the effects of monetary policy, as well as inflation, and national economic conditions. Results unreported show that for local banks lending volumes are weakly correlated with monetary conditions, whereas for diversified banks lending volumes appear to be counter-cyclical.

2.3. Data sources and descriptions

2.3.1 Banking sector data

The main data source for bank financial data is the Consolidated Reports of Condition & Income (usually known as the Call Reports[19]). Observations are excluded for states where (and years when) banks are allowed to branch across county boundaries. Thus, in counties included in our sample, loans recorded under a bank are extended exclusively to residents and businesses that are located in the headquarter county of the bank. Panel A of Table 2 provides summary statistics of the main characteristics of local banks versus diversified banks (i.e., bank subsidiaries of multicounty holding companies).

[insert Table 2 about here]

[18] For example, Boyd, De Nicolò, and Al Jalal (2005) show both theoretically and empirically that bank concentration is inversely correlated with loan to asset ratio. Adams and Amel (2005) find that the impact of monetary policy on loan originations is weaker in more concentrated markets.

[19] The data are complied by the Federal Reserve Bank of Chicago, and cover all commercial banks and savings banks regulated by the Federal Reserve System, Federal Deposit Insurance Corporation, and the Comptroller of the Currency.

Despite the fact that county-banking restrictions effectively impose a ceiling on how large a bank can grow (restricted by local economy size), as Panel B of Table 2 shows, the size distribution of banks in the county-banking states is not significantly shifted to the left compared to that of the national population, although local banks are somewhat smaller. Diversified banks are on average larger than local banks; but below the 90th percentile distribution diversified banks are usually only several-fold larger than their local counterparts (whereas in Kashyap and Stein [2000] "large banks" are usually more than an cap of magnitude larger than the "small banks," and the size effect could be non-linear in such a case). Those very large banks or bank subsidiaries above the 90th percentile are more likely to cluster in a small number of urban center counties (e.g., Houston, Harris County, as is also documented by Brickley, Linck and Smith [2003]; or Chicago, Cook County, where Continental Illinois Bank was focusing); as a result, in a typical county outside the urban centers, a *diversified bank*'s size is usually only twice as large as those of *local banks*. Later we will explicate control for bank size to show that our results are not driven by the size difference between diversified and local banks.

County-level market share of diversified banks is also a measure of banking market integration at a higher geographic level (state and national). Counties with greater loan market share controlled by BHCs that operate across county or even state borders are considered better integrated into state and national banking markets. In the year 1980, in counties with presence of diversified banks, they on average control 45% of total loans outstanding[20]. Table 3 provides a summary descriptive of time-varying bank market integration in the sample, by state and year. There is large cross-state heterogeneity in the level of bank market integration, but in general the

[20] The ratio rises to 50% in 1985. Nevertheless, the percentage of counties with a diversified bank presence rose drastically, from 27% to 47%, during this period as more states started to allow formation of multi-bank holding companies and inter-state banking deregulation introduced out-of-state buyers.

level of integration is increasing gradually over time during the sample period.[21]

[insert Table 3 about here]

2.3.2. Measuring monetary policy stance

We use the Boschen-Mills narrative index as the main measure of monetary policy stance. Boschen and Mills (1995), based on their reading of FOMC documents, rate the monetary policy as being in one of five categories: -2(strongly concretionary), -1(mildly contractionary), 0(Neutral), 1(mildly expansionary), and 2 (strongly expansionary).

Exhibit 1 uses this measure to portray the evolution of the monetary policy stance during the sample period 1977-1986. There were large swings in monetary policy stance in this period. During 1979-1981 (particularly after October 1979), the new Fed Chairman, Paul Volker, tightened monetary policy drastically to fight inflation (Walsh, 2004). This move was considered as unexpected and a surprise because it was generally believed to be political impossible for the Federal Reserve to initiate a restrictive monetary policy in the political and economic environments of the late 1970s. In March 1980, President Jimmy Carter also invoked the Credit Control Act of 1969 to authorize the Federal Reserve to restrict credit growth directly (Schreft, 1990). Therefore, these several years considered as strongly contractionary. In comparison, during 1985 and 1986 the monetary stance was considered as particularly loose (Kashyap, Lamont, and Stein, 1994). In the regressions we average the monthly ratings over a calendar year to measure monetary stance in a certain year.

[21] To measure local banking market concentration, we also calculate a Herfindahl measure at county level, based on loan market share. In year 1980, the average HHI in the sample is 0.41, which is considered as concentrated. (Local markets with HHI below 0.18 are deemed to be served by enough banks to assume that conditions are very competitive.) HHIs at county level remain rather constant over time, which corroborates other previous studies (e.g., Dick, 2006) that show that banking sector consolidations did not usually take place within a local market, but more in the form of geographic diversifications and expansions.

[insert Exhibit 1 about here]

We will also use the Funds-rate-based Bernanke-Mihov index (as portrayed in Exhibit 2) to test the robustness of our results. Bernanke and Mihov (1998) created the index using a flexible VAR model based on more specific assumptions about Fed operating procedures, which controls for the endogeneity of federal fund rates to economic conditions. Such measures based on Fed funds rates, however, are considered not very appropriate for this study's sample period, which mainly coincides with the tenure of Paul A. Volcker (August 1979 to August 1987), when Fed funds rates were not always the target of open market operations and were strongly volatile as a result of the targeting of aggregate bank reserve supply.[22]

[insert Exhibit 2 about here]

2.3.3. County-level economic structure

In county-banking states, banks are not allowed to branch across county boundaries. Therefore, local industrial structure is likely to be reasonable proxy for the industry mix of potential borrowers and (when interacted with monetary-policy stance) the local demand for credit. We obtain industrial structure data from the County Business Pattern database. Manufacturing employment share is defined as the share of workers employed in the

[22] As pointed out by Kashyap and Stein (2000), "both conventional wisdom as well as the formal statistical analysis of Bernanke and Mihov (1998) suggests that funds rate may be particularly inappropriate during the high-volatility Volcker period," because Volcker was mainly targeting bank reserve rather than funds rate in conducting his monetary policy. The Boschen-Mills index is usually considered to be a better indicator of monetary policy stance during this period. For the sample period, the two indices agree on the big-picture movement of monetary stance, but there are some important disagreements on the details. The Bernanke-Mihov index, based on the innovations to Fed funds rate determines that the 1979-1982 tightening started to be loosened in 1980, although in that year the Carter administration just imposed a harsh direct credit control measure. Then, in 1983 and 1984, the Boschen-Mills narrative index records a mild tightening comparable to the stance in 1981, while the Bernanke-Mihov index records a continuing loosening in 1983 and in general a less tightening environment in these two years. Finally, in 1985 and 1986, the Bernanke-Mihov index points to a much less dramatic loosening than does the Boschen-Mills index.

manufacturing sector. In our sample, on average 23% of workers are employed in the manufacturing sector and the share declines gradually over time. The average and the trend is consistent with the national numbers. Yet there is large heterogeneity (a standard deviation of around 15%) across counties, with Grate Lake states recording the highest manufacturing employment share in the nation and Rocket Mountain states the lowest.

3. Empirical Results

3.1. Loan volume fluctuations in response to monetary shocks

In Table 4, regression results are reported on what determines bank-level loan volume fluctuations (see Section 2.2. for explanations of the regression specifications). In Column (1), the results show that the coefficient on the diversified bank dummy is positive, which indicates that the loan volumes of diversified banks (i.e., subsidiaries of BHCs that operate in multiple counties) grow on average faster than do local banks, by nearly 1.2% yearly, regardless of monetary-policy stance.[23]

[insert Table 4 about here]

More important, the results also show that the coefficient on the interaction term "Diversified bank × Monetary policy stance" is significantly negative, which suggests that diversified banks lending is less sensitive to monetary contraction than is local banks lending, or in other words, the growth differential between diversified banks and local banks is wider during monetary tightening than during loosening.

The magnitude of the coefficient suggests that in a mildly *contractionary* environment

[23] This is inconsistent with Rose and Wolken's (1990) findings based on 1968-1983 data (and a smaller sample of banks) that affiliation with geographic-diversified bank holding companies provides only minor short-term benefits in market share expansion. Nevertheless, Rose (1999), using more recent data (1980-1996) produces results similar to ours.

(i.e., Boschen-Mills Index = −1) a diversified bank's lending grows annually, on average 2.1% faster than that of a similar local bank. In a mildly *expansionary* environment (i.e., Boschen-Mills Index = 1), in contrast, the differential can be as small as 0.3%. The difference is consistent with Dell'Ariccia and Garibaldi (2005) and Craig and Haubrich (2006)'s findings that the reallocation of credit across banks is more intensive and the cross-bank heterogeneity in lending growth is greater during downturns. The results suggest that internal capital markets of multi-county bank holding companies indeed help their local subsidiaries in weathering monetary tightening, and that the effects have been present since a much earlier date. Ashcraft (2003) for example concludes that the benefit of holding-company affiliation appeared only after the formal announcement of the Federal Reserve's source-of-strength doctrine in February 1987.

In Column (1), it is also found that the coefficient on "Manufacturing share × Monetary policy stance" is significantly positive, which confirms that lending volume in counties with a higher manufacturing employment share is indeed more sensitive to monetary policy change.[24] This result is consistent with theories on the interest-rate/cost-of-capital channel of monetary policy transmission mechanism,[25] and confirms our previous hypothesis that the interaction term between local manufacturing employment share and national monetary policy stance is a good proxy for a county's *demand* for loans. Local industrial structure has a direct impact on commercial and industrial loans demand, but it also influences demand for real estate and consumer loans through its influence on local income and employment growth.

In Column (2), results are reported for a regression that includes a triple interaction term "Diversified bank × Money Stance × Manufacturing Share." The coefficient is found to be

[24] A back-of-the-envelop calculation suggests that, after a switch of monetary stance from mildly expansionary to mildly contractionary, bank loan growth will be slowed down by on average 1.6% in a low manufacturing employment county, compared to on average 3.6% in a high manufacturing employment county. The results clearly show that monetary tightening have more negative consequence for high manufacturing employment counties.

[25] See for example Carlino and Defina (1998), Peersman and Smets (2005), and Braun and Larrain (2005). First, the manufacturing sector in general requires a higher level of capital investment and is more sensitive to interest rates. Second, demand for manufactured products, in particular in the durables sector, is more pro-cyclical and will create procyclicality in the manufacturing sector's demand for finance.

significantly positive, which suggests that local banks' greater lending procyclicality is less pronounced when a county employs more people in manufacturing. The magnitude of the coefficient suggests that in a mildly contractionary environment (Boschen-Mills Index = −1), in a county with 14.7% of workers in manufacturing (the 25th percentile county, representative of Great Plains states such as Arizona or Oklahoma), a diversified bank's lending grows 2.5% faster than that of a local bank, whereas in a county with 33.8% of workers in manufacturing (the 75th percentile county, representative of Great Lake states such as Michigan), a diversified bank grows only 1.8% faster, not very different from their normal speed.

Diversified banks' differential strength during monetary tightening and easing can be explained also by local credit demand. The manufacturing sector's demand for credit is more pro-cyclical because of the conventional interest-rate channel. Therefore, during monetary tightening, financial constraints for manufacturing firms are less binding than in other sectors, and thus the bank lending channel may not work as strongly where there are more manufacturing activities, because the contraction in loan volume in these places is mainly caused by demand-side instead of supply-side constraints. The results are also suggestive evidence that bank holding companies reallocate lending from low loan-demand counties to high loan-demand counties, or more precisely, from manufacturing-intensive counties to service-intensive counties during monetary contractions, and in the opposite direction during monetary expansions.

The results, on the other hand, also indicate that local banks tend to maintain relatively stable lending volume in manufacturing-intensive counties. This can be explained by stand-alone banks' lack of outside options to geographically diversify and allocate lending, even when the local demand for finance and lending opportunity is low (e.g., in manufacturing-intensive counties during periods of tight money). The regression results indicate that when manufacturing employment share exceeds 23% in a county, the difference in lending procyclicality between local banks and diversified banks becomes statistically indistinguishable from zero. Such counties account for about half of the sample. The results therefore indicate that diversified banks' less

pro-cyclical lending is most evident in service-oriented counties, where financial constraints are more likely to be binding during monetary tightening than during easing.

There are several other bank balance sheet characteristics that are suggested to affect lending sensitivity to monetary shocks. First, Kashyap and Stein (2000) find that smaller banks and less liquid banks are more sensitive to monetary shocks. Second, Van den Heuvel's (2001) theory suggests that less capitalized banks may be more sensitive to money tightening; and Van den Heuvel (2002) provides some evidence based on state-level data.[26] If diversified banks and local banks differ in size, liquidity, and capital-asset ratio, then their differential responses to monetary shocks could be driven by these factors, as opposed to their BHC affiliation status.

In the sample, although on average a diversified bank controls twice as much county market share as a local bank, they are in general *less* liquid and *less* capitalized. This is consistent with previous literature, which finds that larger and more diversified banks are able to take more risks (e.g., Demsetz and Strahan, 1997). In order to find out whether our results are driven by differences in these bank-specific characteristics, we also control for them in the regressions. We control for market share, balance sheet liquidity ratio and capital asset ratio (CAR)[27], respectively. All of them are lagged by one year to avoid endogeneity. Each of them also enters in interaction terms with the measure of monetary policy stance. We use local market share instead of absolute size to measure bank size, because in county-banking states bank size for both diversified and local banks is capped by the size of the host county economy size. As a matter of fact, in results unreported, we find that absolute size, as measured by the log of total loans, does not explain the

[26] Peek and Rosengren (1995) show that leverage-capital-constrained banks react little to monetary loosening, because an increase in the availability of reserves will not release a binding capital constraint, as happened in New England in early 1990s and in Japan in late 1990s. This also suggests that lending by capital-constrained banks is more stable across monetary cycles, unless a tightening (loosening) causes severe loan loses (higher profitability), which indirectly forces the banks to cut back (expand) on lending.

[27] During the sample period, the Federal Reserve set minimum capital requirement based on primnal capital to total asset ratio of about 6% (Keeley, 1988). Risk-weighted capital requirement was enacted much later following the 1988 Basel Accord.

difference in lending procyclicality between diversified and local banks.[28]

The results reported in Column (3) and (4) indeed confirm that lending by larger (in local market share) and more liquid banks responses less to monetary policy shocks.[29] Nevertheless, the coefficient on "Diversified bank × Money stance" remains significantly negative and the magnitude of the coefficient is only greater, which indicates that the differences in these characteristics do not explain away our main results. In Column (6), all the control variables are included simultaneously, and the results remain unchanged.

In Column (7), we use the Bernanke-Mihov measure to replace the Boschen-Mills measure of monetary policy stance, and re-estimate the regression, to test for the robustness of the results. We inflate the Bernanke-Mihov index by a factor of 20 to make it roughly comparable in scale with the Boschen-Mills index. The rank correlation coefficient between the Bernanke-Mihov index and the Boschen-Mills index during the sample period is 0.79. The main empirical results discussed above remain robust to this alternative measure of monetary policy stance.

3.2. Counter-cyclicality of bank liquidity buffer: diversified vs local banks

In the lending regressions, we find that diversified banks react less strongly to monetary shocks than do local banks. What can explain their relatively stable lending during periods of tight money? What explains their greater willingness and capacity in maintaining lending volume when local banks cut back on loans supply? We attempt to provide some explanations by studying the fluctuations of a bank's liquid assets, which are the substitute of loans in a bank's asset balance sheet.

[28] It implies that, large local banks (in absolute size) may still exhibit grater lending procyclicality than do small diversified banks.

[29] For the result on local market share, an alternative explanation (than the one that larger banks have easier access to wholesale funding) is that a dominant bank in a concentrated local market is more willing to maintain stable lending in bad times expecting that it can recoup the rents in good times from secured banking relationship. In a more competitive market, however, borrowers can easily switch to different lenders, and relationship banking becomes less attractive a strategy. Nevertheless, Boot and Thakor (2000)'s model shows that competition among banks actually encourages relationship banking.

The lending view of monetary transmission believes that central banks influence commercial banks through controlling liquidity available to banks. Facing a monetary tightening and outflow of insured deposits (and our data confirm that diversified banks do not have an advantage in retaining deposits), banks need either to cut back on loans or draw down on their liquid assets, but the later can create liquidity risks. Research in general shows that banks pursue counter-cyclical liquidity policy to hedge risks[30] (e.g., Aspachs, Nier, and Tiesset, 2005). But diversified banks (local subsidiaries of BHCs) may be able to resist this tendency, because they may benefit from the geographic diversification through the internal capital markets of the holding companies, and thus, are less affected by idiosyncratic and isolated local economic shocks.[31] Knowing that they may receive contingent liquidity support through internal capital markets from other subsidiaries located in different counties not perfectly correlated with their local conditions, diversified banks may be more willing than local banks to take on liquidity risks when the Fed reduces the supply of liquidity. In contrast, local banks, without the internal capital market of holding companies and mutual-insurance function of geographic diversification, in order to build up safer buffers against local economic shocks, usually have to hold greater amount of liquid assets, and thus, have to cut back on lending during recessions.[32] Finally, Carletti, Hartmann, and Spagnolo (2006)'s theory shows that this diversification effect dominates internalization effect when the relative cost of refinancing is high, which should suggest that

[30] Moreover, the opportunity cost of holding liquidity is lower during monetary tightening, when the interest rate margin is compressed and lending becomes less profitable.

[31] We are aware that, in Emmons, Gilbert and Yeager (2004), simulations of mergers among community banks show that the greatest (default) risk-reduction benefits are achieved by increasing a community bank's size, regardless of where the expansion takes place. However, risks are chosen endogenously by the banks. Morgan and Samolyk (2003), for example, show that geographic diversification increases banks' capacity in lending (i.e., loan-to-asset ratio). When a diversified bank decides to hold less liquid assets, it as a result loads up more liquidity risks, and therefore, the overall effect of diversification on the riskiness of the bank could be neutral even when these banks indeed enjoy the risk-reduction benefit of geographic diversification.

[32] Ehrmann and Worms (2004) argues that the existence of bank networks is important for banks' reactions to monetary policy. For the example of Germany, it is found that small banks access the interbank market indirectly through the large head institutions of their respective network organizations. The interbank flows within these networks allow smaller banks to manage their funds in a fashion that helps them in keeping their loan portfolio with nonbanks relatively unaffected after a monetary contraction.

diversified banks need to hold less liquid assets than local banks particularly during monetary tightening.

In Table 5, we use a bank's annual *change* of percentage point in liquidity ratio as the dependent variable, while retaining the same set of control variables, to study the determinants of a bank's liquidity position. Liquid assets include mainly Fed funds sold, securities purchased under agreements to resell, securities held to maturity and trading assets.[33] The data have shown that, the diversified banks exhibit lower liquid asset ratio than do the local banks, regardless of monetary policy stance. In the regressions we will instead focus on the *change* and examine whether the gap *grows wider* when monetary policy is tightened.

[insert Table 5 about here]

The regression results clearly show that a diversified bank's liquidity position behaves in an opposite way to its lending fluctuations. The results help identify the balance sheet composition dynamics that enable diversified banks to maintain relatively stable lending volumes. In periods of tight money, previous results show that diversified banks reduce lending less than local banks. Table 5 presents robust results showing that in periods of tight money diversified banks build up their liquidity buffers significantly *less* than do local banks, as evidenced by the significantly positive coefficient on the interaction term "Diversified Bank × Money". Further, the magnitude of the saving in liquidity holding (about one percentage point less for every Boschen-Mills index point increase) can explain most of the stronger loan growth of diversified banks versus local banks after receiving a restrictive monetary shock (as documented previously in the bank lending regressions).

[33] Following Kashyap and Stein (2000), the measure of a bank's liquidity is computed as RCFD0400 + RCFD0600 + RCFD0900+RCFD0380+ RCFD1350, prior to 1984. Between 1984 and 1992, it is computed as RCFD0390 + RCFD1350+ RCFD2146. Cash in vaults is not counted as liquidity because a greater portion of it is stored for purposes of reserve requirements. The balance sheet liquidity ratio is defined as the ratio of liquidity to total assets.

The results suggest that, subsidiaries of a holding company can afford to lower their liquidity ratio during monetary tightening because when facing an unexpected liquidity shock they can expect support from fellow subsidiaries located in other areas (and liquidity shocks are not perfectly correlated across geographic regions), whereas local banks have to hoard securities and other liquid assets to independently cope with such contingencies.

Finally, the results showing that geographically more diversified banks can at the margin make more liquidity available for the financial system, combined with the general trend of increasing consolidation and geographic expansion in the U.S. banking industry, may explain why Berger and Bouwman (2006) find that the amount of liquidity created by the U.S. banking system (by transforming illiquid assets into liquid liabilities) has grown substantially in recent periods.

3.3. Additional tests on the bank lending behavior

We also conduct additional tests to explore further the dynamics of bank lending behaviors, and to examine the robustness and validity of our empirical model. The results are reported in Table 6.

[insert Table 6 about here]

3.3.1. Does loan securitization potential matter?

We also control for a bank's risk management potential.[34] Loutskina (2005) shows that banks with more home mortgages in loan portfolios can better withstand monetary shocks,

[34] Previous literature also suggests other risk management techniques that can help shield bank lending from monetary shocks. For example, Purnanandam (2006) shows that banks using more interest rate derivatives for hedging purposes respond less to interest rate shocks. The data he uses are not available prior to 1985, but he also shows that smaller banks rarely use derivatives. Cebenoyan and Strahan (2004) show that banks engaging in loan purchases and sales activities can better withstand monetary shocks; the data however are available between 1987 and 1993 only.

because it is easier to securitize home mortgages due to the liquid market created by federal agencies. In 1980, about 10% of home mortgage loans were securitized, whereas in 1985 the ratio reached nearly 25%. During the same period, less than 5% of multifamily residential mortgage loans were securitized. A bank with more home mortgages on its balance sheet, therefore, is effectively more liquid (Estrella, 2002). In Column (1) of Table 6, results are reported for a regression that includes an interaction term between monetary policy stance and the ratio of home mortgages in a bank's loan portfolio (lagged by one year). The results however show that lending by banks with a higher home mortgage ratio is actually more sensitive to monetary policy shocks, probably because the cyclical demand for home mortgage dominates the supply side factor. Note that diversified banks on average have more (17% versus local banks' 15.7%) home mortgage in their loan portfolios. Our previous results still hold that diversified banks are significantly less sensitive to monetary policy shocks.

3.3.2. Does bank or bank subsidiary size matter?

Geographic diversification does not generate equal benefits for all bank holding companies or equal benefits for all subsidiaries of a bank holding company. A multi-county bank holding company that allocates only 10% of its assets outside the county where it is headquartered should benefit less than one that allocates 60%. Within a bank holding company, the lead subsidiary that accounts for 70% of the BHC asset should benefit less than the smaller ones that accounts for only 5%. To provide evidence for these hypotheses, we revise the definition of "Diversified Bank." Now a BHC subsidiary that accounts for more than 50% of group assets will be considered as a "Local Bank," because this lead subsidiary is less likely to receive substantial support from other smaller subsidiaries located outside its home county and should behave similar to local banks. This new definition reclassifies no more than 17% of diversified banks into local banks, and what remain as "diversified banks" under the new definition are those smaller subsidiaries that are not the lead banks in their respective holding companies. In Column (2), the results are reported based on this new definition and are more

comparable to Campello (2002) in which only smaller subsidiaries are included in the comparison. Our previous results still hold, and the magnitude of effects is stronger: The smaller subsidiaries, as predicted, indeed benefit disproportionately from geographic diversification than do the larger lead subsidiaries.

In Column (3), we also consider the possibility that the smaller community banks, by their large numbers, are driving the regression results. If the growth differential between diversified banks and local banks exists mainly in the smaller size group, the aggregate effect on the macro economy could be much smaller than the coefficients show. We thus estimate the regression based on only larger banks (both local and diversified banks) that control more than 10% of a county's loan market. Only half of the banks or bank subsidiaries in the sample exceed this threshold. The new regression results show that even local banks of substantial size (controlling >10% of local market share) respond stronger to monetary shocks than do diversified banks of similar size.

3.3.3. Does the state of the economy matter?

If banks perceive potential liquidity needs to be greater when a negative monetary shock is coupled with negative local economic shocks, then we should observe that diversified banks' smaller sensitivity to monetary tightening should be more evident during economic downturns versus upturns, because in the upturns liquidity constraints are less likely to be binding for both diversified banks and local banks. We measure economic cycles simply by state-level real GDP growth, to avoid the endogeneity between lending and growth at county level. The cross-sectional standard deviation of state-level annual growth rate is on average nearly 4% during the sample period, and exceeds 6% in year 1980 and 1986. Therefore, an identical national change in monetary policy stance may strike individual states at different stage of business cycle. In Column (4), we include in the bank lending regression both state-level real GDP growth, and a triple interaction term "Diversified bank × Monetary Policy × GDP growth".

The new interaction term enters with a positive sign, which suggests that after monetary

tightening, the lending volume gap between diversified banks and local banks is much wider in recession states. The magnitude of the coefficient suggests that, during a mild tightening (Boschen-Mills Index = −1), the lending volume of diversified banks is more stable than local banks unless the host states grow faster than 4.8% in that year. In year 1980 for example, these were Oklahoma, Texas, and Wyoming, three oil-producing states benefited by the rocketing oil prices. In contrast, in Michigan and Indiana, two states that experienced contraction of GDP by more than seven percent, local banks' lending volume, according to our empirical model, should contract the most compared with the diversified banks that operate in the same local markets. In 1986, the fortunate of the two groups of states was reversed as oil price plummeted, but so was the monetary stance, and thus, bank diversification again mattered less in the three oil-producing states. A back-of-the-envelop calculation would suggest that the three oil-producing states may have experienced much greater problems in the banking sector had the Fed chosen to tighten monetary policy in 1986. Fortunately (for the three states), by then President Ronald Reagan had managed to appoint several doves on Board of Governors.

In Column (5) and (6) we consider two special years to test for the validity of our empirical model specification. First, in 1980, the Carter administration imposed direct credit controls on the economy. The measures were considered to be strongly contractionary. If diversified banks can better withstand monetary tightening, then their lending should outpace local banks with a wider margin in 1980, even after the monetary policy stance was controlled for. In Column (5), we include an interaction term between the diversified bank dummy and the year 1980 dummy. The results confirm the hypothesis. Second, in 1986, the Reagan administration's Tax Reform Act repealed the regular portion of the Investment Tax Credit (ITC), which provided for a 10% tax credit on investment and affected the manufacturing sector disproportionately (Baker, 1984). This created a tax incentive for them to borrow more in 1986 (Gordon and MacKie-Mason, 1990; Ostergaard, 2001). If the empirical model of this study can capture local credit demand effectively, then we should expect overall lending volume to increase more in

manufacturing-intensive counties in 1986. In Column (6), the results are reported for a regression that includes an interaction term between manufacturing employment share and the year 1986 dummy. The results indeed show that lending increased more in manufacturing-intensive counties in 1986, after controlling for monetary policy stance. These two results based on large exogenous shocks show that the study's empirical model is well behaved in describing credit supply and demand fluctuations in the data.

4. Policy Implications

Our study is closely related to the literature that attempts to identify the bank lending channel of monetary policy transmission by studying the heterogeneous response to monetary shocks by individual banks of different characteristics such as liquidity condition (e.g. Kashyap and Stein [2000]), use of interest rate swap or loan sales to manage risks (e.g., Purnanandam [2006], Cebenoyan and Strahan [2004]). This study draws evidence from U.S. county-banking states in a ten-year period (1977-1986) and shows that (a) bank geographic diversification reduces the sensitivity of bank lending to monetary shocks and (b) the effect is stronger in counties where manufacturing employment share is smaller.

The two results may suggest that, in the United States, banks' increasing geographic diversification since the beginning of the 1980s, coupled with declining manufacturing employment share in the economy, may have reduced bank-loan supply's sensitivity to monetary shocks, and hence, lowered the efficacy of the bank lending channel of monetary transmission. As Cecchetti (1995) notes (in discussing the bank lending and balance sheet channels), "with the introduction of interstate banking and the development of more sophisticated pools of loans, it is only the balance sheet effects that will remain." Central bankers may need to take into account

this new development when conducting monetary policy operations.[35] The results also help shed light on the asymmetric impact of Euro zone common monetary policy on member countries. We suspect that a geographically fragmented banking system could partly explain why the German economy is more responsive to monetary shocks than are other European countries (as documented in Cecchetti [2001]).

This study's results also have implications for banking system stability. The results show that diversified banks hold less liquid assets and create more loans than do local banks during periods of tight money. Diversified banks, benefiting from the mutual-insurance function of geographic diversification, enjoy the comparative advantage in originating and funding loans (illiquid assets) during monetary contractions, and thus, end up supplying a larger share of lending when local banks have to rush for liquid assets. The net effect of geographic diversification on the safety of individual diversified banks is unclear: they benefit from the mutual insurance function of geographic diversification, but they have also loaded more risks accordingly (by holding less liquid assets during tough times). However, the impact of geographic diversification on the safety of the banking system as a whole is likely to be positive, because now some of the liquidity risks are shifted to the subsidiaries of the large bank holding companies, which enjoy the comparative advantage in burdening them in unfavorable monetary conditions. Calomiris (1993), for example, comparing the historical experiences of U.S. and Canada, suggests that the banking market fragmentation in the U.S. in the early part of the 20th century destabilized the banking system by creating small, poorly diversified banks that were vulnerable to bank runs and portfolio shocks. Bank geographic diversification may reduce the

[35]Empirical studies have shown that in recent periods the correlation between Fed funds rate changes and subsequent quarters' real GDP growth has reached near zero (Kuttner and Mosser, 2002; Estrella 2002; Boivin and Giannoni 2002; Taylor 1995), leading to the notion that monetary policy has become less effective. There have been many explanations. The results of this study provide one new explanation for the trend, that banks geographic diversification may have weaken the bank lending channel of monetary policy transmission. One important caveat to the extrapolation of past trends are the dynamic changes that have taken place since the 1980s, but we believe that the empirical results of this study, drawn from a relatively clear-cut and controlled "natural experiment," can shed light on how banks with a different level of geographical diversification react to monetary shocks. They can help us understand the basic interaction mechanism between bank market integration and monetary policy.

efficacy of monetary policy operations, but it also buffers the banking system against many other unfavorable shocks, including not only monetary shocks, but more importantly, real sector shocks, in particular those isolated shocks specific to particular regions only.

The greater stability of diversified banks loan volumes also has implications for relationship banking. One of the comparative advantages of financial institutions versus market finance is their ability to do intertemporal smoothing (Allen and Gale, 1997). Larrain (2006) shows that a developed banking sector helps smooth out industrial volatility by conducting counter-cyclical lending. Many factors (e.g., a bank's own financial health) can determine whether a bank is able to maintain a stable lending volume over time and to insulate its borrowers against negative shocks. Berlin and Mester (1999) for example show that the access to core deposits with inelastic rates permits a bank to make contractual agreements with borrowers that are infeasible if the bank must pay market rates for funds, and such access insulates a bank's costs of funds from exogenous shocks, allowing it to insulate its borrowers against exogenous credit shocks.[36] Previous studies have shown that banks geographic expansion may have cost savings effects. Our study provides new evidence for a novel channel in which the geographic diversification also may help banks avoid cutting back lending to relationship-based borrowers. If such a stable relationship and support is desirable for both the banks and their borrowers, then the diversified banks may be able to achieve higher market share and profitability. Studies have shown that, although geographic diversification of banks typically raises *profit* efficiency, it sometimes leads to lower *cost* efficiency (because there are small rooms for cost-cutting in diversified acquisition than in focused acquisitions) (Berger and Humphrey, 1992; Akhavein, Berger, and Humphrey, 1997; Berger, 1998).[37] The results of this study are consistent with the

[36] Also, Gatev and Strahan (2006) and Gatev, Schuermann, and Strahan (2006) both show that transactions deposits help banks hedge liquidity risk from unused loan commitments. As a result, users of credit line could consider banks with better access to core deposit as more reliable.

[37] Nevertheless, eographic diversification does not always lead to lower cost efficiency. Berger and DeYoung (2001) for example show that some efficient organizations can export efficient practices to

possibility that the benefits of bank geographic diversification are more likely to be achieved in the profit efficiency side (helped by stronger market positions) but not in the cost-saving side.

Several limitations remain with the current study, which we plan to address in the future. First, we have not yet distinguished between banking organizations with a different level of geographic diversification; some holding companies clearly stretch farther geographically to more regions than do others, and some holding companies operate in a set of regions that exhibit less synchronized business cycles with one another; and their subsidiaries may benefit more from such a wider geographic diversification than do those affiliated with a holding company that operates only in two neighboring and closely related counties. Nevertheless, in our sample, because of the county-banking restriction, the largest distinction that sets one group of bank apart from the other is whether a bank belongs to a holding company that operates in multiple counties. The stand-alone banks that operate in only one county are clearly "local", and comparing them with the rest of the banks are very useful in identifying whether geographic diversification affects bank lending behavior. Second, some holding companies have listed securities (equities and/or debts) in capital markets, and they may be able to tap the capital markets for funding when monetary policy is tightened. Such benefits can be passed onto their subsidiaries. In the study, we have not yet distinguished between publicly-listed and privately-held bank holding companies. We are seeking access to certain data (e.g. the lists of publicly-traded banks complied by SNL Securities) to be able to do that. Nevertheless, our perception is that, among the bank holding companies in our sample, only very few were publicly-listed during our sample period. The restrictions on bank expansions in the county-banking states had severely limited the size growth potential of the bank holding companies, and most of the banks therefore were too small to get access capital market. Therefore, we believe that the regression results are unlikely to materially change after controlling for some very large banks access to the capital market.

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distant affiliates, and suggest that some banks may be able to operate efficiently on a nationwide or international basis while others operate more efficiently within a single region.

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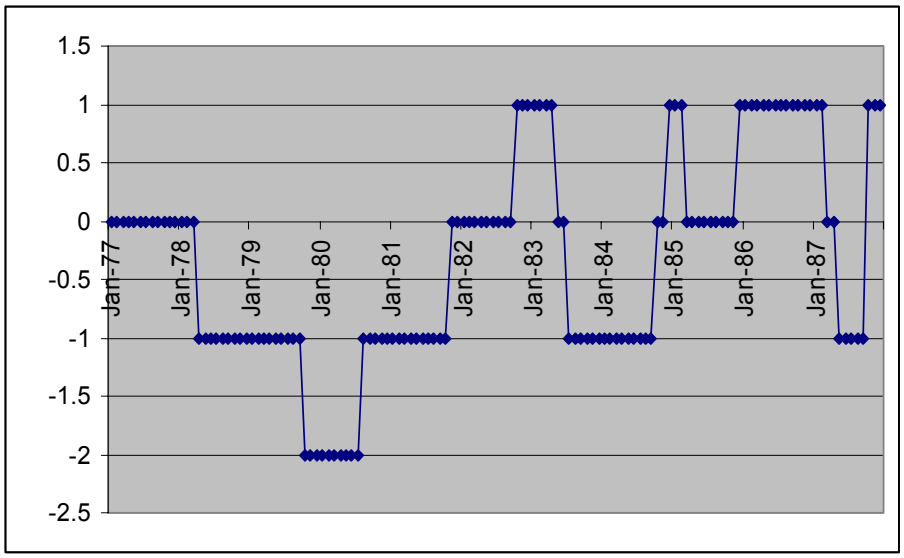
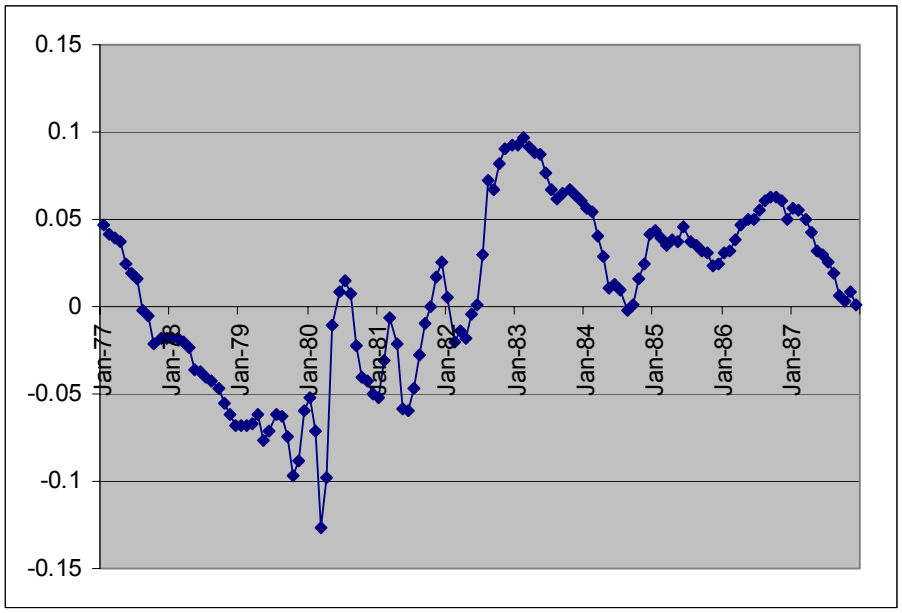
Exhibit 1: Boschen-Mills (1995) index of monetary policy stance



Boschen and Mills (1995), based on their reading of FOMC documents, rate Fed policy as being in one of the five categories: -2 (strongly concretionary), -1 (mildly contractionary), 0 (Neutral), 1 (mildly expansionary), and 2 (strongly expansionary). Exhibit 1 uses this measure to portray the evolution of the monetary policy stance during the sample period.

Exhibit 2: Bernanke-Mihov (1998) index of monetary policy stance



Bernanke and Mihov (1998) create the index based on a flexible VAR model that nests previous VARs based on more specific assumptions about Fed operating procedures. This index thus controls for the endogeneity of federal fund rates to economic conditions. High values indicate looser monetary policy stance. In the study, we inflate the index by a factor of 20 to make it comparable in scale with the Boschen-Mills index.

Tables 1: Timeline of branching deregulations

State	Deregulation date	Changes of restrictions	MBHC date	Changes of restrictions
Arkansas	01/01/94	(06/28/85) may take over out-of-county failed banks → Allowed into contiguous counties	02/05/71	Grandfathered BHCs
Colorado	08/01/91	Within 3,000 feet →Statewide by merger	N/A	No limitations
Illinois	09/01/88	→Contiguous counties	01/01/82	Prohibited → Home and contiguous regions
Indiana	07/01/89	Countywide→ Allowed into contiguous counties	07/01/85	Prohibited→BHC (10% cap)
Iowa	2001		N/A	8% cap
Kansas	04/30/87	→Statewide by merger	07/01/85	Prohibited → BHC (9% cap)
Kentucky	07/13/90	→Statewide by merger	07/14/84	Prohibited→3 banks in five years
Michigan	03/01/87	→Statewide by merger	04/??/71	Prohibited→No limitations
Minnesota	08/01/87	→Allowed in seven-county Minneapolis-St. Paul area	N/A	No limitations
Montana	01/01/90	→Statewide by merger, or de novo in adjoining county	N/A	No limitations
Nebraska	03/04/85	(03/31/83) failed bank→ Statewide by merger	09/01/83	Grandfathered→ (03/31/83) failed banks→9% cap
North Dakota	07/05/87	→Statewide by merger	N/A	No limitations
Oklahoma	03/16/88	→Statewide by merger	10/10/83	11% cap
Oregon	03/12/85	Restricted for city of less than 50,000 population in which another bank is located → statewide	N/A	No limitations
Tennessee	04/19/85	Countywide→ Previously operated as an affiliate of a BHC → Statewide (03/08/90)	N/A	Unlimited→ (03/03/74) five years old or same county, 16.5% cap→ (04/18/85) five years limit wavered if in a county of >200,000 residents
Texas	10/26/88	Countywide→ Statewide	08/18/70	Prohibited → No limitations
Wisconsin	08/01/89	25miles→statewide	N/A	No limitations
Wyoming	04/09/88	Failed bank→ Statewide by merger	N/A	No limitations

This table documents the timeline of branching deregulations in county-banking states. The second column, "deregulation date," indicates the date when a state first legalized bank branching across county boundaries, prior to which "county-banking" was practiced. As of 1985, none of 28 states in our sample had allowed branching across county boundaries. The third column briefly summarizes the changes initiated by the deregulations. See Amel (1993) for details. The fourth column, "MBHC date," indicates the date when formation of multi-bank holding companies was first legalized in a state. N/A indicates that MBHCs have always been legal. The fifth column briefly summarizes the changes of restrictions initiated by the statutory changes. For details also see Amel (1993).

Table 2: Summary statistics

Panel A: Bank characteristics (Diversified vs Local Banks)

	Mean		Median	
	Diversified	Local	Diversified	Local
Total Asset (000')	508,858	74,530	91,256	36,961
Total Loan (000')	292,772	40,318	52,194	19,223
County Market Share	0.235	0.173	0.195	0.096
Loan Growth Rate (%)	2.049	0.928	0.762	0.109
Loan to Asset Ratio	0.568	0.527	0.576	0.539
Deposit to Asset Ratio	0.873	0.884	0.892	0.896
Capital to Asset Ratio	0.075	0.087	0.072	0.082
C&I Loan Ratio	0.278	0.213	0.261	0.185
Real Estate Loan Ratio	0.357	0.324	0.345	0.309
Home Mortgage Ratio	0.198	0.189	0.170	0.157
Liquidity Ratio	0.297	0.363	0.287	0.352
Fed Funds Pur. Ratio	0.026	0.009	0.003	0.000
Fed Funds Sold Ratio	0.061	0.061	0.042	0.046
Lending Rate (%)	11.89	11.68	11.91	11.89
Deposit Rate (%)	6.25	6.05	6.29	6.24
Net Interest Margin (%)	5.64	5.65	5.48	5.48

Panel B: Distribution of bank size (total loan in thousands of 1993 constant USD)

Size distribution percentile	1978			1985		
	Diversified	Local	National Population	Diversified	Local	National Population
1%	4,605	1,775	2,165	3,975	1,761	1,974
5%	13,530	4,127	4,885	8,027	3,937	4,520
10%	17,808	5,897	7,227	11,833	5,647	6,746
25%	34,261	10,640	13,417	21,777	9,934	12,654
50%	67,311	21,552	28,355	47,352	19,068	26,947
75%	163,148	42,734	62,077	112,997	37,326	62,527
90%	428,143	85,091	161,102	313,848	70,704	176,463
95%	1,262,502	132,399	332,421	697,836	107,225	438,528
99%	6,027,880	387,841	1,821,513	5,080,295	297,450	2,615,301
No. Obs.	644	7,550	13,955	1,385	5,633	12,642

"National population" sample includes banks charted in any US states, while diversified banks and local banks are drawn only from the county-banking states.

Table 3: Time-varying banking market integration

State	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
Arkansas	0.09	0.08	0.08	0.08	0.09	0.09	0.13	0.33	0.36	0.43
Colorado	0.67	0.66	0.68	0.67	0.71	0.72	0.72	0.73	0.74	0.74
Illinois	0.03	0.53	0.57	**0.27**	**0.07**	0.62	0.64	0.63	0.63	0.66
Indiana	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.30	0.62
Iowa	0.27	0.28	0.28	0.29	0.32	0.33	0.36	0.40	0.42	0.44
Kansas	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.18	0.20
Kentucky	0.00	0.00	0.00	0.00	0.00	0.00	0.11	0.30	0.52	0.62
Michigan	0.65	0.68	0.70	0.73	0.75	0.77	0.78	0.84	0.85	0.87
Minnesota	0.57	0.58	0.58	0.60	0.62	0.66	0.68	0.70	0.71	0.71
Montana	0.56	0.56	0.56	0.59	0.67	0.69	0.69	0.68	0.69	0.69
Nebraska	0.09	0.14	0.14	0.18	0.19	0.19	0.30	0.36	N/A	N/A
North Dakota	0.34	0.34	0.34	0.35	0.34	0.42	0.43	0.43	0.42	0.41
Oklahoma	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.26	0.29	0.34
Oregon	0.32	0.34	0.37	0.68	0.64	0.65	0.65	0.72	N/A	N/A
Tennessee	0.43	0.43	0.43	0.42	0.44	0.47	0.56	0.41	N/A	N/A
Texas	0.51	0.56	0.58	0.60	0.65	0.71	0.74	0.75	0.74	0.73
Wisconsin	0.44	0.45	0.46	0.48	0.49	0.52	0.55	0.60	0.62	0.68
Wyoming	0.44	0.43	0.46	0.52	0.54	0.53	0.55	0.62	0.63	0.64

The table documents the evolution of banking market integration over time in county-banking states as bank holding companies acquire more assets out-of-county. Ratios in the table are loan market shares of diversified banks in state i in year t. The discrete jump of the ratio in Illinois during 1980 and 1981 was caused by the exit and re-entry into diversified bank status of the two largest banks in the state: Continental Illinois Bank (80, 81), and First Chicago Corp (81). N/A indicates that in state i and year t banks are allowed to branch across county borders and the bank market integration measure we are using becomes not applicable.

Table 4: Diversified banks lending is less sensitive to monetary shocks

Dependent Var.	Real annual growth rate of bank loan (%)						
Measure of Monetary Stance	Boschen-Mills						Bernanke-Mihov
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
SUPPLY-SIDE FACTORS							
Diversified	1.198 (0.227)***	1.231 (0.228)***	1.298 (0.229)***	1.329 (0.233)***	1.960 (0.235)***	1.988 (0.234)***	2.332 (0.204)***
Diver × Money	**-0.923 (0.250)*****	**-1.819 (0.438)*****	**-1.669 (0.440)*****	**-2.010 (0.441)*****	**-1.900 (0.454)*****	**-1.920 (0.449)*****	**-1.767 (0.402)*****
Diver × Money × $Manufacture_{t-1}$		3.701 (1.417)***	3.661 (1.417)***	3.939 (1.416)***	4.057 (1.395)***	4.090 (1.397)***	6.340 (1.343)***
DEMAND-SIDE FACTORS							
$Manufacture_{t-1}$	1.712 (0.697)**	1.587 (0.695)**	1.380 (0.703)**	1.688 (0.698)**	2.198 (0.700)***	1.994 (0.714)***	-0.557 (0.574)
$Manufacture_{t-1}$ × Money	5.338 (0.641)***	4.922 (0.645)***	4.498 (0.655)***	4.796 (0.648)***	5.168 (0.638)***	4.658 (0.656)***	2.825 (0.487)***
BANK CHARACTERISTICS INTERACTED WITH MONEY STANCE							
$Market\ Share_{t-1}$ × Money			-2.196 (0.570)***			-2.237 (0.613)***	-2.504 (0.401)***
$Liquidity_{t-1}$ × Money				-2.458 (0.845)***		-2.681 (0.965)***	-4.916 (0.767)***
CAR_{t-1} × Money					-2.134 (7.606)	-1.256 (7.745)	3.120 (5.983)
BANK AND BANK MARKET CHARACTERISTICS							
$Market\ Share_{t-1}$	-11.888 (0.560)***	-11.901 (0.560)***	-12.928 (0.666)***	-11.530 (0.573)***	-8.939 (0.567)***	-9.883 (0.703)***	-8.654 (0.568)***
$Liquidity_{t-1}$				2.629 (0.771)***		-0.505 (0.841)	1.335 (0.746)*
CAR_{t-1}					77.191 (6.959)***	77.479 (7.065)***	78.078 (5.587)***
HHI_{t-1}	6.695 (0.781)***	6.712 (0.781)***	6.724 (0.781)***	6.118 (0.787)***	3.397 (0.805)***	3.331 (0.802)***	3.302 (0.804)***
Observations	68678	68678	68678	68678	68678	68678	68678
R-squared	0.15	0.15	0.15	0.15	0.17	0.17	0.17

The dependent variable is the bank-level real annual growth rate of loans (%). "**Diver**" is the dummy variable for diversified banks; "**Money**" is the monetary stance index; "**Manufacture**" is a county's manufacturing employment share; "×" indicates interaction between two variables. Year and state dummy variables are included, but their coefficients are not reported. Standard errors reported in parentheses are adjusted for heteroskedacity, and are robust to clustering of residuals by county × year. Statistical significance at the 10%, 5%, and 1% levels is indicated by *, **, ***, respectively.
Definitions and data sources of the variables can be found in Section 2.2, Section 2.3, and the Appendix.

Table 5: Diversified banks liquidity ratio is less counter-cyclical

Dependent Var.	Annual Absolute Change in Liquidity Ratio (%)						
Measure of Monetary Stance	Boschen-Mills						Bernanke-Mihov
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
SUPPLY -SIDE FACTORS							
Diversified	-0.130 (0.088)	-0.137 (0.088)	-0.143 (0.088)	-0.515 (0.088)***	-0.114 (0.088)	-0.467 (0.088)***	-0.911 (0.078)***
Diver × Money	**0.844** **(0.100)****	**1.015** **(0.186)****	**1.002** **(0.186)****	**1.313** **(0.184)****	**1.014** **(0.187)****	**1.269** **(0.183)****	**1.021** **(0.165)****
Diver × Money × $Manufacture_{t-1}$		-0.708 (0.597)	-0.705 (0.597)	-1.328 (0.579)**	-0.698 (0.597)	-1.300 (0.578)**	-1.248 (0.553)**
DEMAND-SIDE FACTORS							
$Manufacture_{t-1}$	0.446 (0.269)*	0.470 (0.270)*	0.488 (0.270)*	0.157 (0.269)	0.489 (0.270)*	0.259 (0.269)	-0.003 (0.234)
$Manufacture_{t-1}$ × Money	0.208 (0.262)	0.288 (0.271)	0.326 (0.273)	0.530 (0.268)**	0.297 (0.272)	0.655 (0.269)**	0.597 (0.210)***
BANK CHARACTERISTICS INTERACTED WITH MONEY STANCE							
$Market\ Share_{t-1}$ × Money			0.196 (0.202)			0.498 (0.212)**	0.700 (0.156)***
$Liquidity_{t-1}$ × Money				3.267 (0.293)***		3.238 (0.287)***	3.341 (0.241)***
CAR_{t-1} × Money					0.034 (1.460)	-0.367 (1.688)	-1.090 (1.319)
BANK AND BANK MARKET CHARACTERISTICS							
$Market\ Share_{t-1}$	2.192 (0.219)***	2.194 (0.219)***	2.286 (0.232)***	1.221 (0.227)***	2.284 (0.225)***	1.754 (0.240)***	1.473 (0.235)***
$Liquidity_{t-1}$				-8.984 (0.285)***		-9.370 (0.268)***	-11.082 (0.261)***
CAR_{t-1}					2.382 (1.189)**	8.584 (1.409)***	8.681 (1.331)***
HHI_{t-1}	-1.561 (0.307)***	-1.564 (0.307)***	-1.565 (0.307)***	0.134 (0.315)	-1.664 (0.313)***	-0.179 (0.322)	-0.150 (0.323)
Observations	68678	68678	68678	68678	68678	68678	68678
R-squared	0.07	0.07	0.07	0.11	0.07	0.11	0.11

The dependent variable is the bank-level annual absolute change in liquidity ratio (%). "**Diver**" is the dummy variable for diversified banks; "**Money**" is the monetary stance index; "**Manufacture**" is a county's manufacturing employment share; "×" indicates interaction between two variables. Year and state dummy variables are included, but their coefficients are not reported. Standard errors reported in parentheses are adjusted for heteroskedacity, and are robust to clustering of residuals by county × year. Statistical significance at the 10%, 5%, and 1% levels is indicated by *, **, ***, respectively.
Definitions and data sources of the variables can be found in Section 2.2, Section 2.3, and the Appendix.

Table 6: Sensitivity of bank lending to monetary shocks: additional tests

Dependent Var.	Real annual growth rate of bank loan (%)					
	(1)	(2)	(3)	(4)	(5)	(6)
	Potential for Securitization	Small subsidiary (group share <50%)	Large bank (market share>10%)	State-specific business cycle	1980 Carter Credit Control	1986 Tax Reform
Diversified	1.200	0.730	0.154	1.508	1.304	1.204
	(0.226)***	(0.253)***	(0.228)	(0.236)***	(0.228)***	(0.227)***
Diver × Money	**-1.894**	**-2.133**	**-1.560**	**-1.827**	**-2.114**	**-1.561**
	(0.434)***	**(0.473)*****	**(0.408)*****	**(0.438)*****	**(0.462)*****	**(0.433)*****
Diver × Money × $Manufacture_{t-1}$	3.686	3.579	3.110	3.260	3.481	2.587
	(1.408)***	(1.519)**	(1.271)**	(1.415)**	(1.410)**	(1.399)*
$Manufacture_{t-1}$	1.025	1.634	2.248	0.044	1.598	-1.033
	(0.696)	(0.697)**	(0.682)***	(0.682)	(0.696)**	(0.802)
$Manufacture_{t-1}$ × Money	3.583	5.006	5.097	1.560	4.950	2.087
	(0.656)***	(0.646)***	(0.626)***	(0.646)**	(0.646)***	(0.756)***
HHI_{t-1}	6.578	6.446	6.696	6.368	6.713	6.689
	(0.779)***	(0.777)***	(0.743)***	(0.764)***	(0.781)***	(0.778)***
Market $Share_{t-1}$	-11.830	-11.661	-7.724	-11.866	-11.902	-11.892
	(0.560)***	(0.554)***	(0.593)***	(0.550)***	(0.560)***	(0.559)***
Home $Mortgage_{t-1}$ × Money	4.944					
	(0.661)***					
Home $Mortgage_{t-1}$	0.886					
	(0.111)***					
Diver × Money × GDP growth				0.178		
				(0.043)***		
GDP growth				0.396		
				(0.028)***		
Diver × Year 1980					-1.917	
					(0.701)***	
Manufacture × Year 1986						13.501
						(2.362)***
Observations	68678	68678	35099	68678	68678	68678
R-squared	0.15	0.15	0.17	0.15	0.15	0.15

The dependent variable is the bank-level real annual growth rate of loans (%). "**Diver**" is the dummy variable for diversified banks; "**Money**" is the monetary stance index; "**Manufacture**" is a county's manufacturing employment share; "×" indicates interaction between two variables. Year and state dummy variables are included, but their coefficients are not reported. Standard errors reported in parentheses are adjusted for heteroskedacity, and are robust to clustering of residuals by county × year. Statistical significance at the 10%, 5%, and 1% levels is indicated by *, **, ***, respectively.
Definitions and data sources of the variables can be found in Section 2.2, Section 2.3, and the Appendix.

Appendix: Variable Definition Table

Variable	Definition	Underlying Data Source
Total loan	Call Report item RCFD1400 plus RCFD2165 prior to 1984, and RCFD1400 alone in and after 1984	Call Report
Loan growth	Natural log of total loan at year t minus the natural log of total loan at year t-1, and adjusted for inflation; in percentage term	Call Report
Liquidity ratio growth	Liquidity ratio at year t minus the liquidity ratio at year t-1, in percentage term	Call Report
Diver(sified)	Dummy variable for diversified banks, which are affiliated with bank-holding companies that own subsidiaries in multiple counties	Call Report
Money	Measure of monetary policy stance; A higher (lower) value indicates a more expansionary (contractionary) policy stance.	based on either Boschen and Mills (1995), or Bernanke and Mihov (2001)
Manufacture	Manufacturing employment to total employment ratio, of a county	County Business Patterns
Market share	Deposit market share of a bank in a county	Call Report
Liquidity	Liquid asset to total asset ratio	Call Report
CAR	Equity to total asset ratio	Call Report
HHI	Herfindahl measure of market concentration at the county market level	Call Report
Home mortgage	Home mortgage loan to total loan ratio	Call Report
GDP growth	Real GDP growth rate at state level, in percentage term	Bureau of Economic Analysis
Year 1980	Dummy variable for year 1980, when Carter administration imposed direct credit control	
Year 1986	Dummy variable for year 1986, when the Tax Reform Act came into effect	