Liquidity Shocks, Local Banks, and Economic Activity: Evidence from the 2007-2009 Crisis*

Juan Carlos Gozzi† and Martin Goetz‡

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Abstract

This paper studies the relationship between shocks to local banks and economic activity, by exploiting differences in the liability structure of small U.S. commercial banks during the 2007-09 crisis. Banks that relied more heavily on wholesale liabilities reduced lending relatively more during the crisis than banks funding themselves with retail deposits, suggesting that the use of short-term wholesale funding exposed banks to a sudden dry-up in market liquidity. Moreover, metropolitan areas where banks relied more on wholesale liabilities experienced larger reductions in employment and establishments during the crisis, suggesting that adverse shocks to banks hurt the economy. This effect was stronger in areas with more bank-dependent firms, such as small businesses and firms with higher external financing needs.

Keywords: banking and financial crisis, wholesale funding, credit
JEL Classification Codes: E44, E51, G01, G21, G01

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†Department of Economics, Brown University. Email:Juan_Carlos_Gozzi_Valdez@brown.edu
‡Federal Reserve Bank of Boston

1 Introduction

This paper studies the relationship between shocks to local banks and economic activity. By exploiting differences in the liability structure of small U.S. commercial banks during the 2007-09 crisis we analyze (I) whether banks that were more exposed to liquidity shocks to wholesale funding markets modified their lending relatively more, and (II) whether metropolitan areas where banks had higher exposure to wholesale funding markets experienced different changes in economic activity during this period. A salient feature of the 2007-09 crisis was a dry-up of liquidity in short-term wholesale funding markets. We analyze whether banks transmitted fluctuations in their funding to their business lending. Furthermore, we study whether areas that were more exposed to these liquidity shocks through their local banks experienced larger decreases in employment and establishments during the crisis.

Although theoretical work articulates how adverse shocks to banks can curtail economic activity by decreasing the supply of credit (Angeloni and Faia, 2009; Gertler and Kiyotaki, 2010), empirical evidence on the linkages running from banks' financial condition to credit supply to economic activity is inconclusive. The empirical evidence shows that changes in bank liquidity are correlated with changes in loan volumes and economic activity (Bernanke, 1983; Bernanke and Blinder, 1992) and that output and credit decrease during periods of bank distress (Eichengreen and Rose, 1998; Kaminsky and Reinhart, 1999). However, this evidence does not help to disentangle the direction of causality, since shocks to banks are usually correlated with changes in overall economic conditions, which affect loan demand and economic activity, irrespective of any potential changes in credit supply. Moreover, reductions in bank lending may have little effect on output if firms can access alternative financing sources. A large literature has tried to overcome these identification problems using different strategies (Gertler and Gilchrist, 1994; Peek and Rosengren, 2000; Ashcraft, 2005; Khwaja and Mian, 2008). While the existing evidence suggests that banks tend to respond to shocks by reducing lending, evidence on the effects of these changes in credit supply on aggregate economic activity has proved less conclusive (Driscoll, 2004; Ashcraft, 2006; Jiménez et al., 2010).

The 2007-09 crisis has brought the debate on the link between bank performance and economic activity to the forefront once more. The financial turmoil that started in early 2007 with increased defaults on subprime mortgages was followed by the collapse of financial markets, the failure of some of the largest financial institutions in the world, and a severe economic downturn. According to the National Bureau

of Economic Research, the U.S. economy experienced its longest recession since the Great Depression between 2007 and 2009. Accounts of the crisis argue that liquidity and solvency problems in financial institutions led to a credit contraction, which contributed to the economic downturn.[1] Concerns about the negative effects of bank distress on economic activity also motivated the massive government interventions to provide support to financial institutions during the crisis.

However, it is not clear whether and to what extent bank distress actually contributed to the economic downturn, or whether banking sector problems simply reflect the recession itself. First, the same shocks that triggered banking sector problems may have also led to a decline in aggregate demand. The 2007-09 crisis originated in the collapse of the real estate market, and hence, shocks to underlying fundamentals might have caused the economic downturn. Earlier research finds a strong connection between the housing market and economic fluctuations in the U.S. (Green, 1997; Gauger and Snyder, 2003; Leamer, 2007).[2] The decline in housing prices may have negatively affected consumer spending, through a reduction in household wealth, and could have increased uncertainty, leading firms to postpone investment and reducing demand for credit.[3] Other shocks may have also contributed to depressing economic activity and credit demand during this period (Hamilton, 2009; Campbell et al., 2010). In sum, economic activity and lending could have decreased during the 2007-09 crisis, even in the absence of a feedback effect from banks' financial condition to credit supply.

In addition, even if liquidity and solvency problems among banks led to a reduction in credit supply during the crisis, such a reduction might not have lowered economic activity. If firms can access non-bank financing sources or can rely on internal funds to finance their activities, reductions in bank lending may have little real effect. Over the last decades, financial innovation, coupled with the rise of new financial intermediaries, has led to a decrease in the relevance of commercial banks in the U.S. financial system (Boyd and Gertler, 1994; Feldman and Lueck, 2007). This suggests that, even if liquidity and solvency problems affected banks' ability to engage in financial intermediation, firms may have been able to access alternative

[1]For detailed overviews of the financial crisis, see Adrian and Shin, 2010; Brunnermeier, 2009; Caballero and Krishnamurthy, 2009; Diamond and Rajan, 2009; and Gorton, 2009.

[2]IMF, 2008, for instance, finds that all recessions in the U.S. over the past 35 years, with the exception of the recession of the late 1970s, were preceded by slowdowns in residential investment similar in magnitude to that experienced starting in mid-2006.

[3]There is significant discussion regarding the actual magnitude of the wealth effects generated by changes in housing prices. See, for example, Carroll et al., 2006; Mishkin, 2007; Buiter, 2010; and Calomiris et al., 2009.

financing sources. From a different perspective, Bates et al., 2009 find that U.S. industrial firms held an abundance of cash prior to the crisis. This raises the possibility that firms may have been able to weather reductions in bank financing during the crisis without reducing investment and output.[4]

Accounts of the 2007-09 crisis argue that liquidity shocks in financial markets played a major role in the unfolding of the crisis, but whether these shocks affected bank lending and ultimately economic activity is not clear. A salient feature of the crisis was a sharp decline in liquidity in short-term wholesale funding markets, especially following the failure of Lehman Brothers in September 2008 (Acharya and Merrouche, 2009; Brunetti et al., 2009; Gorton, 2009). Commercial banks have traditionally financed themselves with retail deposits, but in recent years have increasingly relied on wholesale funding sources, such as repos, commercial paper, interbank loans, and wholesale deposits (i.e., large insured deposits), to finance their activities (Huang and Ratnovski, 2010; Raddatz, 2010). This increased reliance on wholesale funding exposed banks to the sudden dry-up in liquidity in these markets that occurred during the crisis (Brunnermeier, 2009; IMF, 2010). However, whether banks transmitted these fluctuations in their funding to their lending and whether this in turn contributed to the economic downturn is not clear. First, if most banks could easily substitute across financing sources or responded to these liquidity shocks by reducing holdings of other assets, then lending may have been relatively unaffected (Boyson et al., 2010). Second, as mentioned above, even if banks responded to shocks by reducing credit supply, this may have had little real effect if firms had access to non-bank financing sources or could rely on internal funds.

In this paper, we analyze whether small U.S. commercial banks cut back their business lending when faced with negative liquidity shocks to their funding during the crisis, and whether this had any effects on local economic activity at the metropolitan area (MSA) level.[5] We first analyze whether small banks that were more exposed to wholesale funding markets reduced their lending relatively more during the crisis. Then, we examine whether MSAs where banks relied more heavily on wholesale funding experienced larger decreases in employment and establish-

[4]Federal Reserve Chairman Ben Bernanke argued that "(...) as a whole, the nonfinancial business sector remains in good financial condition, with strong profits, liquid balance sheets, and corporate leverage near historical lows" during his testimony to Congress on February 2008.

[5]Metropolitan statistical areas (MSAs) are geographic entities that contain a core urban area of 50,000 or more inhabitants and also include any adjacent counties that have a high degree of social and economic integration (as measured by commuting to work) with the urban core.

ments during this period. We focus on small commercial banks for two reasons. First, these banks tend to lend mostly to local firms, which makes it easier to link their financial condition to local economic activity. Distance plays an important role in business lending, in particular for small businesses, as geographic proximity facilitates monitoring and screening (Petersen and Rajan, 2002; Brevoort and Hannan, 2006).[6] Second, analyzing the behavior of small commercial banks during the crisis is interesting in itself, because these banks account for relatively large fraction of small business lending and little is known about how they fared during the crisis.[7] When analyzing changes in economic activity, we focus on differences across MSAs because these are considered to be the relevant geographic lending market for small banks (Gilbert and Zaretsky, 2003; Hannan and Prager, 2004; Laderman and Pilloff, 2007).

We first find that small banks with a higher dependence on wholesale financing decreased their lending relatively more following the failure of Lehman Brothers. This effect is not only statistically significant but also economically large, as our results suggest that banks in the top 25 percent in terms of exposure to wholesale funding reduced their business lending by about 1.6 percent per quarter during the crisis (relative to what it would have been in normal times). Banks in the bottom 25 percent, on the other hand, decreased their lending only by 0.8 percent per quarter over the same period.

These findings are consistent with the idea that banks responded to shocks to their funding sources by reducing the supply of loans. At the same time, however, shocks to the real economy, as well as increased uncertainty, may have led to a reduction in the demand for credit during the crisis. While a decline in demand may have resulted in an overall reduction in lending, it is not clear why it should have generated differences in lending across banks, particularly along the lines of our partition scheme. One possibility is that banks with higher dependence on wholesale funding tend to lend to firms whose credit demand fell more during the crisis. To address this issue, we control for several bank characteristics and differences in the evolution of banks' geographical markets during the crisis period. Specifically, our

[6]For instance, Wolken and Rhode, 2002 find that the median distance between a small firm and its bank is about ten miles. Proximity to borrowers seems to be particularly relevant for small banks, which tend to rely more on soft information (Berger et al., 2005).

[7]Commercial and industrial loans by small banks (defined as those below the 90th percentile of the asset size distribution) represented 11 percent of the total business lending by banks as of June, 2007. Moreover, small banks accounted for over 25 percent of total bank lending to small businesses (defined as commercial and industrial loans with original amounts below 250,000 dollars).

results hold when including, alternatively, state-time fixed effects and MSA-time fixed effects to capture unobserved changes in local demand conditions over time. Furthermore, we also find that our results are robust to including several proxies for the characteristics of borrowers.

Building upon these findings, we exploit geographical variation to study whether differences across MSAs in exposure to liquidity shocks were associated with differences in economic activity during the crisis. We find that those MSAs where banks relied more heavily on wholesale funding experienced larger decreases in employment and establishments during the crisis.

These findings are consistent with the idea that adverse shocks to bank liquidity had a negative effect on economic activity. However, shocks to the real economy, as well as increased uncertainty, may have also contributed to the slowdown of business activity. Similarly, shocks to financial markets in general (and not necessarily to local commercial banks) may have made it more difficult for firms to access external financing during the crisis. Even though these arguments predict that economic activity should decline during the crisis, they do not imply that we should observe larger declines in activity in MSAs with higher dependence on wholesale funding, which is what we find. One possibility is that MSAs where banks relied more heavily on wholesale funding also have industries that were more affected by (real or financial) shocks during the crisis. To address this issue, we control for several MSA characteristics, as well as differences in the evolution of regions during the crisis by including region-time fixed effects in our regressions. We also conduct our analyses excluding sectors that were directly affected by shocks during this period (e.g., construction) and those MSAs that are more likely to have been affected by these shocks. Our findings remain unchanged.

Finally, we examine these findings in greater depth by exploiting differences across MSAs in the degree of bank dependence. In particular, we analyze whether the negative effect of banks' exposure to wholesale funding on economic activity during the crisis was larger in those MSAs with higher fractions of bank-dependent firms. If our results capture the impact of banks' financial condition on lending and the local economy, we would expect this to be the case. Consistent with this hypothesis, we find that the effect of banks' exposure to wholesale funding on economic activity was stronger in (1) MSAs with a higher fraction of employment in small firms (which tend to rely relatively more on bank credit as a source of financing) and (2) MSAs with a higher fraction of employment in industries more dependent on external finance. These results suggest that shocks to bank funding had a larger

effect on economic activity in areas where businesses rely more on bank financing, consistent with the idea that banks played a role in transmitting these shocks to the local economy.

Our paper contributes to several strands of economic research. On the one hand, it is related to research on the effects of bank distress on economic activity during crises. A large literature discusses the consequences of bank distress for the U.S. economy during the Great Depression. Bernanke (1983) argues that the contraction in bank lending that followed bank failures during 1930-33 contributed to the magnitude of the Great Depression. Consistent with this argument, Calomiris and Mason (2003) find that local credit supply explains income growth variations across states during this period. Findings by Rockoff (1993) and Cole and Ohanian (2001), however, question the impact of bank lending on economic activity during the Great Depression. Another strand of this literature exploits cross-country differences in the timing of banking crises jointly with differences across industries to identify the real effects of bank distress. Kroszner et al. (2007) and Dell'Ariccia et al. (2008) find that industries that depend more on external finance perform relatively worse during banking crises, which they interpret as consistent with the hypothesis that bank distress affects output.

Our work is also related to research focusing on the effects of local banks and financial markets on economic activity (Guiso et al., 2004). Becker (2007) finds that MSAs with higher levels of deposits have more firms, and also more new firm starts, suggesting that local loan supply can affect business activity. Ashcraft (2006), on the other hand, does not find a significant relationship between loan supply and changes in personal income at the state level. Similarly, Driscoll (2004) finds that, while shocks to money demand at the state level are associated with large changes in bank lending, these changes in loan supply have little effect on state output. Ashcraft (2005) analyzes the effect of exogenous' small bank failures in the U.S. on county business activity. He finds that bank loans and county income declined in two cases where the Federal Deposit Insurance Corporation closed healthy subsidiaries of bank holding companies to cover losses at other affiliated banks. In contrast, Gilbert and Kochin (1989) and Clair and O'Driscoll (1994) find little evidence that bank failures affect county output.

Moreover, our paper also complements a growing body of empirical research that analyzes the 2007-09 crisis. Several papers study the behavior of U.S. banks during the crisis (Santos, 2009; Boyson et al., 2010; Contessi and Francis, 2009; Huang,

2010).[8] Using data on syndicated loans, Ivashina and Scharfstein (2010) show that new loans to large borrowers fell during the financial crisis and that this decrease was larger among banks with less deposit financing. Syndicated loans are usually large and only a small number of big banks actively participate in this market (the sample in their paper covers less than 40 banks). Our findings complement their work by presenting evidence on changes in lending during the crisis for a much larger sample of banks (our sample covers almost 7,000 banks) and focusing on small banks. Moreover, we have much more detailed data on bank characteristics, which allows us to better control for differences among banks. Closer to our work, Cornett et al. (2010) study how U.S. commercial banks managed liquidity during the crisis. Analyzing within-bank variation in asset composition, they find that banks with less liquid assets and less transaction deposits increased their holdings of liquid assets during the crisis, which in turn reduced their capacity to make new loans. Our findings on changes in bank lending during the crises are broadly consistent with their results, although we focus on cross-sectional differences among banks and analyze changes in total lending, instead of focusing on the composition of assets. Moreover, different from their paper, we also analyze how shocks to bank funding affected local economic activity during the crisis.

Some papers have also tried to analyze the effects of the 2007-09 crisis by exploiting differences across firms. For instance, Almeida et al. (2009) find that firms that had a large fraction of their debt maturing right after the third quarter of 2007 reduced investment more than other firms. Duchin et al. (2010) find that firms with greater cash holdings reduced their investment less at the beginning of the crisis, which they interpret as consistent with a reduction in the supply of external finance. In contrast, Kahle and Stulz (2010) analyze firm-level financial policies and conclude that there is little evidence of a contraction in credit supply for the firms in their sample. Different from these papers, we do not analyze whether the financial crisis affected firms in general, but rather focus on the transmission of financial shocks to the real economy through local commercial banks. Moreover, we do not analyze changes in firm behavior but rather focus on aggregate outcomes.

The remainder of this paper is organized as follows. Section 2 briefly discusses the use of wholesale funding markets by commercial banks and presents an overview the main events in these markets during the crisis. Section 3 describes our data

[8]There is also a growing body of research on the lending behavior of banks in other countries during the crisis. Among others, Albertazzi and Marchetti (2010) analyze the case of Italy, Iyer et al. (2010) present evidence from Portugal, and Puri et al. (2010) focus on retail lending in Germany.

sources. Section 4 presents the empirical strategy and results of our analysis of changes in bank lending during the crisis. Section 5 presents our analysis of changes in economic activity at the MSA level. Section 6 analyzes differences in the effect of dependence on wholesale funding across MSAs. Section 7 concludes.

2 Wholesale funding and the 2007-09 financial crisis

2.1 Wholesale Funding

Commercial banks have traditionally financed their operations primarily with retail deposits. However, in recent years, due to several reasons (financial innovation, competition from non-bank financial intermediaries, deregulation), banks have increasingly relied on other sources of financing, such as commercial paper, repos, interbank loans, and large-denomination certificates of deposit. These types of financing are typically known as wholesale funds. Wholesale funding tends to be short-term and is more informationally sensitive than traditional funding through retail deposits (Gorton, 2009).

Earlier research on wholesale financing focused on the advantages of a broader funding base and the potentially positive effects of increased market discipline on bank stability. Access to wholesale funding may allow banks to exploit valuable opportunities without being constrained by local deposit supply and may provide financing in case of unexpected retail deposit withdrawals (Goodfriend and King, 1998). Wholesale funding may also increase bank stability, by serving as a disciplining device for banks to act in investors' best interest, which reduces the risk of bank failure (Calomiris, 1999). However, more recent research has highlighted the "dark side" of reliance on wholesale funding, as it exposes banks to liquidity dry-ups (Rajan, 2006) and can lead to inefficient liquidation when wholesale depositors are uninformed (Huang and Ratnovski, 2010).

2.2 Summary of events in wholesale funding markets during the 2007−09 financial crisis

In the following, we provide a short overview of the 2007-09 financial crisis, focusing on events in wholesale funding markets. More comprehensive accounts of the financial crisis are provided by Adrian and Shin (2010), Brunnermeier (2009),

Diamond and Rajan (2009), and Gorton (2009)).

The trigger of the 2007-09 financial crisis is considered to be an increase in subprime mortgage defaults in the U.S. in early 2007 (Brunnermeier, 2009). Subprime mortgages played a relatively small role in the U.S. mortgage market, accounting for about 12 percent of the total mortgage volume, so most analysts expected these increased defaults to have limited consequences. However, in the summer of 2007 the crisis took hold, as two hedge funds run by Bear Stearns that specialized in the subprime mortgage market experienced liquidity problems. Additionally, Countrywide Financial Corp, a major U.S. home loan lender, announced a drop in earnings. The downgrade of several tranches of subprime-related mortgage deals by Moody's, Standard & Poor's, and Fitch also suggested deeper problems in these markets.

In August 2007, liquidity in the asset-backed commercial paper (ABCP) market, an important source of financing for many banks, dried-up, as a result of increased concerns regarding the quality and valuation of structured products and the failure of several banks to provide liquidity support to off-balance sheet entities. Banks had been moving mortgages and other loans off-balance sheet into investment vehicles that financed themselves by selling commercial paper with an average maturity of 90 days. Although these entities were off-balance sheet, the liquidity risk remained in the banking system because sponsoring banks granted credit lines to insure them in case investors stopped buying their commercial paper. As investors became concerned about the quality of the collateral backing asset-backed commercial, they stopped refinancing maturing commercial paper. In July 2007, IKB, a small German bank, was unable to provide liquidity support when one of its investment vehicles could not roll-over its commercial paper. This shattered confidence in the credit lines provided by banks and led to the collapse of the ABCP market, with the amount outstanding falling by almost 35 percent by end-2007.

The collapse of the ABCP market sparked concerns over banks' exposure to their off-balance sheet vehicles and led to an increase in the perceived default and liquidity risk of banks. As a result, banks began hoarding liquidity, cut back credit lines, and even ceased to lend to each other, leading to an "illiquidity wave" in interbank lending markets (Brunnermeier, 2009). This is illustrated in Figure 1, which shows the LIBOR-OIS spread, which is the difference between the 3-month London Inter-Bank Offered Rate (LIBOR) and the overnight interest swap (OIS) rate. The LIBOR rate is the interest rate paid on unsecured loans among banks, whereas the OIS rate is a proxy for the expected risk-free interest rate. The difference between the two is a measure of counterparty and liquidity risk in interbank lending markets. As shown

in Figure 1, the LIBOR-OIS spread almost quadrupled in two days, increasing from 0.13 percent in August 8, 2007 to 0.47 percent in August 10. Central banks around the world reacted to the freeze in interbank markets by providing liquidity to the financial sector. The Federal Reserve lowered the discount rate and broadened the type of collateral banks could post. Moreover, in November 2007 it created the Term Auction Facility (TAF) to allow banks to bid anonymously for three-month loans using a broad set of collateral. These measures helped to resuscitate the U.S. interbank market (McAndrews et al., 2008; Cecchetti, 2009).

The next large event of the financial crisis was the insolvency and brokered bailout of investment bank Bear Stearns in March 2008. Investors started to worry about the financial health of Bear Stearns because of its high exposure to the mortgage market. These concerns were intensified by Bear Stearns' high leverage, eventually leading to a run on its assets by its hedge fund clients and other counterparties. The Federal Reserve considered Bear Stearns to be "too interconnected to fail" because its trades were spread out across many counterparties. Therefore, the Federal Reserve Bank of New York helped broker a deal through which JP Morgan Chase acquired Bear Stearns. To further ease the liquidity problems of investment banks, the Federal Reserve opened its discount window to these financial institutions through the newly created Primary Dealer Credit Facility.

The most significant events of the crisis took place in September 2008, when investment bank Lehman Brothers and insurance company AIG failed. Although Lehman Brothers had survived the fallout of Bear Stearns in March 2008, it did not take actions to strengthen its equity base to weather possible liquidity shortages. When further liquidity problems arose in the second half of 2008, bankruptcy seemed unavoidable. The Federal Reserve Bank of New York tried to broker a bailout of Lehman Brothers. However, since the U.S. Treasury and the Federal Reserve decided not to provide governmental guarantees, and banks were unwilling to take over Lehman without such guarantees, bankruptcy was inevitable. In the same week, serious liquidity shortages led to the collapse of insurance company AIG, which was very active in the market for structured products. Due to its interconnectedness, the Federal Reserve decided to bail out AIG in exchange for an 80 percent equity stake.

These events rippled through the financial system. Lehman Brother's failure generated losses in money market funds that had invested in its commercial paper. In particular, Reserve Primary Fund, a large money market fund, experienced significant losses on its 785 million Dollars holdings of Lehman's commercial pa-

per and, as a result, its net asset value fell below one dollar ("broke the buck"), meaning that investors lost principal (Kacperczyk and Schnabl, 2010). This had only happened once before in the history of money market funds and led to a broad run on these funds. Within a few days, more than 200 million Dollars flowed out of non-government money market funds and their assets under management fell by almost 25 percent in three weeks. Due to the size and severity of these events, the U.S. Treasury announced a temporary extension of deposit insurance to all money market investments, which helped stop the run.

These events were followed by a significant reduction in liquidity in wholesale funding markets. Money market funds were among the main purchasers of commercial paper. But following the failure of Lehman they reduced their holdings of commercial paper, leading to a collapse of the commercial paper market for financial institutions (Figure 2). The amount outstanding of financial commercial paper fell by almost 30 percent in just one month. This led to the introduction of the Commercial Paper funding Facility by the Fed. Money market funds also pulled back from the repo market and scaled down their non-government repo holdings. Furthermore, increased concerns about the solvency of financial institutions led to a significant decline in wholesale deposits, further reducing funding liquidity for banks that relied on these financing sources (Figure 2).

The increase in counterparty risk following the failure of Lehman Brothers resulted in precautionary hoarding of liquidity by financial institutions, and banks froze lending through the interbank lending market. The LIBOR-OIS spread reached historically record-high levels, dwarfing the increase observed during the summer of 2007 (Figure 1).

As this brief overview has highlighted, a salient feature of the 2007-09 crisis was a sharp decline in liquidity in short-term wholesale funding markets, especially following the failure of Lehman Brothers in September 2008. From this perspective, IMF (2010), for instance, argues that "the inability of multiple financial institutions to roll over or obtain new short-term funding was one of the defining characteristics of this crisis." Consistent with this view, recent research suggests that exposure to wholesale funding may be behind the failure of some financial institutions and played a significant role in the propagation of the crisis (Shin, 2010; Raddatz, 2010).

3 Data sources

3.1 Data on bank-level variables

All of the bank-level variables used in our analyses are obtained from the Report of Condition and Income data ("Call Reports").[9] All banking institutions regulated by the Federal Deposit Insurance Corporation, the Federal Reserve, or the Office of the Comptroller of the Currency must file these reports on a regular basis. These reports include complete balance sheet and income statement data, as well as data on off-balance sheet activities, for each bank. We collect quarterly data on insured commercial banks in the 50 states of the U.S. and the District of Columbia over the period March 2006-December 2009. As described above, we focus our analysis on small banks. Following the literature (e.g., Campello, 2002) we define small banks as those below the 90th percentile of the asset size distribution in a given quarter. We use the most recent merger file from the Federal Reserve Bank of Chicago to identify mergers and acquisitions, which may create jumps in balance sheet variables. We exclude banks in any quarter in which they are involved in merger activity. This leaves us with a sample of almost 7,000 banks with over 90,000 bank-quarter observations.

3.2 Data on MSA-level variables

We conduct our analyses of changes in economic activity during the crisis at the metropolitan statistical area (MSA) level. MSAs are geographic entities, defined by the U.S. Office of Management and Budget (OMB), that contain a core urban area of 50,000 or more inhabitants and also include any adjacent counties that have a high degree of social and economic integration (as measured by commuting to work) with the urban core.

The main data source for our analysis of economic activity at the MSA level is the Quarterly Census of Employment and Wages (QCEW) from the Bureau of Labor Statistics (BLS), which provides data on employment, establishments, and wages by industry at different regional aggregation levels. The QCEW derives its data from quarterly tax reports submitted by employers subject to state unemployment insurance laws and federal agencies. These tax reports provide information on the number of people employed and wages paid in each quarter. Based on the

[9] We employ the version of the Call Reports made publicly available online at the Federal Reserve Bank of Chicago's website.

location and industrial activity of each reporting establishment, data are aggregated by industry to the county level and higher aggregate levels. We collect quarterly data on the number of workers and establishments by industry at the metropolitan statistical area (MSA) level for the period March 2006-December 2009.

The QCEW program serves as a near census of monthly employment information by industry at different regional levels, covering about 99.7% of all wage and salary civilian employment in the U.S. Excluded from the program are members of the armed forces, the self-employed, proprietors, unpaid family workers, and railroad workers covered by the railroad unemployment insurance program. Data on employment in the QCEW represent the number of workers who received pay during the month. Data on establishments, in turn, represent the number of economic units that produce goods or provide services, such as farms, mines, factories, or stores.

To control for conditions in local real estate markets, we use the House Price Index (HPI) calculated by the Federal Housing Finance Agency (FHFA). The HPI is a weighted repeat-sales index, meaning that is measures price changes in repeat sales or refinancings of the same properties to correct for differences in the quality of houses being sold at any point in time.[10] The information for the construction of the index is obtained from conventional conforming mortgages on single-family properties purchased or securitized by Fannie Mae or Freddie Mac since 1975. We collect quarterly data on the HPI at the metropolitan statistical area (MSA) level for the period March 2006-December 2009.[11]

Additional variables are taken from other sources. Per capita income is from the Bureau of Economic Analysis regional accounts. Total population is from the Census Bureau. Data on the fraction of employment accounted for by small businesses come from the Statistics of U.S. Businesses (SUSB) collected by the Census Bureau. We also use firm-level data from Compustat for the period 1990-2000 to calculate industry-level financial dependence following Rajan and Zingales (1998).

[10]The HPI index supplements repeat sales data with appraisal information.

[11]For some MSAs, the FHFA reports data on housing prices for metropolitan divisions, which are smaller groupings of counties that make up an MSA. For these MSAs, we aggregate data on quarterly changes in house prices at the MSA level by taking the average quarterly change across all divisions that make up an MSA. Similar results are obtained if we consider the maximum or minimum quarterly change across all divisions within an MSA.

4 Changes in bank lending during the crisis

As the overview of the 2007-09 crisis in Section 2 highlights, concerns about the solvency and liquidity of the financial system led to a significant reduction in liquidity in wholesale funding markets, especially following the failure of Lehman Brothers in September 2008. This section analyzes the effects of this liquidity shock on banks' lending behavior, by exploiting variation in the liability structure of banks to identify those banks that relied more on wholesale funding.

4.1 Empirical strategy and variables

4.1.1 Empirical model

To analyze the effect of the reduction of liquidity in wholesale funding markets on bank lending, we estimate the following baseline regression, using quarterly data on bank characteristics for the period March 2006-December 2009.

$$\begin{aligned} y_{i,r,t} &= \gamma_0 + \gamma_1 y_{i,r,t-1} + \alpha F_{i,r,t-1} + \beta F_{i,r,t-1} \times C_t + \\ &\quad + \delta X_{i,r,t-1} + \lambda X_{i,r,t-1} \times C_t + \sum_t \eta_t + \sum_r \theta_r + \epsilon_{i,r,t}, \quad (1) \end{aligned}$$

where $y_{i,r,t}$ is a measure of lending by bank i from region r during period t, $F_{i,r,t-1}$ is a lagged measure of the bank's exposure to wholesale funding. C_t is a dummy variable that captures the crisis period and equals one following the failure of Lehman Brothers in September 2008, and zero before. $X_{i,r,t-1}$ are lagged values of additional bank-level characteristics, η_t and θ_r are a series of time and region fixed-effects, respectively.

Our main coefficient of interest is β, which captures the extent to which banks that relied more on wholesale funding modified their lending relatively more after the failure of Lehman Brothers. If banks with a higher dependence on wholesale funding were not able to easily access alternative financing sources, they may have experienced difficulties in funding their activities as liquidity in wholesale markets decreased, potentially leading them to cut back on new lending. This argument would predict β to be negative. On the other hand, if banks could easily substitute across financing sources or responded to the liquidity shocks by reducing holdings of other assets, the structure of their liabilities should not have affected their lending activity during the crisis. These arguments would predict β to be insignificant.

Our empirical approach relies on differences across banks in their exposure to

shocks to wholesale funding markets following the failure of Lehman Brothers to identify reductions in the supply of credit.[12] During this period, shocks to the real economy, as well as increased uncertainty, may have led to a reduction in the demand for credit. However, while a decline in loan demand may have resulted in an overall reduction in lending, it does not necessarily lead to differences in lending activity across banks, particularly along the lines of our partition scheme. One possibility is that banks with higher wholesale funding may have lent to firms whose credit demand also fell more during the crisis. To address this issue, we control for bank characteristics and differences in the evolution of banks' geographical markets during the crisis period. Moreover, we also find that our results are robust to controlling for several proxies for lender characteristics. We discuss this issue in greater detail below.

4.1.2 Variable definitions and descriptive statistics

To capture banks' reliance on wholesale funding sources, we use the ratio of non-core liabilities to total assets. Non-core liabilities, as defined in the Uniform Bank Performance Report (UBPR), are the sum of total time deposits of 100,000 dollars or more, foreign office deposits, insured brokered deposits issued in denominations of less than 100,000 dollars, securities sold under agreements to repurchase, federal funds purchased, and other borrowed money.[13] The first three variables measure banks' exposure to wholesale deposits, while the last three variables measure banks' dependence on non-deposit financing sources, such as repos, federal funds (interbank) loans, commercial paper, and debentures.

To measure banks' lending activity, we use three alternative variables based on commercial and industrial (C&I) loans. C&I loans include loans for commercial and industrial purposes to business enterprises (proprietorships, partnerships, and corporations) and have been the focus of most of the literature. By focusing on C&I loans, we also avoid possible confounding effects that could arise from including real-estate loans in our dependent variable, since these loans were directly affected by the

[12]This approach is similar to that followed in the literature on the bank lending channel of monetary policy, which has exploited cross-bank differences in several characteristics, including size (Kashyap and Stein, 1995, Kashyap and Stein, 2000), capitalization (Kishan and Opiela, 2000), and affiliation with a bank holding company (Ashcraft, 2006), to analyze the effects of changes in monetary policy on lending.

[13]The UBPR is a report published by the federal banking agencies (Federal Deposit Insurance Corporation, Board of Governors of the Federal Reserve System, and Office of the Comptroller of the Currency) that summarizes information on a bank's performance and balance-sheet composition and is used for bank supervisory, examination, and management purposes.

collapse of the housing market during the crisis.[14] Our first measure of C&I lending is the change in the logarithm of the stock of C&I loans. To account for the provision of lines of credit by banks, we define our second measure of lending as the change in the logarithm of C&I loans plus other unused commitments.[15] Following the failure of Lehman Brothers many corporate borrowers withdrew funds from pre-existing lines of credit due to concerns about the solvency and liquidity of the banking sector. These increased precautionary drawdowns resulted in an increase in the stock of on-balance sheet C&I loans of commercial banks, although banks were not voluntarily granting new loans (Huang, 2010; Ivashina and Scharfstein, 2010). Thus, taking into account changes in unused commitments seems particularly relevant to analyze lending during this period. Because drawdowns increase the stock of on-balance sheet loans and decrease unused commitments (which are off-balance sheet) by a similar amount, our variable is unchanged by drawdowns of pre-existing C&I commitments. Our third measure of lending is the change in the logarithm of C&I loans plus other unused commitments, adjusted for net loan charge-offs.[16] When a loan is charged-off, outstanding loans decrease by the amount of the charge-off. This reduces the stock of loans on the bank's balance sheet, but does not represent a change in actual lending, since it only reflects losses from pre-existing loans. Our variable eliminates changes in the stock of C&I loans due to losses on past loans and therefore provides a better proxy for (net) new lending by banks.[17]

We include several additional bank-level controls in the regressions ($X_{i,r,t-1}$ in equation (1) above). These are variables used in the literature to explain variations in loan growth, including bank capitalization (Tier 1 capital/adjusted total assets), the ratio of non-performing loans (loans 90 days or more past due plus non-accruing loans) to total loans, the ratio of total loans to assets, and the logarithm of assets.

[14] C&I loans exclude all loans secured primarily by real estate, even if for commercial and industrial purposes. As a robustness test, we conducted all our analyses using total loans instead of C&I loans to construct our dependent variables and obtained results similar to those reported throughout the paper.

[15] Unused C&I commitments are not reported separately in the Call Reports. Following the literature (e.g., Kashyap et al., 2002), we use "Other Unused Commitments" as a measure of outstanding C&I credit facilities. This item includes, among other things, commitments to extend credit through overdraft facilities or commercial lines of credit, retail check credit and related plans, and overdraft protection programs in which the bank advises account holders of the available amount of protection.

[16] This variable is defined as the log of (C&I loans$_t$ + other unused commitments$_t$ + Net loan charge-offs$_t$) - log of (C&I loans$_{t-1}$ + other unused commitments$_{t-1}$).

[17] As a robustness test, we conducted all our analysis considering only the change in C&I loans adjusted for loan write-offs (without including unused commitments) as our dependent variable and obtained results similar to those reported throughout the paper.

In addition, we also control for three variables that may be particularly relevant for explaining bank lending behavior during the 2007-09 crisis. First, we control for a measure of total unused loan commitments.[18] Unused loan commitments expose banks to liquidity risk, as they allow borrowers to take down a loan on demand. This risk materialized when borrowers increasingly withdrew funds from pre-existing lines of credit following the failure of Lehman Brothers. Banks with higher exposure to unused commitments may have increased their precautionary holdings of liquid assets to meet the higher demand for funds, potentially reducing new loan origination (Ivashina and Scharfstein, 2010; Cornett et al., 2010). Second, we control for the ratio of real estate loans to total loans, which measures banks' exposure to the real estate market through their lending portfolio. Finally, in some specifications we also include a dummy variable that equals one if the bank sold any residential mortgages during that quarter and zero otherwise to proxy for banks' involvement in originate-and-distribute activities.[19] Being able to transfer loans to a third party provides banks with an additional source of funding, allowing them to expand their lending (Cebenoyan and Strahan, 2004; Franke and Krahnen, 2007; Goderis et al., 2007). When securitization activity slowed down during the 2007-09 crisis, banks that were more involved in originate-and-distribute activities may have faced increasing funding problems, potentially leading them to curtail lending (Loutskina, 2010). Moreover, some papers suggest that originate-and-distribute activities were associated with lower mortgage quality (Dell'Ariccia et al., 2009; Mian and Sufi, 2008; Keys et al., 2010), thus this variable might also proxy for the underlying quality of banks' residential mortgage portfolio. Appendix Table 1 presents detailed definitions of all the variables used in our analyses.

As described in equation (1) above, we include the interaction between all bank-level controls and a dummy variable that captures the crisis period. Specifically, since liquidity in wholesale funding markets decreased significantly following the failure of Lehman Brothers, we include a dummy that equals one starting on September 2008 and zero before.

Table 1 displays summary statistics for all bank-level variables included in our

[18]This variable is defined as total unused commitments$_t$/(total unused commitments$_t$+total assets$_t$). We define the variable this way so that it is expressed as a ratio between zero and one (note that unused commitments are off-balance sheet, so they are not part of total assets).

[19]Data on residential mortgage sales are only available starting in the third quarter of 2006. Data on mortgages sold include mortgages transferred off-balance sheet and securitized by the reporting bank and mortgages sold to a third party, such as another financial institution, Fannie Mae, or Freddie Mac, which then securitizes them. They also include sales of mortgages that were not securitized.

analysis. The top panel presents data for all banks in our sample and the bottom panel shows data only for banks headquartered in metropolitan statistical areas (MSAs). As mentioned earlier, we focus on MSAs because they are considered to be the relevant geographic market for small commercial banks in the U.S. (Gilbert and Kochin, 1989). Furthermore, in Section 5 we analyze differences in economic activity across MSAs during the crisis.

The top panel of Table 1 shows that banks in our sample tend to be relatively small, with median total assets of 109.7 million dollars. In terms of dependence on wholesale funding, on average non-core financing represents about 22.6 percent of total assets for the banks in our sample, with relatively large differences across banks (the first decile of the ratio of non-core financing to assets equals 9.4 percent, while the ninth decile equals 37.5 percent). The bottom panel of Table 1 shows similar patterns for most of our control variables when restricting the sample to banks headquartered in MSAs. These banks tend to be bit larger (with median total assets of 140.1 million dollars) and display a relatively similar dependence on wholesale funding, with the ratio of non-core financing to assets averaging 24.7 percent.

4.2 Results

4.2.1 Full bank sample

Table 2 presents the results of regressions of changes in lending on bank characteristics, including all the banks in our sample. Standard errors are adjusted for clustering at the bank level. Columns (1)-(4) display the results of regressions using the change in C&I loans as a dependent variable, columns (5)-(8) present results using the change in C&I loans plus other unused commitments as dependent variable, and columns (9)-(12) show results using this last variable adjusted for net loan charge-offs as outcome variable.

The results in Table 2 show that those banks with a higher dependence on wholesale financing decreased their lending relatively more following the failure of Lehman Brothers. Columns (1), (5), and (9) present the results for our baseline specification described in equation (1) above, including time and state fixed effects. These results show that the coefficient on the interaction between the crisis dummy and the ratio of non-core financing to total assets is negative and significant at the one percent level, consistent with the hypothesis that banks that were more exposed to liquidity shocks reduced their lending relatively more during the crisis. In contrast,

the coefficient of non-core financing over assets is positive and significant, suggesting that during normal times banks that use more wholesale financing expanded their lending relatively faster. The coefficient on the other interaction terms suggest that banks with more loans as a fraction of assets increased their lending relatively more during the crisis, while those with a higher exposure to real estate loans reduced lending more during this period.

A possible concern is that banks with a higher dependence on non-core financing might be located in areas that experienced larger decreases in real activity during the crisis and therefore our results may capture reductions in loan demand. To address this issue, columns (2), (6), and (10) display regressions including state-time fixed effects, which allow us to control for time-varying differences across states. These regressions yield similar conclusions as those described above, that is, banks that had a higher ratio of non-core liabilities to total assets reduced their lending relatively more during the crisis.

Another possibility is that our results capture changes across banks that occurred after the crisis started. While it is not clear how this would affect our conclusions, we estimate our regressions taking the pre-crisis values of the control variables displayed in Table 1. That is, we include lagged values of these variables up to September 2008 and from then on take the value of these variables as of September 2008.[20] These results are reported in columns (3), (7), and (11). The coefficient on the interaction between the crisis dummy and the ratio of non-core financing to total assets remains negative and significant at the one percent level for all our dependent variables. Finally, in columns (4), (8), and (12) we estimate the regressions taking the pre-crisis values of the displayed controls and including also a dummy variable that captures banks' participation in mortgage originate-and-distribute activities.[21] The coefficient on our main variable of interest is not affected by the inclusion of this additional control. Moreover, the results indicate that banks that were involved in mortgage sales reduced their lending relatively more during the crisis period, consistent with the argument that when securitization markets shut down, banks that were more involved in originate-and-distribute activities faced increasing

[20]For these regressions, we take the September 2008 values only for those variables displayed in the table, while allowing the rest of the bank-level controls to vary over time. We do this because we want to control for changes in variables that may have been affected by the crisis, such as bank capital and the fraction of non-performing loans.

[21]We only include the dummy for residential mortgages sold in those regressions that use pre-crisis values of the displayed variables because, after September 2008, there was a large increase in mortgages sold by banks which was not driven by increased market securitization activities, but rather by government purchases of mortgage-backed securities.

funding problems, leading them to curtail lending.

The results in Table 2 suggest that the effect of banks' exposure to wholesale funding on their lending activity during the crisis is not only statistically significant, but also economically relevant. For instance, the coefficient on the interaction between the crisis dummy and the ratio of non-core financing to assets in column (4) implies that those banks in the top 25 percent in terms of exposure to non-core funding reduced their C&I lending by 1.6 percent per quarter during the crisis (relative to what it would have been in normal times), while those banks in the bottom 25 percent decreased their lending only by 0.8 percent per quarter over the same period.

4.2.2 Banks headquartered in MSAs

The results in Table 2 are consistent with the hypothesis that those banks that were more exposed to wholesale funding reduced their lending relatively more following the failure of Lehman Brothers. However, these results could be affected by differences in the evolution of banks' geographical markets during this period. In particular, while in Table 2 we include state-time dummies to account for time-varying differences across states, the relevant market for the banks in our sample may not be a state. In fact, as mentioned above, the literature suggests that MSAs constitute the geographic market for small commercial banks in the U.S. (Gilbert and Kochin, 1989). Therefore, we re-estimate our regressions focusing only on banks headquartered in MSAs. This allows us to better control for possible changes in the local demand conditions that banks may have faced during the crisis.

Table 3 presents the results of the regressions of changes in lending on bank characteristics, restricting the sample to banks headquartered in MSAs. This table follows a similar structure as Table 2. Columns (1)-(4) display the results of regressions using the change in C&I loans as a dependent variable, columns (5)-(8) present results using the change in C&I loans plus other unused commitments as dependent variable, and columns (9)-(12) show results using this last variable adjusted for net loan charge-offs as outcome variable.

The results in Table 3 show that banks with a higher dependence on wholesale financing decreased their lending relatively more during the crisis period, even when controlling for possible changes in demand conditions at the MSA level. Columns (1), (5), and (9) present the results controlling for state-time fixed effects. These regressions are similar to those reported in Table 2. Columns (2), (6), and (10) present the results of the regressions controlling for MSA-time fixed effects. The

results show that, even when controlling for time-varying differences across MSAs, banks that were more exposed to wholesale funding reduced their lending relatively more during the crisis. Results for the other control variables are also similar to those reported in Table 2. The results remain unchanged when using the pre-crisis values of the displayed variables and also when controlling for banks' involvement in residential mortgage sales.

4.3 Discussion

The results presented in Tables 2 and 3 are consistent with a reduction in the supply of credit by banks that were more exposed to liquidity shocks following the failure of Lehman Brothers. One possible concern regarding this interpretation is that our estimations also show that banks with a higher ratio of non-core funding to assets expanded their lending relatively faster during normal periods, suggesting that these banks may also have different lending policies. For instance, these banks might have lower lending standards. In this case, our results may be capturing differences in the underlying credit quality of the C&I loan portfolio of banks, which might have materialized during the crisis period, and not differences in their funding sources.

However, several pieces of evidence suggest that this is not the case. First, Tables 2 and 3 show that all our results remain unchanged when adjusting C&I lending for loan charge-offs, thus the results are not only capturing differences in loan write-downs during the crisis. Second, in additional robustness tests we also estimate all the regressions including other control variables that may proxy for the credit quality of banks' C&I lending portfolio and obtain similar results. In particular, we estimate the regressions controlling for the fraction of non-performing C&I loans and the average interest rate on C&I loans. Finally, if exposure to non-core financing is simply capturing cross-bank differences in the expansion of lending before the crisis then, once we account for these differences, the non-core financing variable should not be statistically significant. However, we find that, even if we include additional variables to control for banks' lending expansion, our main results hold. In particular, we estimate the regressions in Tables 2 and 3 controlling for up to three lags of the dependent variables and obtain similar results. We also estimate all our regressions controlling for the average growth rate of the lending variables between 2001 and 2005 to proxy for differences in banks' pre-crisis expansion patterns and obtain similar conclusions, that is, those banks with a higher dependence on wholesale financing reduced their lending relatively more during the

crisis. Appendix Table 2 displays some of these robustness tests.

As discussed above, the underlying identification assumption for our analysis is that differences across banks in changes in loan demand during the crisis period were not correlated with banks' dependence on wholesale financing. If banks that relied more on wholesale funding also lent to borrowers that were more affected by the crisis, then our results may be capturing reductions in credit demand and not only changes in supply. In the regressions reported in Tables 2 and 3 we try to account for cross-bank differences in changes in demand by controlling for several bank-level characteristics and by including, alternatively, state-time fixed effects and MSA-time fixed effects to capture unobserved changes in local demand conditions over time. However, it is possible that, even within a given banking market, banks that relied more on wholesale funding also lent to borrowers that were particularly affected by the crisis.

To address this issue, we estimate all our regressions including several additional control variables that may proxy for the characteristics of borrowers. First, as mentioned above, we control for the fraction of non-performing C&I loans and the average interest rate on C&I loans, which may proxy for the riskiness of borrowers. Second, we also control for the share of small business lending, given that small firms might have been differently affected by the crisis.[22] We find that all our results are robust to the inclusion of these additional controls. Appendix Table 2 reports some of these robustness tests.

Furthermore, we also estimate our regressions replacing the crisis dummy with a continuous variable to measure conditions in wholesale funding markets. In particular, we include the interaction between all our bank-level controls and the LIBOR-OIS spread which, as described in Section 2, is a measure of liquidity and counterparty risks in interbank lending markets. Appendix Table 3 reports some of these regressions. We find that the interaction between the LIBOR-OIS spread and the ratio of non-core financing to assets tends to be negative and statistically significant, consistent with the hypothesis that banks that had a higher exposure to wholesale funding markets reduced their lending relatively more as conditions in these markets worsened. For these findings to be explained only by reductions in credit demand it would have to be the case that, within a particular banking market, commercial banks with a higher exposure to wholesale funding on average lent more to firms whose demand for bank financing increased in periods with lower LIBOR-OIS

[22]We control, alternatively, for the share of C&I loans with original amounts below 100,000 dollars and below 250,000 dollars and obtain similar results to those reported above.

spreads and decreased in periods with higher spreads.

5 Changes in MSA economic activity during the crisis

The results in Section 4 are consistent with a reduction in the supply of credit by banks that were more exposed to liquidity shocks to wholesale funding markets following the failure of Lehman Brothers in September 2008. In this section, we study whether differences across metropolitan areas in the exposure of local banks to these liquidity shocks were associated with differences in economic activity. Specifically, we aggregate bank-level characteristics at the MSA level, and analyze whether MSAs where banks relied more heavily on wholesale funding experienced larger decreases in employment and establishments during this period.

5.1 Empirical strategy and variables

5.1.1 Empirical model

To analyze whether differences across MSAs in their exposure to wholesale funding were associated with differences in economic activity during the crisis, we estimate the following regression, using quarterly data on MSA characteristics for the period March 2006-December 2009.

$$\begin{aligned} y_{i,t} \quad = \gamma_0 + \gamma_1 y_{i,t-1} \quad & + \alpha F_{i,t-1} + \beta F_{i,t-1} \times C_t + \theta B_{i,t-1} + \phi B_{i,t-1} \times C_t + \\ & + \delta X_{i,t-1} + \lambda X_{i,t-1} \times C_t + \sum_t \eta_t + \epsilon_{i,t}, \end{aligned} \tag{2}$$

where $y_{i,t}$ is a measure of changes in economic activity in MSA i during period t and $F_{i,t-1}$ is a lagged measure of the aggregate exposure of banks in the MSA to wholesale funding. C_t is a dummy variable that captures the crisis period and equals one in every quarter following (and including) September 2008, and zero before. $B_{i,t-1}$ are lagged values of additional bank characteristics aggregated at the MSA level, $X_{i,t-1}$ are lagged values of other MSA characteristics, and η_t are a series of time fixed effects.

Our main coefficient of interest is β, which captures the extent to which MSAs where banks relied more heavily on wholesale funding experienced different changes in economic activity following the failure of Lehman Brothers. The results in Section

4 are consistent with the hypothesis that banks with a higher exposure to wholesale funding markets were more affected by liquidity shocks to these markets and reduced their business lending relatively more during the crisis. If firms depend on local commercial banks to finance their activities, and could not easily access alternative financing sources when these banks were affected by shocks to their funding, then we would expect β to be negative. On the other hand, if firms could easily access non-bank financing sources, or could rely on trade credit or internal funds to finance their activities, then the exposure of banks in a particular MSA to wholesale funding should not have affected local economic activity during the crisis. Besides, even if firms depend on bank financing, they may have been able to borrow from banks located in other geographical areas, and hence the financial condition of local banks might have had no effect on the local economy. These alternative arguments would predict β to be insignificant.

Our empirical approach exploits differences across MSAs in the exposure of local commercial banks to wholesale funding markets to identify the effects of shocks to these banks on economic activity. However, during this period, shocks to the real economy, as well as increased uncertainty, also contributed to the slowdown in economic activity. Moreover, shocks to financial markets in general (and not necessarily to local commercial banks) may have made it more difficult for firms to access external financing during the crisis. While these arguments predict that economic activity should have decreased during the crisis, they do not necessarily imply differences in economic outcomes across MSAs during this period, in particular along the lines of our partition scheme. One possibility is that MSAs where banks had a higher dependence on wholesale funding were also particularly affected by other shocks during the crisis. For instance, MSAs with a higher exposure to non-core financing may have also experienced larger appreciations of housing values and/or construction booms in the run-up to the crisis, which made these areas more susceptible to the collapse of the real estate market. To address this issue, we control for several MSA characteristics in our regressions and also account for differences in the evolution of different regions over time by including region-time fixed effects. Furthermore, we also conduct our analyses excluding (1) sectors more likely to be directly affected by other shocks during this period, and (2) MSAs more likely to be affected by shocks. We find that our results are robust to these exclusions. Finally, we also exploit differences across MSAs, focusing in particular on the extent to which local firms depend on bank finance. We discuss these issues and results in greater detail below.

5.1.2 Variable definitions and descriptive statistics

To conduct our analyses, we aggregate bank-level data to the MSA level. Specifically, we calculate MSA-level bank variables by taking weighted averages of all bank characteristics used in Section 4. The weights are given by the fraction of total bank assets in an MSA represented by each bank.[23] Since mergers and acquisitions generate jumps in our aggregate series, we eliminate quarterly observations for which the aggregate bank assets in a given MSA change by more than 15 percent.[24] Moreover, we exclude MSAs with less than five quarters of available data.[25] This leaves us with a sample of 331 MSAs, with about 4,500 MSA-quarter observations.

To measure changes in economic activity at the MSA level, we consider, alternatively, the percentage change in private employment and in the number of private establishments. We report results considering both changes in total private employment and establishments and also excluding sectors that were directly affected by the crisis, namely, construction and finance and insurance. Given the seasonal patterns in the Quarterly Census of Employment and Wages (QCEW) series, particularly in the case of employment, we use the change in employment and establishments with respect to the same quarter of the previous year as our dependent variable to eliminate seasonality.[26]

We include several additional MSA-level controls in the regressions ($X_{i,t-1}$ in equation 2 above). First, we control for the industry structure of MSAs, because some industries may have been differently affected by shocks during the crisis. Specifically, we control for the fraction of employment/establishments in construction (NAICS code 23) and finance and insurance (NAICS code 52), as these sectors were directly affected by the collapse of the real estate market and the turmoil in financial markets, respectively. We also include the fraction of employment/establishments in manufacturing (NAICS code 31-33) as a control variable, given the long-term decline experienced by the manufacturing sector in the U.S. and the sharp decrease in manufacturing activity, particularly durable goods, during the crisis. Second, we control for shocks to real estate markets by including the change in housing prices at the MSA-level. Appendix Table 1 presents detailed definitions

[23] Given that most of our control variables are expressed as ratios of total assets, similar results are obtained if we first aggregate the different variables at the MSA level and then calculate ratios of these aggregate variables.

[24] We obtain broadly similar results if we drop observations with changes in assets larger than 20 percent.

[25] Results are similar if we include all MSAs.

[26] For ease of interpretation, we express these variables as quarterly changes. The same results are obtained if we express these variables in annual terms.

of all the variables used in our analyses.

Finally, as described in equation (2) above, we include the interaction between all the controls and our dummy variable that captures the crisis period. Similar to the analysis of changes in bank lending presented in Section 4, this dummy equals one for the period following the failure of Lehman Brothers in September 2008, and zero before.

Table 4 displays summary statistics for all MSA variables included in our analysis. The aggregate ratio of non-core financing to assets averages about 25.5 percent for MSAs in our sample, with relatively large differences across areas (the first decile of the ratio of non-core financing to assets equals 14.6 percent, while the ninth decile equals 36.4 percent). Appendix Table 4 presents the list of MSAs included in our analysis, ranked by their average ratio of non-core liabilities to assets before the crisis (March 2006-June 2008).

Figure 3 shows the spatial distribution of MSAs in our sample, according to the dependence of their local banks on wholesale funding. We divide MSAs in four quartiles based on their average ratio of non-core liabilities to assets before the crisis, with darker colors indicating higher ratios. The map shows that there is wide geographic dispersion of MSAs in terms of their exposure to wholesale funding. Moreover, the map shows that, in most cases, there is significant variation in the ratio of non-core liabilities to assets within larger states that have several MSAs. The figure also suggests that there are some regional patterns in terms of exposure to wholesale funding. For instance, there is a large concentration of MSAs with high exposure in Florida, Georgia, and South Carolina. These regional patterns may raise some concerns, as our findings could be affected by different regional shocks during the crisis. To account for this, we include region-time fixed effects in our regressions to capture unobserved changes in regional economic conditions over time, and find that our results remain unchanged. Moreover, our findings are not affected by the exclusion of particular states or regions. We discuss this issue in greater detail below.

5.2 Estimation results

5.2.1 Main estimations

Table 5 presents the results of regressions of changes in employment on MSA characteristics. Standard errors are adjusted for clustering at the MSA level. Columns (1)-(5) display the results of regressions using the change in total private employ-

ment as dependent variable, columns (6)-(10) present results using the change in private employment excluding construction and finance and insurance as dependent variable.

The results in Table 5 show that MSAs where commercial banks relied more heavily on wholesale funding experienced larger decreases in employment following the failure of Lehman Brothers. Columns (1) and (6) present results for our baseline specification described in equation (2) above, controlling only for MSA-level bank characteristics. These results show that the coefficient on the interaction between the crisis dummy and the aggregate ratio of non-core financing to total assets is negative and significant, consistent with the hypothesis that MSAs where banks were more exposed to liquidity shocks experienced larger decreases in economic activity during the crisis. The coefficient on non-core financing over assets is not significant, suggesting that employment growth is not correlated with the dependence of local banks on wholesale funding during normal times.

A possible concern is that MSAs where banks had a higher dependence on non-core financing might also have industries that were more affected by other shocks during the crisis. Columns (2) and (6) display regressions controlling for the industry structure of employment in the different MSAs by including, separately, the fraction of employment in manufacturing, finance and insurance, and construction. Because changes in housing prices played a significant role in the 2007-09 crisis, we also control for the change in housing prices in columns (3) and (7). These regressions yield similar results as those described above, that is, MSAs where banks relied more on non-core liabilities experienced larger decreases in employment during the crisis.

Another possibility is that our results capture changes in banks' funding structure that occurred after the crisis started. While it is not clear how this would affect our conclusions, we estimate our regressions taking the pre-crisis values of the control variables displayed in Table 5. Hence, we include lagged values of these variables up to September 2008 and from then on take the value of these variables as of September 2008. These results are reported in columns (4) and (9). The coefficient on the interaction between the crisis dummy and the aggregate ratio of non-core financing to total assets remains negative and significant. In columns (5) and (10) we estimate the regressions taking the pre-crisis values of the displayed controls and also including a variable that captures the participation of local banks in mortgage originate-and-distribute activities. The coefficient on our main variable of interest is not affected by the inclusion of this additional control.

In terms of economic magnitude, the results in Table 5 suggest that, for instance if we take the results in column (1), MSAs in the top 25 percent in terms of exposure to wholesale funding experienced a decrease in employment of about 0.9 percent during the crisis, while those in the bottom 25 percent saw reductions in employment of only by 0.6 percent over the same period. Another way of analyzing the economic magnitude of this effect is to look at total employment in MSAs where banks relied more heavily on wholesale funding. Our estimations suggest that if those MSAs in the top 25 percent in terms of exposure to non-core funding had had the exposure of those in the bottom 25 percent instead, they would have lost 80,000 fewer jobs in the six quarters following the failure of Lehman Brothers. This represents about five percent of the total reduction in employment experienced by these MSAs over this period.

Table 6 presents the results of similar regressions, using the change in the number of establishments as dependent variable. This table follows the same structure as Table 5. The results show that, consistent with the results on employment, those MSAs where commercial banks relied more heavily on wholesale funding experienced larger decreases in the number of establishments following the failure of Lehman Brothers. Moreover, this finding is robust to the inclusion of additional controls as discussed above.

5.3 Controlling for time-varying differences across regions

The results reported in Tables 5 and 6 might be affected by unobserved differences across geographical regions during the crisis period. In particular, Figure 3 suggests that there are some regional patterns in terms of exposure to wholesale funding. Our findings would be biased if MSAs where banks relied more heavily on wholesale funding are located in regions that experienced larger decreases in economic activity during the crisis due to other factors. To address this, we re-estimate our regressions including region-time fixed effects to control for unobserved changes over time in regional economic conditions. We define geographic regions based on the nine U.S. Census divisions.[27]

[27]The nine Census divisions and their component states are: New England (Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont); Middle Atlantic (New Jersey, New York, and Pennsylvania); East North Central (Illinois, Indiana, Michigan, Ohio, and Wisconsin); West North Central (Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, and South Dakota); South Atlantic (Delaware, District of Columbia, Florida, Georgia, Maryland, North Carolina, South Carolina, Virginia, and West Virginia); East South Central (Alabama, Kentucky, Mississippi, and Tennessee); West South Central (Arkansas, Louisiana, Oklahoma, and Texas); Mountain (Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, and Wyoming); and

Table 7 presents the results of regressions of changes in employment and establishments on MSA characteristics, including region-time fixed effects. This table follows a similar structure as Tables 5 and 6. Columns (1)-(5) display the results of regressions using the change in private employment as dependent variable and columns (6)-(10) present results using the change in the number of private establishments as outcome variable.[28] The results in Table 7 show that MSAs where commercial banks relied more heavily on wholesale funding experienced larger decreases in employment and establishments during the crisis, even when controlling for possible changes in economic conditions at the regional level.

5.4 Additional robustness

This subsection presents further robustness tests. In particular, we exclude those MSAs that may have been more affected by other shocks during the crisis from our regressions to address three alternative explanations for our findings.

First, MSAs where banks relied more heavily on wholesale funding may have also experienced larger appreciations of housing values in the run-up to the crisis, which made them more susceptible to the collapse of the real estate market. While we account for this in Tables 5 to 7 by controlling for changes in real estate prices, this may not fully capture differences in the pre-crisis housing boom. Thus, we re-estimate our regressions excluding those MSAs that experienced larger increases in housing values between December 1999 and December 2005. Specifically, we exclude those MSAs in the top 20 percent in terms of housing price appreciation over this period.[29]

Second, the manufacturing sector in the U.S. has experienced a long-term decline and manufacturing activity experienced a sharp decrease during the crisis. This could affect our results because MSAs where banks had a higher exposure to wholesale funding also had a larger share of manufacturing employment. In the regressions reported above, we include the share of manufacturing employment or establishments as a control variable. In this subsection, we re-estimate our regressions excluding MSAs with a high fraction of manufacturing employment. Specifically, for

Pacific (Alaska, California, Hawaii, Oregon, and Washington).

[28]We only report results for these variables excluding construction and finance and insurance. Similar results are obtained if we use as dependent variables total private employment and the total number of private establishments.

[29]In unreported robustness tests, we estimate our regressions including the change in housing prices over this period as an additional control variable and obtain results similar to those reported above.

each MSA we calculate the average fraction of total employment accounted for by the manufacturing sector over the period March 2006 and June 2008 (that is, before the failure of Lehman Brothers) and exclude those MSAs in the top 20 percent in terms of this variable.[30]

Finally, Figure 3 shows there is a large concentration of MSAs with high exposure to wholesale funding in Florida, Georgia, and South Carolina. If these states also experienced larger decreases in economic activity during the crisis due to other factors, this could account for our findings. In Table 7 we try to control for time-varying changes in economic conditions across geographic regions by including region-time fixed effects and find that our results remain unchanged. As an alternative, we re-estimate our regressions excluding all the MSAs located in these three states.[31]

Table 8 presents the results of these robustness tests. Columns (1)-(6) display the results of regressions using the change in private employment as dependent variable and columns (7)-(12) present results using the change in the number of private establishments as outcome variable. The results show that our main findings are robust to excluding the different samples of MSAs described above. In particular, columns (1), (2), (7), and (8) show that our results remain unchanged when excluding MSAs that experienced larger housing price increases before the crisis. Columns (3), (4), (9), and (10) present the results excluding MSAs with a higher share of manufacturing employment. The results indicate that the interaction between the aggregate ratio of non-core financing to assets and the crisis dummy is negative and statistically significant in all specifications. Finally, excluding Florida, Georgia, and South Carolina does also not affect our results (columns (5), (6), (11), and (12)). Overall, these regressions confirm our finding that MSAs where commercial banks relied more heavily on wholesale funding experienced larger decreases in employment and establishments during the crisis.

5.5 Discussion

Our results are consistent with the idea that adverse liquidity shocks in wholesale funding markets following the failure of Lehman Brothers were transmitted by

[30] As an alternative way of excluding areas with high exposure to the manufacturing sector, in unreported robustness tests, we drop from our regressions all the MSAs located in states in the so-called "Rust Belt" (Illinois, Indiana, Michigan, New Jersey, New York, Ohio, Pennsylvania, and West Virginia) and obtain results similar to those reported throughout the paper.

[31] In unreported robustness tests, we also estimate our regressions dropping all the states in the South Atlantic Census division which, apart from these three states, also comprises Delaware, District of Columbia, Maryland, North Carolina, Virginia, and West Virginia, and find results similar to those reported throughout the paper.

commercial banks to the local economy. As discussed above, the underlying identification assumption for our analysis is that differences across MSAs in exposure to wholesale funding markets are not correlated with differences in their exposure to other financial or real shocks that may have affected economic activity during the crisis. In our analysis we address this by controlling for different MSA characteristics and including region-time fixed effects to account for time-varying differences across geographic regions. Furthermore, we also report results excluding sectors that were directly affected by the crisis (construction and finance and insurance) from our dependent variable and also excluding from our regressions MSAs that may have been more affected by other shocks during the crisis. In further robustness tests, we estimate our regressions controlling for additional MSA characteristics. These include total population and GDP per capita, to account for demographic and income differences across MSAs, and the logarithm of the aggregate assets of local banks in an MSA, to control for the size of the local banking sector. We include this variable since metropolitan areas with more active banking markets may have been more affected by general shocks to financial markets, independently of the funding sources of local banks. Appendix Table 5 reports some of these robustness tests; all our results are robust to the inclusion of these additional controls.

Finally, we also estimate our regressions replacing the crisis dummy with a continuous variable which captures liquidity in wholesale funding markets. In particular, we replace our crisis dummy with the LIBOR-OIS spread which, as described in Section 2, is a measure of liquidity and counterparty risk in interbank lending markets. Appendix Table 6 reports some of these regressions. We find that the interaction between the LIBOR-OIS spread and the ratio of non-core financing to assets tends to be negative and statistically significant, consistent with the hypothesis that MSAs where banks had a higher exposure to wholesale funding markets experienced larger decreases in economic activity as conditions in these markets worsened. These findings could also be explained by other shocks besides the liquidity shock to wholesale funding markets if, within a particular region, MSAs with a higher exposure to wholesale funding experienced negative shocks during periods with high LIBOR-OIS spreads and positive shocks during periods of low spreads. While our results are consistent with the hypothesis that adverse shocks to bank funding liquidity affected local economic activity during the crisis, we cannot rule out that an MSA's exposure to wholesale funding is correlated with exposure to other negative shocks that occurred during this period.

6 Differences in the effect of dependence on wholesale funding across MSAs

In this section, we analyze whether the effect of banks' dependence on wholesale funding on economic activity during the crisis differed across MSAs. Particularly, we ask whether this effect was larger in MSAs where local businesses relied more on banks to finance their operations. If liquidity shocks hindered the financial intermediation provided by local banks, we would expect MSAs where firms relied more on these banks to have been relatively more affected. In contrast, if the firms in an MSA did not depend on bank lending to finance their activities, then local banks' exposure to liquidity shocks should have had little effect on economic outcomes. Thus, we hypothesize that the (negative) effect of dependence on wholesale funding on employment and establishments during the crisis was concentrated among MSAs with more bank-dependent firms and industries.

To test this, we differentiate MSAs along two dimensions. First, we focus on differences in industry structure across MSAs. Due to technological reasons, some industries may rely relatively more on external funds to finance their operations (Rajan and Zingales, 1998). Hence, we expect MSAs where (more) financially dependent industries account for a larger share of the economy to be more affected by shocks to banks. Second, we focus on differences across MSAs in the fraction of economic activity accounted for by small firms. Small firms are more dependent on bank financing than larger firms, as the latter usually face lower information costs and can raise funds through securities markets. Moreover, bigger firms may borrow from banks located in other areas, as geographic proximity is less important as a screening and monitoring mechanism for these firms. Thus, we would expect MSAs where small firms represent a larger fraction of the economy to be more severely affected by shocks to local banks.

6.1 Differences in industry financial dependence across MSAs

To analyze differences in the industry structure of MSAs, we aggregate data on the degree to which industries depend on external financing up to the MSA level. Specifically, we first calculate the dependence on external finance of different industries following the methodology in Rajan and Zingales (1998). Dependence on external finance is measured by the fraction of investment not financed with funds from operations. We collect data on U.S. firms from Compustat for the 1990s

and calculate the industry dependence on external finance by aggregating firm-level data up to the 3-digit NAICS sector, which gives us a sample of 69 industries.[32] To determine an MSA's overall degree of dependence on external finance we then aggregate the industry data at the MSA level by calculating a weighted average of the industry financial dependence, using the fraction of total employment represented by each industry for the weights. We restrict the sample to those MSAs for which we have data on industry-level employment for industries representing at least 70 percent of total employment (excluding construction and finance and insurance).[33] Finally, to conduct our analyses we split MSAs according to whether they were above or below the median level of aggregate financial dependence before September 2008.[34]

Table 9 presents the results of regressions comparing MSAS with different levels of dependence on external finance. Columns (1)-(4) display the results of regressions using the change in employment as dependent variable and columns (5)-(8) present results using the change in the number of establishments as outcome variable.

The results in Table 9 are consistent with the idea that the negative effect of reliance on wholesale funding on economic activity during the crisis was concentrated among MSAs with a higher dependence on external finance. In particular, columns (1) and (2) show that the interaction between the aggregate ratio of non-core financing to assets and the crisis dummy is negative and statistically significant for MSAs with high financial dependence, whereas it is not statistically significant for MSAs with low financial dependence. These findings are robust to the inclusion of region-time fixed effects (columns (3) and (4)). Moreover, columns (5)-(8) show that using changes in the number of establishments as dependent variable, instead of changes in employment, yields similar conclusions.

These results are consistent with the notion that adverse liquidity shocks in wholesale funding markets, following the failure of Lehman Brothers, were transmitted by small commercial banks to the local economy, affecting in particular MSAs where industries relied more on external financing. MSAs with more financially

[32]We exclude firms in construction and finance and insurance. Further, we require at least ten firms per industry to compute the industry-level financial dependence.

[33]In some cases, the Bureau of Labor Statistics withholds the publication of employment at the industry-level to protect the identity of employers. Data on total employment at the MSA level include the undisclosed industry data.

[34]Specifically, for each MSA we calculate the average of the MSA-level financial dependence in each quarter over the period March 2006 and June 2008 (that is, before the failure of Lehman Brothers). We then classify MSAs as high (low) financial dependence if they are above (below) the median of this variable across MSAs.

dependent industries may have also been more affected by the crisis, because these industries tend to be more sensitive to economic downturns (Braun and Larrain, 2005) and to financial shocks in general. However, while these arguments predict that economic activity should have decreased more in MSAs with higher financial dependence during the crisis, they do not predict that the adverse effect of dependence on wholesale funding on economic activity should have been stronger in these MSAs, which is what we find.

6.2 Differences in fraction of small firms across MSAs

To analyze differences in firm size across MSAs, we collect data on the fraction of employment accounted for by small businesses in each MSA. Specifically, we use data from the Statistics of U.S. Businesses (SUSB), collected by the Census Bureau, which provide annual information on the distribution of local economic activity by enterprise size. We define small firms as those with less than 500 employees and calculate the fraction of employment accounted for by these firms in each MSA.[35] For our analyses, we calculate the average share of employment in small firms between 2006 and 2007 (the latest year with data available) for each metropolitan area and split MSAs according to whether they were above or below the median of this variable.[36]

Table 10 presents the results of regressions comparing MSAs with different levels of employment in small businesses. Columns (1)-(4) display the results of regressions using the change in employment as dependent variable and columns (5)-(8) present results using the change in the number of establishments as outcome variable.

The results in Table 10 are consistent with the hypothesis that the negative effect of dependence on wholesale funding on economic activity during the crisis was larger (i.e., more negative) in MSAs where small firms represented a higher fraction of the local economy. In particular, columns (1) and (2) show that the interaction between the aggregate ratio of non-core financing to assets and the crisis dummy is negative and statistically significant for MSAs with a high fraction of small business employment, and is not significant for MSAs with low small business employment. Similar results are obtained when including region-time fixed effects (columns (3) and (4)). Using changes in the number of establishments as the dependent variable

[35]The U.S. Small Business Administration defines small businesses as those with less than 500 employees for research purposes.

[36]Similar results are obtained if we consider either 2006 or 2007 to measure the fraction of employment accounted for by small firms.

also shows that the effect of dependence on wholesale funding on economic activity during the crisis was larger in MSAs where small firms accounted for a higher fraction of employment (columns (5) to (8)).

The results reported above are consistent with the idea that shocks to wholesale funding were transmitted by commercial banks to the local economy, affecting relatively more MSAs where small firms represented a larger fraction of total employment. Small firms may be more sensitive to economic contractions and may be more affected by shocks to financial markets in general. These arguments predict that MSAs where small firms accounted for a large fraction of the economy should have experienced more severe economic downturns during the crisis. But they do not predict that we should observe a larger (i.e., more negative) effect of dependence on wholesale funding on economic activity in these MSAs, which is what we find. Overall, the results presented in this section are consistent with the hypothesis that the adverse effect of dependence on wholesale funding on employment and establishments during the crisis was concentrated among MSAs with more bank-dependent firms and industries.

7 Conclusion

Adverse shocks to banks may have negative effects on economic activity, as they can lead to a reduction in the supply of credit. This argument is one of the reasons why banks are heavily regulated and supervised. This argument is also why governments provide liquidity assistance and various forms of bailout programs to banks in distress, as witnessed during the 2007-09 financial crisis around the world. In this paper, we analyze how shocks to banks' funding sources during this crisis affected bank behavior and ultimately economic activity in the U.S.

Commercial banks have increasingly relied on wholesale funding sources to supplement retail deposits over the last decades. Although reliance on wholesale funding can be beneficial, it may also make banks more susceptible to fluctuations in wholesale markets. This risk became apparent during the 2007-09 financial crisis, as liquidity in wholesale funding markets evaporated suddenly, especially after the failure of Lehman Brothers in September 2008. We find that this liquidity shock affected the lending behavior of small local banks. In particular, banks that were more exposed to wholesale funding markets decreased their lending relatively more during the crisis than banks funding themselves with retail deposits.

Further, we also find evidence that this liquidity crunch in wholesale markets

was transmitted by local commercial banks to economic activity. Urban areas where banks relied more heavily on wholesale funding experienced larger decreases in employment and establishments during the financial crisis. Moreover, the adverse effect of exposure to liquidity shocks in wholesale funding markets was larger in areas where businesses relied more on banks to finance their operations. We consider several alternative explanations for our results and account for other confounding influences in our analysis. Although our findings suggest that small banks played an important role in transmitting liquidity shocks to local economic activity, we cannot rule out that other mechanisms may be able to explain our findings as well.

From a policy perspective, our results highlight the need to consider the relative risks of different sources of bank funding when designing regulatory policies. In particular, our results are consistent with the notion that reliance on wholesale funds exposed banks to a sudden dry-up in market liquidity, with adverse effects on lending and economic activity. The salient role played by wholesale funding markets in the 2007-09 crisis has led to growing research on the implications of reliance on these markets for financial stability (Huang and Ratnovski, 2010; Stein, 2010) and also to calls for regulating the use of wholesale funding by financial institutions (Perotti and Suarez, 2010; Shin, 2010). Further research is needed to examine the interplay between banks' funding structure, lending, and economic activity in greater depth. This will help to answer whether regulating the use of wholesale funding is warranted, and if so, how regulation should be designed.

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Table 1

Summary Statistics - Bank Variables

This table reports summary statistics for the variables used in the analysis of changes in bank lending. Data correspond to bank-level variables at a quarterly frequency for the period March 2006 - December 2009. All variables are lagged one period, except for changes in C&I lending. The sample covers small insured commercial banks in the 50 states of the U.S. and the District of Columbia. Small banks are defined as those below the 90th percentile of the asset size distribution in a given quarter. The top panel shows data for all banks in the sample. The bottom panel shows data only for banks headquartered in metropolitan statistical areas (MSAs). See Appendix Table 1 for the definition of the variables.

All small banks

	Number of banks	Number of observations	Mean	Median	90th percentile	10th percentile	Standard deviation
Percentage change in commercial and industrial (C&I) loans (%)	6,933	92,358	1.714	0.922	16.208	-11.929	13.553
Percentage change in (C&I loans+other unused commitments) (%)	6,922	92,373	1.629	0.807	18.150	-14.166	15.282
Percentage change in (C&I loans+ other unused commitments+net loans write-offs) (%)	6,922	92,371	1.778	0.939	18.232	-13.914	15.229
Total assets (million U.S. dollars)	6,940	93,221	158.5	109.7	367.4	32.1	140.6
Non-core financing/Total assets	6,940	93,221	0.226	0.214	0.375	0.094	0.109
Total loans/Total assets	6,940	93,221	0.658	0.682	0.833	0.448	0.150
Real estate loans/Total loans	6,940	93,221	0.673	0.703	0.877	0.415	0.175
Dummy residential mortgages sold during the quarter	6,679	74,934	0.029	0.000	0.000	0.000	0.168
Capital ratio	6,940	93,221	0.111	0.097	0.156	0.077	0.051
Non-performing loans/Total loans	6,940	93,221	0.013	0.007	0.033	0.000	0.018
Total unused commitments/(Total assets+total unused commitments)	6,940	93,221	0.091	0.085	0.164	0.027	0.054

Small banks headquartered in metropolitan statistical areas (MSAs)

	Number of banks	Number of observations	Mean	Median	90th percentile	10th percentile	Standard deviation
Percentage change in commercial and industrial (C&I) loans (%)	3,587	45,635	2.686	1.246	18.177	-11.860	15.636
Percentage change in (C&I loans+other unused commitments) (%)	3,578	45,574	2.431	1.085	19.893	-13.951	17.085
Percentage change in (C&I loans+other unused commitments+net loans write-offs) (%)	3,578	45,574	2.604	1.220	19.970	-13.609	17.012
Total assets (million U.S. dollars)	3,594	46,049	190.1	140.1	435.0	41.0	154.0
Non-core financing/Total assets	3,594	46,049	0.247	0.235	0.415	0.096	0.123
Total loans/Total assets	3,594	46,049	0.684	0.713	0.851	0.473	0.150
Real estate loans/Total loans	3,594	46,049	0.735	0.762	0.908	0.531	0.152
Dummy residential mortgages sold during the quarter	3,417	37,133	0.044	0.000	0.000	0.000	0.205
Capital ratio	3,594	46,049	0.117	0.096	0.167	0.076	0.075
Non-performing loans/Total loans	3,594	46,049	0.014	0.006	0.038	0.000	0.021
Total unused commitments/(Total assets+total unused commitments)	3,594	46,049	0.105	0.099	0.184	0.035	0.059

Table 2
Changes in Lending and Bank Characteristics
All Small Banks

This table reports ordinary least square regressions of changes in bank lending on bank characteristics, using quarterly data for the period March 2006 - December 2009. Standard errors are adjusted for clustering at the bank level. Columns (1)-(4) report regressions using the percentage change in commercial and industrial (C&I) loans as dependent variable. Columns (5)-(8) report regressions using the percentage change in (C&I loans+other unused commitments) as dependent variable. Columns (9)-(12) report regressions using the percentage change in (C&I loans+other unused commitments+net loans write-offs) as dependent variable. The crisis dummy equals one on and after September 2008 and zero before. Additional bank controls included in the regressions, but not reported in the table, are: capital ratio, non-performing loans/total loans, total unused commitments/(total assets+total unused commitments) and the logarithm of total assets. These unreported controls are also interacted with the crisis dummy. In columns (1)-(2), (5)-(6), and (9)-(10) all control variables are lagged one period. In columns (3)-(4), (7)-(8), and (11)-(12) pre-crisis values of the displayed control variables are used. That is, lagged values of these variables are used up to September 2008 and from then on, the value of these variables as of September 2008 is used. The sample covers small insured commercial banks in the 50 states of the U.S. and the District of Columbia. Small banks are defined as those below the 90th percentile of the asset size distribution in a given quarter. See Appendix Table 1 for the definition of the variables. All regressions include one lag of the dependent variable. A constant is estimated but not reported. t-statistics are in brackets. *, **, *** mean significance at ten, five, and one percent level, respectively.

	Percentage change in C&I Loans				Percentage change in (C&I Loans+other unused commitments)				Percentage change in (C&I Loans+other unused commitments+net loans write-offs)			
	Lagged values of controls		Pre-crisis values of controls		Lagged values of controls		Pre-crisis values of controls		Lagged values of controls		Pre-crisis values of controls	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Non-core financing/Total assets	7.990 ***	8.085 ***	8.093 ***	7.848 ***	7.596 ***	7.872 ***	7.875 ***	7.604 ***	7.696 ***	7.979 ***	7.982 ***	7.742 ***
	[12.363]	[11.884]	[11.888]	[9.588]	[10.809]	[10.576]	[10.577]	[8.709]	[10.975]	[10.745]	[10.747]	[8.883]
Non-core financing/Total assets * Crisis dummy	-3.139 ***	-3.901 ***	-5.432 ***	-5.184 ***	-5.027 ***	-4.810 ***	-6.249 ***	-5.975 ***	-4.809 ***	-4.658 ***	-6.044 ***	-5.801 ***
	[-3.386]	[-3.984]	[-5.483]	[-4.798]	[-5.012]	[-4.516]	[-5.860]	[-5.235]	[-4.817]	[-4.390]	[-5.697]	[-5.104]
Total loans/Total assets	-3.633 ***	-2.621 ***	-2.616 ***	-3.108 ***	2.369 ***	3.333 ***	3.331 ***	3.734 ***	2.479 ***	3.445 ***	3.444 ***	3.868 ***
	[-7.056]	[-4.859]	[-4.847]	[-4.737]	[4.249]	[5.674]	[5.669]	[5.390]	[4.466]	[5.895]	[5.891]	[5.610]
Total loans/Total assets * Crisis dummy	1.875 **	1.853 **	1.919 **	2.418 ***	1.815 **	1.231	0.634	0.231	1.921 **	1.336	0.747	0.322
	[2.417]	[2.277]	[2.320]	[2.676]	[2.256]	[1.456]	[0.734]	[0.247]	[2.403]	[1.590]	[0.871]	[0.346]
Real estate loans/Total loans	3.709 ***	4.739 ***	4.736 ***	5.634 ***	0.566	1.958 ***	1.957 ***	1.222 **	0.503	1.887 ***	1.887 ***	1.088 *
	[8.925]	[9.985]	[9.972]	[9.981]	[1.288]	[3.904]	[3.901]	[2.032]	[1.152]	[3.790]	[3.787]	[1.821]
Real estate loans/Total loans * Crisis dummy	-0.333	-2.185 ***	-2.143 ***	-3.031 ***	-1.947 ***	-3.593 ***	-2.754 ***	-2.015 **	-1.830 ***	-3.447 ***	-2.619 ***	-1.817 **
	[-0.523]	[-3.046]	[-2.974]	[-3.914]	[-2.857]	[-4.577]	[-3.480]	[-2.379]	[-2.704]	[-4.413]	[-3.325]	[-2.150]
Dummy residential mortgages sold				0.545				1.181 ***				1.183 ***
				[1.605]				[3.082]				[3.090]
Dummy residential mortgages sold * Crisis dummy				-0.989 **				-1.263 **				-1.221 **
				[-2.320]				[-2.505]				[-2.441]
Bank-level controls	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Time dummies	✓	-	-	-	✓	-	-	-	✓	-	-	-
State dummies	✓	-	-	-	✓	-	-	-	✓	-	-	-
State-time dummies	-	✓	✓	✓	-	✓	✓	✓	-	✓	✓	✓
Observations	90,950	90,950	90,491	72,902	91,011	91,011	90,547	72,955	91,010	91,010	90,546	72,956
Banks	6,912	6,912	6,852	6,627	6,908	6,908	6,850	6,626	6,908	6,908	6,850	6,626

Table 3
Changes in Lending and Bank Characteristics
Small Banks Headquartered in Metropolitan Statistical Areas (MSAs)

This table reports ordinary least square regressions of changes in bank lending on bank characteristics, using quarterly data for the period March 2006 - December 2009. Standard errors are adjusted for clustering at the bank level. Columns (1)-(4) report regressions using the percentage change in commercial and industrial (C&I) loans as dependent variable. Columns (5)-(8) report regressions using the percentage change in (C&I loans+other unused commitments) as dependent variable. Columns (9)-(12) report regressions using the percentage change in (C&I loans+other unused commitments+net loans write-offs) as dependent variable. The crisis dummy equals one on and after September 2008 and zero before. Additional bank controls included in the regressions, but not reported in the table, are: capital ratio, non-performing loans/total loans, total unused commitments/(total assets+total unused commitments) and the logarithm of total assets. These unreported controls are also interacted with the crisis dummy. In columns (1)-(2), (5)-(6), and (9)-(10) all control variables are lagged one period. In columns (3)-(4), (7)-(8), and (11)-(12) pre-crisis values of the displayed control variables are used. That is, lagged values of these variables are used up to September 2008 and from then on, the value of these variables as of September 2008 is used. The sample covers small insured commercial banks in the 50 states of the U.S. and the District of Columbia. Small banks are defined as those below the 90th percentile of the asset size distribution in a given quarter. The sample is restricted to banks headquartered in metropolitan statistical areas (MSAs). See Appendix Table 1 for the definition of the variables. All regressions include one lag of the dependent variable. A constant is estimated but not reported. t-statistics are in brackets. *, **, *** mean significance at ten, five, and one percent level, respectively.

	Percentage change in C&I Loans				Percentage change in (C&I Loans+other unused commitments)				Percentage change in (C&I Loans+other unused commitments+net loans write-offs)			
	Lagged values of controls		Pre-crisis values of controls		Lagged values of controls		Pre-crisis values of controls		Lagged values of controls		Pre-crisis values of controls	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Non-core financing/Total assets	9.321 ***	9.312 ***	9.332 ***	8.319 ***	8.254 ***	8.340 ***	8.347 ***	7.687 ***	8.372 ***	8.460 ***	8.466 ***	7.818 ***
	[9.207]	[8.246]	[8.248]	[6.327]	[7.648]	[6.853]	[6.853]	[5.394]	[7.760]	[6.955]	[6.954]	[5.492]
Non-core financing/Total assets * Crisis dummy	-4.510 ***	-4.829 ***	-6.100 ***	-5.086 ***	-4.865 ***	-5.044 ***	-6.168 ***	-5.527 ***	-4.791 ***	-5.052 ***	-6.135 ***	-5.501 ***
	[-3.330]	[-3.173]	[-4.015]	[-3.111]	[-3.312]	[-3.046]	[-3.691]	[-3.054]	[-3.283]	[-3.071]	[-3.708]	[-3.067]
Total loans/Total assets	-5.485 ***	-5.279 ***	-5.271 ***	-6.100 ***	1.162	1.037	1.035	1.384	1.259	1.096	1.094	1.458
	[-5.837]	[-5.190]	[-5.173]	[-5.040]	[1.201]	[0.992]	[0.988]	[1.133]	[1.305]	[1.052]	[1.049]	[1.194]
Total loans/Total assets * Crisis dummy	2.124	2.387 *	2.429 *	3.278 **	-0.347	0.297	-0.543	-0.899	-0.232	0.403	-0.454	-0.812
	[1.588]	[1.674]	[1.689]	[2.095]	[-0.254]	[0.200]	[-0.365]	[-0.558]	[-0.171]	[0.274]	[-0.308]	[-0.507]
Real estate loans/Total loans	6.585 ***	6.936 ***	6.924 ***	8.409 ***	3.806 ***	4.278 ***	4.274 ***	4.410 ***	3.723 ***	4.168 ***	4.166 ***	4.232 ***
	[7.764]	[7.217]	[7.194]	[7.260]	[4.436]	[4.588]	[4.581]	[4.069]	[4.334]	[4.457]	[4.450]	[3.919]
Real estate loans/Total loans * Crisis dummy	-1.975	-2.309 *	-2.600 *	-4.082 ***	-4.121 ***	-5.012 ***	-3.569 **	-3.711 **	-4.166 ***	-4.944 ***	-3.519 **	-3.589 **
	[-1.628]	[-1.709]	[-1.930]	[-2.782]	[-3.157]	[-3.551]	[-2.515]	[-2.432]	[-3.209]	[-3.518]	[-2.499]	[-2.373]
Dummy residential mortgages sold				1.031 **				1.550 ***				1.555 ***
				[2.015]				[2.980]				[2.990]
Dummy residential mortgages sold * Crisis dummy				-1.291 *				-1.325 *				-1.486 **
				[-1.947]				[-1.947]				[-2.143]
Bank-level controls	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
State-time dummies	✓	-	-	-	✓	-	-	-	✓	-	-	-
MSA-time dummies	-	✓	✓	✓	-	✓	✓	✓	-	✓	✓	✓
Observations	44,769	44,769	44,488	36,034	44,733	44,733	44,454	36,008	44,734	44,734	44,456	36,010
Banks	3,574	3,574	3,518	3,381	3,565	3,565	3,510	3,375	3,565	3,565	3,510	3,375

Table 4
Summary Statistics - Metropolitan Statistical Area (MSA) Variables

This table reports summary statistics for the variables used in the analysis of changes in economic activity at the metropolitan statistical area (MSA) level. Data correspond to MSA-level variables at a quarterly frequency for the period March 2006 - December 2009. MSA bank variables are calculated by aggregating bank-level data to the MSA level by taking asset-weighted averages. All variables are lagged one period, except for changes in employment, establishments, and housing prices. See Appendix Table 1 for the definition of the variables.

	Number of MSAs	Number of observations	Mean	Median	90th percentile	10th percentile	Standard deviation
MSA bank variables							
Non-core financing/Total assets	331	4,459	0.255	0.248	0.364	0.146	0.085
Total loans/Total assets	331	4,459	0.699	0.708	0.805	0.580	0.095
Real estate loans/Total loans	331	4,459	0.750	0.758	0.867	0.624	0.098
Fraction of assets owned by banks that sold residential mortgages	331	3,516	0.092	0.000	0.351	0.000	0.201
Capital/Total assets	331	4,459	0.104	0.099	0.129	0.083	0.022
Non-performing loans/Total loans	331	4,459	0.013	0.009	0.030	0.002	0.015
Total unused commitments/(Total assets+Total unused commitments)	331	4,459	0.114	0.111	0.167	0.067	0.040
Other MSA variables							
Percentage change in employment (%)	328	4,324	-0.237	-0.030	0.789	-1.570	0.911
Percentage change in establishments (%)	331	4,387	0.233	0.229	1.005	-0.529	0.595
Percentage change in employment, excluding finance and construction (%)	295	3,563	-0.143	0.040	0.815	-1.409	0.845
Percentage change in establishments, excluding finance and construction (%)	331	4,387	0.291	0.277	1.017	-0.399	0.552
Percentage change in housing prices (%)	331	4,459	-0.134	0.156	2.363	-2.904	2.353
Fraction of finance and insurance employment	316	3,998	0.044	0.039	0.069	0.025	0.019
Fraction of construction employment	320	4,070	0.066	0.063	0.095	0.042	0.023
Fraction of manufacturing employment	322	4,143	0.137	0.122	0.232	0.054	0.077
Fraction of finance and insurance establishments	331	4,459	0.060	0.061	0.074	0.044	0.011
Fraction of construction establishments	331	4,459	0.115	0.110	0.151	0.085	0.028
Fraction of manufacturing establishments	331	4,459	0.046	0.042	0.071	0.028	0.019

Table 5

Changes in Economic Activity and MSA Characteristics - Employment

This table reports ordinary least square regressions of changes in economic activity at the metropolitan statistical area (MSA) level on MSA characteristics, using quarterly data for the period March 2006 - December 2009. Standard errors are adjusted for clustering at the MSA level. Columns (1)-(5) report regressions using the percentage change in total private employment as dependent variable. Columns (6)-(10) report regressions using the percentage change in private employment, excluding finance and construction as dependent variable. The crisis dummy equals one on and after September 2008 and zero before. MSA bank variables are calculated by aggregating bank-level data to the MSA level by taking asset-weighted averages. Additional MSA bank controls included in the regressions, but not reported in the table, are: capital ratio, non-performing loans/total loans, and total unused commitments/(total assets+total unused commitments). MSA industry structure controls included in the regressions, but not reported in the table, are, separately, the fraction of employment in manufacturing, finance and insurance, and construction. These unreported controls are also interacted with the crisis dummy. In columns (1)-(3) and (6)-(8) all control variables are lagged one period, except for the change in housing prices for which contemporaneous values are used. In columns (4)-(5) and (9)-(10) pre-crisis values of the displayed control variables are used. That is, lagged values of these variables are used up to September 2008 and from then on, the value of these variables as of September 2008 is used. See Appendix Table 1 for the definition of the variables. All regressions include one lag of the dependent variable and time dummies. A constant is estimated but not reported. t-statistics are in brackets. *, **, *** mean significance at ten, five, and one percent level, respectively.

	Percentage change in total private employment					Percentage change in private employment, excluding finance and construction				
	Lagged values of controls			Pre-crisis values of controls		Lagged values of controls			Pre-crisis values of controls	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Non-core financing/Total assets	-0.058	-0.054	-0.019	-0.019	-0.050	-0.017	0.015	0.040	0.039	0.009
	[-0.661]	[-0.566]	[-0.212]	[-0.211]	[-0.397]	[-0.182]	[0.167]	[0.447]	[0.440]	[0.076]
Non-core financing/Total assets * Crisis dummy	-0.446 ***	-0.457 ***	-0.487 ***	-0.439 **	-0.400 **	-0.501 ***	-0.526 ***	-0.537 ***	-0.490 ***	-0.451 **
	[-2.885]	[-2.763]	[-2.919]	[-2.536]	[-2.005]	[-2.871]	[-3.052]	[-3.099]	[-2.644]	[-2.154]
Total loans/Total assets	-0.149 *	-0.045	-0.017	-0.014	-0.064	-0.106	-0.062	-0.038	-0.037	-0.063
	[-1.947]	[-0.495]	[-0.189]	[-0.157]	[-0.611]	[-1.237]	[-0.707]	[-0.439]	[-0.432]	[-0.612]
Total loans/Total assets * Crisis dummy	0.241	0.192	0.192	0.226	0.272	0.294	0.296	0.292	0.317	0.341
	[1.459]	[0.980]	[0.973]	[1.071]	[1.255]	[1.511]	[1.490]	[1.464]	[1.474]	[1.542]
Real estate loans/Total loans	-0.224 ***	-0.239 ***	-0.232 ***	-0.227 ***	-0.288 ***	-0.120	-0.178 **	-0.168 **	-0.165 **	-0.211 **
	[-3.072]	[-3.079]	[-3.075]	[-3.053]	[-3.109]	[-1.508]	[-2.263]	[-2.150]	[-2.134]	[-2.277]
Real estate loans/Total loans * Crisis dummy	-0.058	-0.078	-0.066	-0.046	0.030	-0.171	-0.176	-0.160	-0.162	-0.099
	[-0.389]	[-0.433]	[-0.365]	[-0.252]	[0.154]	[-1.059]	[-1.026]	[-0.935]	[-0.928]	[-0.530]
Fraction of assets owned by banks that sold residential mortgages					0.029					0.029
					[0.710]					[0.658]
Fraction of assets owned by banks that sold residential mortgages * Crisis dummy					-0.044					-0.038
					[-0.569]					[-0.402]
Additional MSA bank controls	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Time dummies	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
MSA industry structure controls	-	✓	✓	✓	✓	-	✓	✓	✓	✓
MSA change in housing prices	-	-	✓	✓	✓	-	-	✓	✓	✓
Observations	4,291	3,575	3,575	3,503	2,837	3,447	3,389	3,389	3,322	2,684
MSAs	327	296	296	296	292	285	281	281	281	279

Table 6

Changes in Economic Activity and MSA Characteristics - Establishments

This table reports ordinary least square regressions of changes in economic activity at the metropolitan statistical area (MSA) level on MSA characteristics, using quarterly data for the period March 2006 - December 2009. Standard errors are adjusted for clustering at the MSA level. Columns (1)-(5) report regressions using the percentage change in total private establishments as dependent variable. Columns (6)-(10) report regressions using the percentage change in private establishments, excluding finance and construction as dependent variable. The crisis dummy equals one on and after September 2008 and zero before. MSA bank variables are calculated by aggregating bank-level data to the MSA level by taking asset-weighted averages. Additional MSA bank controls included in the regressions, but not reported in the table, are: capital ratio, non-performing loans/total loans, and total unused commitments/(total assets+total unused commitments). MSA industry structure controls included in the regressions, but not reported in the table, are, separately, the fraction of establishments in manufacturing, finance and insurance, and construction. These unreported controls are also interacted with the crisis dummy. In columns (1)-(3) and (6)-(8) all control variables are lagged one period, except for the change in housing prices for which contemporaneous values are used. In columns (4)-(5) and (9)-(10) pre-crisis values of the displayed control variables are used. That is, lagged values of these variables are used up to September 2008 and from then on, the value of these variables as of September 2008 is used. See Appendix Table 1 for the definition of the variables. All regressions include one lag of the dependent variable and time dummies. A constant is estimated but not reported. t-statistics are in brackets. *, **, *** mean significance at ten, five, and one percent level, respectively.

	Percentage change in private establishments					Percentage change in private establishments, excluding finance and construction				
	Lagged values of controls			Pre-crisis values of controls		Lagged values of controls			Pre-crisis values of controls	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Non-core financing/Total assets	0.170 *	0.188 **	0.187 **	0.188 **	0.137	0.133	0.146	0.142	0.142	0.104
	[1.917]	[2.161]	[2.150]	[2.153]	[1.551]	[1.357]	[1.467]	[1.427]	[1.433]	[0.978]
Non-core financing/Total assets * Crisis dummy	-0.497 ***	-0.506 ***	-0.506 ***	-0.461 ***	-0.418 ***	-0.500 ***	-0.483 ***	-0.483 ***	-0.423 ***	-0.391 ***
	[-3.976]	[-3.981]	[-3.983]	[-3.515]	[-3.230]	[-3.890]	[-3.658]	[-3.656]	[-3.058]	[-2.745]
Total loans/Total assets	-0.155 **	-0.085	-0.085	-0.085	-0.062	-0.084	-0.019	-0.025	-0.025	0.022
	[-2.076]	[-1.144]	[-1.137]	[-1.136]	[-0.680]	[-1.090]	[-0.250]	[-0.321]	[-0.315]	[0.227]
Total loans/Total assets * Crisis dummy	0.078	0.057	0.057	0.059	0.024	0.087	0.048	0.051	0.061	0.007
	[0.674]	[0.488]	[0.488]	[0.462]	[0.178]	[0.741]	[0.401]	[0.422]	[0.461]	[0.047]
Real estate loans/Total loans	0.025	0.015	0.014	0.014	0.051	0.055	0.048	0.044	0.044	0.090
	[0.423]	[0.248]	[0.241]	[0.245]	[0.788]	[0.885]	[0.774]	[0.714]	[0.719]	[1.371]
Real estate loans/Total loans * Crisis dummy	-0.432 ***	-0.415 ***	-0.415 ***	-0.425 ***	-0.479 ***	-0.287 ***	-0.319 ***	-0.321 ***	-0.340 ***	-0.396 ***
	[-4.489]	[-3.998]	[-3.987]	[-3.986]	[-4.348]	[-3.168]	[-3.174]	[-3.179]	[-3.235]	[-3.633]
Fraction of assets owned by banks that sold residential mortgages					0.013					0.014
					[0.265]					[0.285]
Fraction of assets owned by banks that sold residential mortgages * Crisis dummy					0.029					0.048
					[0.436]					[0.722]
Additional MSA bank controls	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Time dummies	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
MSA industry structure controls	-	✓	✓	✓	✓	-	✓	✓	✓	✓
MSA change in housing prices	-	-	✓	✓	✓	-	-	✓	✓	✓
Observations	4,351	4,351	4,351	4,261	3,432	4,349	4,349	4,349	4,258	3,422
MSAs	331	331	331	331	331	331	331	331	331	331

Table 7

Changes in Economic Activity and MSA Characteristics - Employment and Establishments - Controlling for Region-Time Fixed Effects

This table reports ordinary least square regressions of changes in economic activity at the metropolitan statistical area (MSA) level on MSA characteristics, using quarterly data for the period March 2006 - December 2009. Standard errors are adjusted for clustering at the MSA level. Columns (1)-(5) report regressions using the percentage change in private employment, excluding finance and construction as dependent variable. Columns (6)-(10) report regressions using the percentage change in private establishments, excluding finance and construction as dependent variable. The crisis dummy equals one on and after September 2008 and zero before. MSA bank variables are calculated by aggregating bank-level data to the MSA level by taking asset-weighted averages. Additional MSA bank controls included in the regressions, but not reported in the table, are: capital ratio, non-performing loans/total loans, and total unused commitments/(total assets+total unused commitments). MSA industry structure controls included in the regressions, but not reported in the table, are, separately, the fraction of employment/establishments in manufacturing, finance and insurance, and construction. These unreported controls are also interacted with the crisis dummy. In columns (1)-(3) and (6)-(8) all control variables are lagged one period, except for the change in housing prices for which contemporaneous values are used. In columns (4)-(5) and (9)-(10) pre-crisis values of the displayed control variables are used. That is, lagged values of these variables are used up to September 2008 and from then on, the value of these variables as of September 2008 is used. See Appendix Table 1 for the definition of the variables. All regressions include one lag of the dependent variable and geographic region-time dummies. Geographic regions are defined on the basis of the nine U.S. Census divisions. A constant is estimated but not reported. t-statistics are in brackets. *, **, *** mean significance at ten, five, and one percent level, respectively.

	Percentage change in private employment, excluding finance and construction					Percentage change in private establishments, excluding finance and construction				
	Lagged values of controls			Pre-crisis values of controls		Lagged values of controls			Pre-crisis values of controls	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Non-core financing/Total assets	0.066	0.067	0.089	0.088	0.057	0.150	0.146	0.142	0.142	0.043
	[0.741]	[0.747]	[1.013]	[0.996]	[0.458]	[1.648]	[1.586]	[1.533]	[1.543]	[0.430]
Non-core financing/Total assets * Crisis dummy	-0.591 ***	-0.555 ***	-0.560 ***	-0.496 **	-0.455 **	-0.438 ***	-0.411 ***	-0.411 ***	-0.373 ***	-0.280 **
	[-3.156]	[-3.010]	[-3.019]	[-2.393]	[-1.989]	[-3.351]	[-3.126]	[-3.124]	[-2.676]	[-1.972]
Total loans/Total assets	-0.058	-0.049	-0.036	-0.025	0.002	-0.068	-0.017	-0.020	-0.015	-0.058
	[-0.759]	[-0.597]	[-0.435]	[-0.301]	[0.023]	[-0.888]	[-0.231]	[-0.270]	[-0.200]	[-0.668]
Total loans/Total assets * Crisis dummy	0.253	0.354 **	0.355 **	0.387 **	0.361 *	0.171 *	0.077	0.079	0.102	0.145
	[1.590]	[2.088]	[2.078]	[2.007]	[1.792]	[1.695]	[0.720]	[0.737]	[0.865]	[1.153]
Real estate loans/Total loans	-0.038	-0.063	-0.040	-0.030	-0.095	0.014	0.039	0.032	0.039	0.041
	[-0.452]	[-0.761]	[-0.482]	[-0.366]	[-0.928]	[0.252]	[0.686]	[0.570]	[0.681]	[0.670]
Real estate loans/Total loans * Crisis dummy	-0.349 **	-0.265 *	-0.263 *	-0.275	-0.190	-0.079	-0.158 *	-0.157 *	-0.189 **	-0.189 **
	[-2.302]	[-1.693]	[-1.681]	[-1.637]	[-1.052]	[-0.966]	[-1.815]	[-1.801]	[-2.063]	[-2.085]
Fraction of assets owned by banks that sold residential mortgages					0.023					0.032
					[0.509]					[0.600]
Fraction of assets owned by banks that sold residential mortgages * Crisis dummy					0.021					0.028
					[0.218]					[0.416]
Additional MSA bank controls	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Region-time dummies	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
MSA industry structure controls	-	✓	✓	✓	✓	-	✓	✓	✓	✓
MSA change in housing prices	-	-	✓	✓	✓	-	-	✓	✓	✓
Observations	3,447	3,389	3,389	3,322	2,684	4,349	4,349	4,349	4,258	3,422
MSAs	285	281	281	281	279	331	331	331	331	331

Table 8

Changes in Economic Activity and MSA Characteristics - Employment and Establishments - Excluding MSAs

This table reports ordinary least square regressions of changes in economic activity at the metropolitan statistical area (MSA) level on MSA characteristics, using quarterly data for the period March 2006 - December 2009. Standard errors are adjusted for clustering at the MSA level. Columns (1)-(6) report regressions using the percentage change in private employment, excluding finance and insurance as dependent variable. Columns (7)-(12) report regressions using the percentage change in private establishments, excluding finance and construction as dependent variable. Columns (1), (2), (7), and (8) report regressions excluding those MSAs in the top 20 percent in terms of housing price appreaciation between December 1999 and December 2005. Columns (3), (4), (9), and (10) report regressions excluding those MSAs in the top 20 percent in terms of the fraction of total employment accounted for by manufacturing between March 2006 and June 2008. Columns (5), (6), (11), and (12) report regressions excluding those MSAs located in Florida, Georgia, and South Carolina. The crisis dummy equals one on and after September 2008 and zero before. MSA bank variables are calculated by aggregating bank-level data to the MSA level by taking asset-weighted averages. Additional MSA bank controls included in the regressions, but not reported in the table, are: capital ratio, non-performing loans/total loans, and total unused commitments/(total assets+total unused commitments). MSA industry structure controls included in the regressions, but not reported in the table, are, separately, the fraction of employment/establishments in manufacturing, finance and insurance, and construction. These unreported controls are also interacted with the crisis dummy. All control variables are lagged one period, except for the change in housing prices for which contemporaneous values are used. See Appendix Table 1 for the definition of the variables. All regressions include one lag of the dependent variable. Geographic regions are defined on the basis of the nine U.S. Census divisions. A constant is estimated but not reported. t-statistics are in brackets. *, **, *** mean significance at ten, five, and one percent level, respectively.

	Percentage change in private employment, excluding finance and construction						Percentage change in private establishments, excluding finance and construction					
	Excluding MSAs with large 1999-2005 housing price appreciation		Excluding MSAs with high fraction of manufacturing employment		Excluding MSAs in Florida, Georgia, and South Carolina		Excluding MSAs with large 1999-2005 housing price appreciation		Excluding MSAs with high fraction of manufacturing employment		Excluding MSAs in Florida, Georgia, and South Carolina	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Non-core financing/Total assets	0.171 *	0.163	-0.010	0.026	0.065	0.085	0.139	0.130	0.193	0.190 *	0.103	0.152
	[1.846]	[1.612]	[-0.091]	[0.248]	[0.744]	[0.964]	[1.323]	[1.363]	[1.640]	[1.710]	[0.986]	[1.623]
Non-core financing/Total assets * Crisis dummy	-0.602 ***	-0.454 **	-0.621 ***	-0.655 ***	-0.511 ***	-0.517 ***	-0.380 ***	-0.235 *	-0.666 ***	-0.551 ***	-0.351 **	-0.342 **
	[-3.140]	[-2.300]	[-3.046]	[-2.992]	[-2.899]	[-2.763]	[-2.904]	[-1.955]	[-4.171]	[-3.391]	[-2.551]	[-2.553]
Total loans/Total assets	-0.020	0.001	-0.056	-0.092	-0.019	-0.032	-0.037	-0.008	-0.033	-0.041	-0.015	-0.026
	[-0.216]	[0.008]	[-0.564]	[-0.976]	[-0.214]	[-0.377]	[-0.472]	[-0.109]	[-0.360]	[-0.464]	[-0.195]	[-0.351]
Total loans/Total assets * Crisis dummy	0.407 *	0.366 **	0.368	0.439 **	0.320	0.351 *	0.087	0.081	0.160	0.137	0.052	0.052
	[1.854]	[2.110]	[1.609]	[2.145]	[1.514]	[1.905]	[0.729]	[0.826]	[1.150]	[1.075]	[0.424]	[0.473]
Real estate loans/Total loans	-0.128	-0.053	-0.144 *	-0.007	-0.149 *	-0.040	0.122 **	0.063	-0.012	0.016	0.044	0.062
	[-1.464]	[-0.551]	[-1.660]	[-0.079]	[-1.820]	[-0.459]	[2.068]	[1.120]	[-0.173]	[0.250]	[0.695]	[1.098]
Real estate loans/Total loans * Crisis dummy	-0.251	-0.200	-0.144	-0.223	-0.175	-0.300 *	-0.393 ***	-0.125	-0.238 **	-0.132	-0.344 ***	-0.234 ***
	[-1.155]	[-1.101]	[-0.777]	[-1.184]	[-0.909]	[-1.822]	[-3.902]	[-1.543]	[-2.145]	[-1.310]	[-3.439]	[-2.639]
Additional MSA bank controls	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Time dummies	✓	-	✓	-	✓	-	✓	-	✓	-	✓	-
Region-time dummies	-	✓	-	✓	-	✓	-	✓	-	✓	-	✓
MSA industry structure controls	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
MSA change in housing prices	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Observations	2,658	2,658	2,649	2,649	2,948	2,948	3,503	3,503	3,339	3,339	3,839	3,839
MSAs	222	222	224	224	246	246	264	264	257	257	289	289

Table 9
Changes in Economic Activity and MSA Characteristics - Employment and Establishments
Differences in Industry Financial Dependence across MSAs

This table reports ordinary least square regressions of changes in economic activity at the metropolitan statistical area (MSA) level on MSA characteristics, using quarterly data for the period March 2006 - December 2009. Standard errors are adjusted for clustering at the MSA level. Columns (1)-(4) report regressions using the percentage change in private employment, excluding finance and insurance as dependent variable. Columns (5)-(8) report regressions using the percentage change in private establishments, excluding finance and construction as dependent variable. The crisis dummy equals one on and after September 2008 and zero before. MSA bank variables are calculated by aggregating bank-level data to the MSA level by taking asset-weighted averages. Additional MSA bank controls included in the regressions, but not reported in the table, are: Capital ratio, non-performing loans/total loans, and total unused commitments/(total assets+total unused commitments). MSA industry structure controls included in the regressions, but not reported in the table, are, separately, the fraction of employment/establishments in manufacturing, finance and insurance, and construction. These unreported controls are also interacted with the crisis dummy. All control variables are lagged one period, except for the change in housing prices for which contemporaneous values are used. MSAs with high (low) financial dependence are those above (below) the median level of aggregate financial dependence between March 2006 and June 2008. See Appendix Table 1 for the definition of the variables. All regressions include one lag of the dependent variable. Geographic regions are defined on the basis of the nine U.S. Census divisions. A constant is estimated but not reported. t-statistics are in brackets. *, **, *** mean significance at ten, five, and one percent level, respectively.

	Percentage change in private employment, excluding finance and construction				Percentage change in private establishments, excluding finance and construction			
	MSAs with high financial dependence	MSAs with low financial dependence	MSAs with high financial dependence	MSAs with low financial dependence	MSAs with high financial dependence	MSAs with low financial dependence	MSAs with high financial dependence	MSAs with low financial dependence
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Non-core financing/Total assets	-0.114	0.152	0.129	0.175	0.121	0.175	0.055	0.325 **
	[-0.707]	[1.438]	[0.741]	[1.529]	[1.064]	[1.049]	[0.430]	[2.399]
Non-core financing/Total assets * Crisis dummy	-0.782 **	-0.319	-1.186 ***	-0.215	-0.824 ***	-0.239	-0.674 ***	-0.392 **
	[-2.321]	[-1.598]	[-2.969]	[-1.075]	[-4.230]	[-1.274]	[-3.083]	[-2.186]
Total loans/Total assets	-0.090	-0.029	-0.109	0.083	-0.044	0.077	0.034	0.068
	[-0.735]	[-0.215]	[-0.888]	[0.568]	[-0.442]	[0.636]	[0.348]	[0.489]
Total loans/Total assets * Crisis dummy	0.449	0.369	0.227	0.492 **	0.219	-0.069	0.037	0.221
	[1.380]	[1.413]	[0.729]	[2.095]	[1.108]	[-0.424]	[0.193]	[1.429]
Real estate loans/Total loans	-0.171	-0.254 **	-0.116	-0.094	-0.089	0.215 **	-0.035	0.168 *
	[-1.398]	[-2.007]	[-0.840]	[-0.897]	[-1.040]	[1.983]	[-0.392]	[1.788]
Real estate loans/Total loans * Crisis dummy	-0.104	-0.140	-0.321	-0.449 **	-0.142	-0.398 **	-0.108	-0.148
	[-0.381]	[-0.506]	[-1.200]	[-2.471]	[-1.001]	[-2.426]	[-0.864]	[-0.968]
Additional MSA bank controls	✓	✓	✓	✓	✓	✓	✓	✓
Time dummies	✓	✓	-	-	✓	✓	-	-
Region-time dummies	-	-	✓	✓	-	-	✓	✓
MSA industry structure controls	✓	✓	✓	✓	✓	✓	✓	✓
MSA change in housing prices	✓	✓	✓	✓	✓	✓	✓	✓
Observations	1,406	1,339	1,406	1,339	1,808	1,874	1,808	1,874
MSAs	119	112	119	112	140	141	140	141

Table 10
Changes in Economic Activity and MSA Characteristics - Employment and Establishments
Differences in Fraction of Small Firms across MSAs

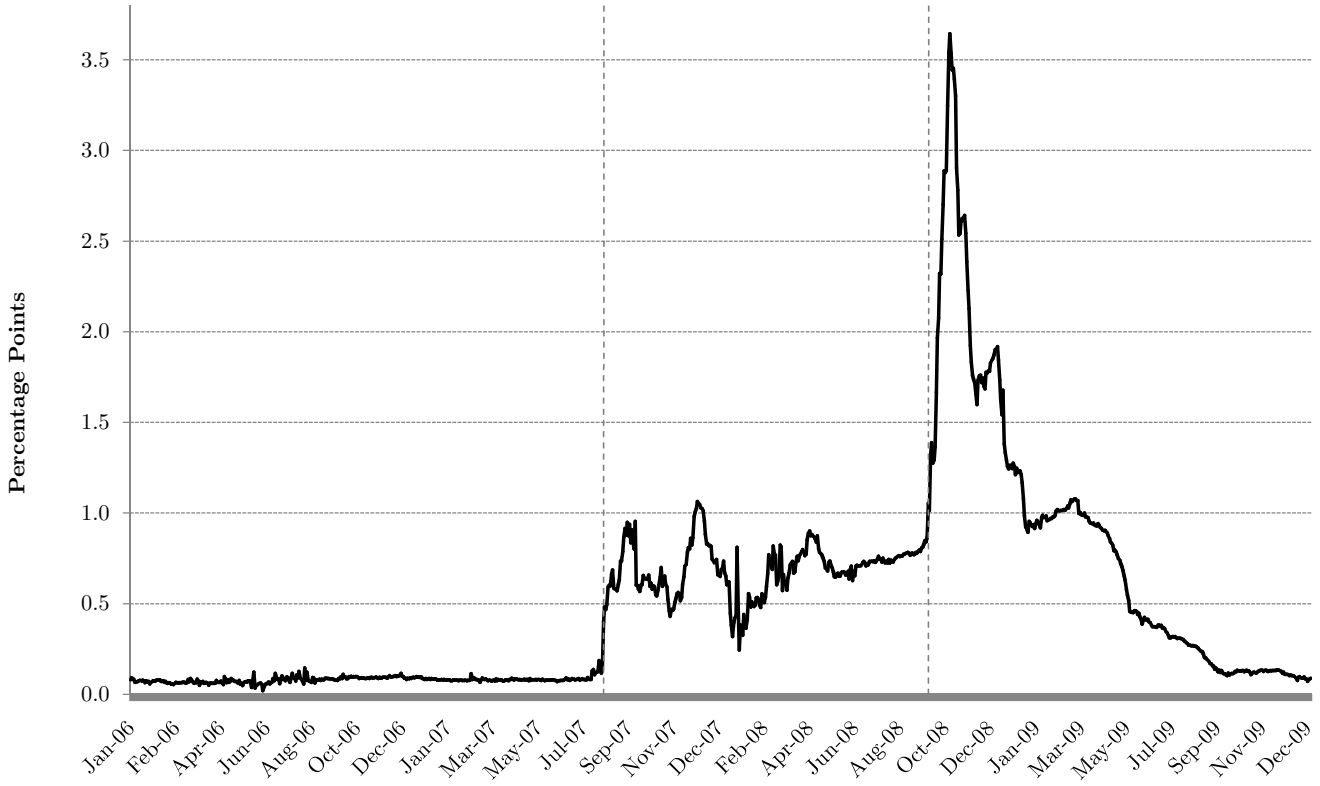
This table reports ordinary least square regressions of changes in economic activity at the metropolitan statistical area (MSA) level on MSA characteristics, using quarterly data for the period March 2006 - December 2009. Standard errors are adjusted for clustering at the MSA level. Columns (1)-(4) report regressions using the percentage change in private employment, excluding finance and insurance as dependent variable. Columns (5)-(8) report regressions using the percentage change in private establishments, excluding finance and construction as dependent variable. The crisis dummy equals one on and after September 2008 and zero before. MSA bank variables are calculated by aggregating bank-level data to the MSA level by taking asset-weighted averages. Additional MSA bank controls included in the regressions, but not reported in the table, are: Capital ratio, non-performing loans/total loans, and total unused commitments/(total assets+total unused commitments). MSA industry structure controls included in the regressions, but not reported in the table, are, separately, the fraction of employment/establishments in manufacturing, finance and insurance, and construction. These unreported controls are also interacted with the crisis dummy. All control variables are lagged one period, except for the change in housing prices for which contemporaneous values are used. MSAs with high (low) fraction of small firm employment are those above (below) the median level of the fraction of total MSA employment accounted for by small firms (defined as those with less than 500 employees) in 2006 and 2007. See Appendix Table 1 for the definition of the variables. All regressions include one lag of the dependent variable. Geographic regions are defined on the basis of the nine U.S. Census divisions. A constant is estimated but not reported. t-statistics are in brackets. *, **, *** mean significance at ten, five, and one percent level, respectively.

	Percentage change in private employment, excluding finance and construction				Percentage change in private establishments, excluding finance and construction			
	MSAs with high fraction of small firm employment	MSAs with low fraction of small firm employment	MSAs with high fraction of small firm employment	MSAs with low fraction of small firm employment	MSAs with high fraction of small firm employment	MSAs with low fraction of small firm employment	MSAs with high fraction of small firm employment	MSAs with low fraction of small firm employment
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Non-core financing/Total assets	-0.002	0.067	0.049	0.076	0.130	0.113	0.166	0.013
	[-0.018]	[0.413]	[0.499]	[0.440]	[0.979]	[0.810]	[1.441]	[0.094]
Non-core financing/Total assets * Crisis dummy	-0.639 ***	-0.367	-0.611 ***	-0.332	-0.546 ***	-0.253	-0.414 **	-0.191
	[-2.948]	[-1.232]	[-2.801]	[-0.942]	[-3.154]	[-1.313]	[-2.343]	[-0.912]
Total loans/Total assets	-0.045	-0.053	-0.163	0.036	0.020	-0.082	-0.053	0.060
	[-0.359]	[-0.446]	[-1.389]	[0.303]	[0.182]	[-0.793]	[-0.474]	[0.526]
Total loans/Total assets * Crisis dummy	0.276	0.346	0.425 *	0.396	0.110	-0.098	0.117	-0.049
	[0.979]	[1.123]	[1.774]	[1.230]	[0.647]	[-0.644]	[0.745]	[-0.319]
Real estate loans/Total loans	-0.192 *	-0.183	-0.073	-0.095	0.010	0.031	-0.005	0.044
	[-1.907]	[-1.328]	[-0.630]	[-0.672]	[0.121]	[0.271]	[-0.055]	[0.415]
Real estate loans/Total loans * Crisis dummy	-0.002	-0.471	-0.016	-0.561 **	-0.218	-0.341 **	-0.082	-0.188
	[-0.010]	[-1.559]	[-0.078]	[-2.244]	[-1.458]	[-2.225]	[-0.616]	[-1.420]
Additional MSA bank controls	✓	✓	✓	✓	✓	✓	✓	✓
Time dummies	✓	✓	-	-	✓	✓	-	-
Region-time dummies	-	-	✓	✓	-	-	✓	✓
MSA industry structure controls	✓	✓	✓	✓	✓	✓	✓	✓
MSA change in housing prices	✓	✓	✓	✓	✓	✓	✓	✓
Observations	1,880	1,509	1,880	1,509	2,184	2,159	2,184	2,159
MSAs	153	128	153	128	165	165	165	165

Figure 1

Evolution of LIBOR-OIS Spread

This figure shows the evolution of the LIBOR-OIS spread between 2006 and 2009. The LIBOR-OIS spread is defined as the difference between the three-month U.S. dollar LIBOR and the overnight interest swap (OIS) rate. The vertical line on the left corresponds to August 9, 2007 and the vertical line on the right corresponds to September 15, 2008.

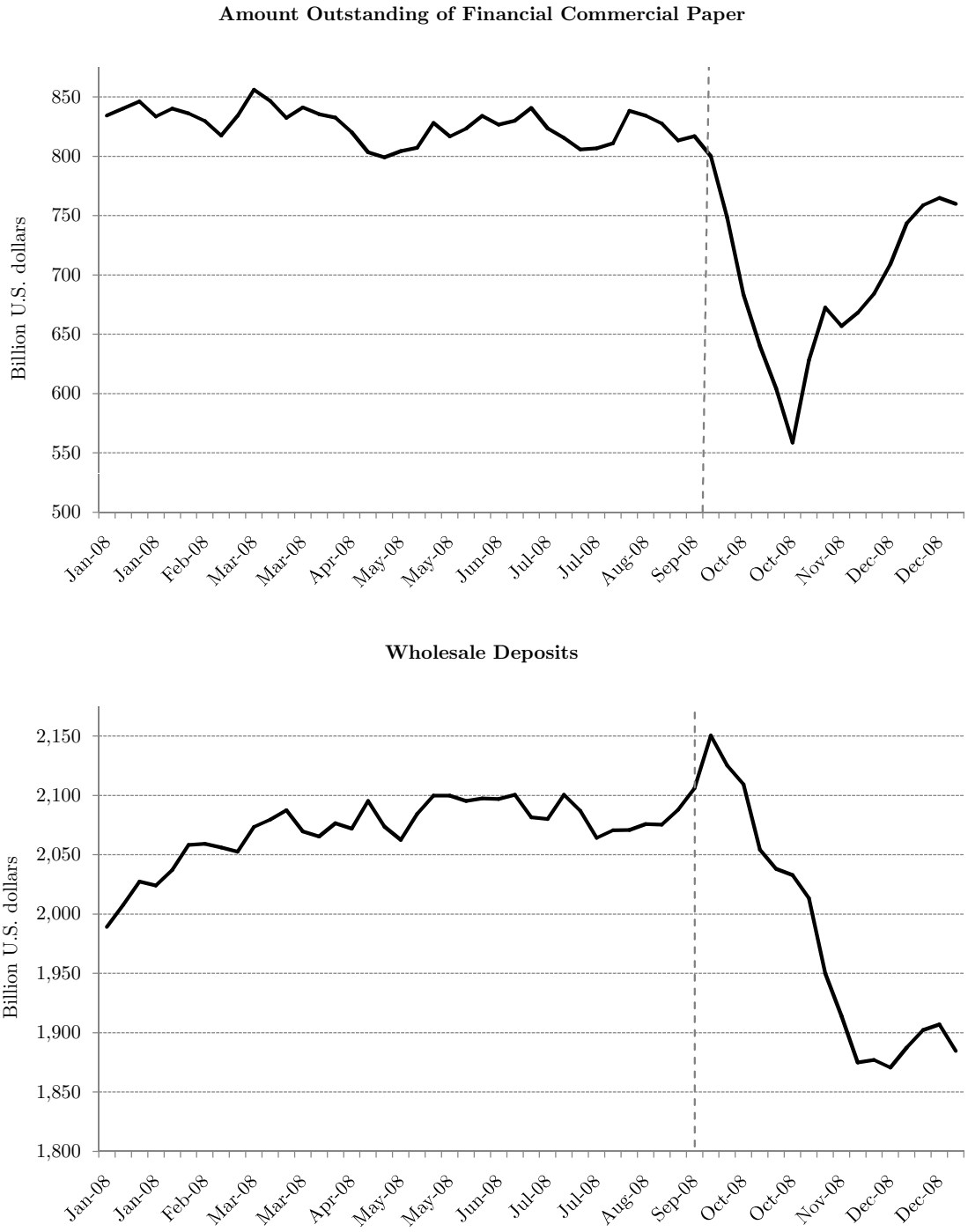


Source: Bloomberg

Figure 2

Evolution of Wholesale Funding Sources

The top figure shows the evolution of the amount outstanding of financial commercial paper during 2008. The bottom figure shows the evolution of total wholesale deposits in commercial banks, defined as time deposits over 100,000 U.S. dollars, during 2008. Series are seasonally adjusted. The vertical line corresponds to September 15, 2008.

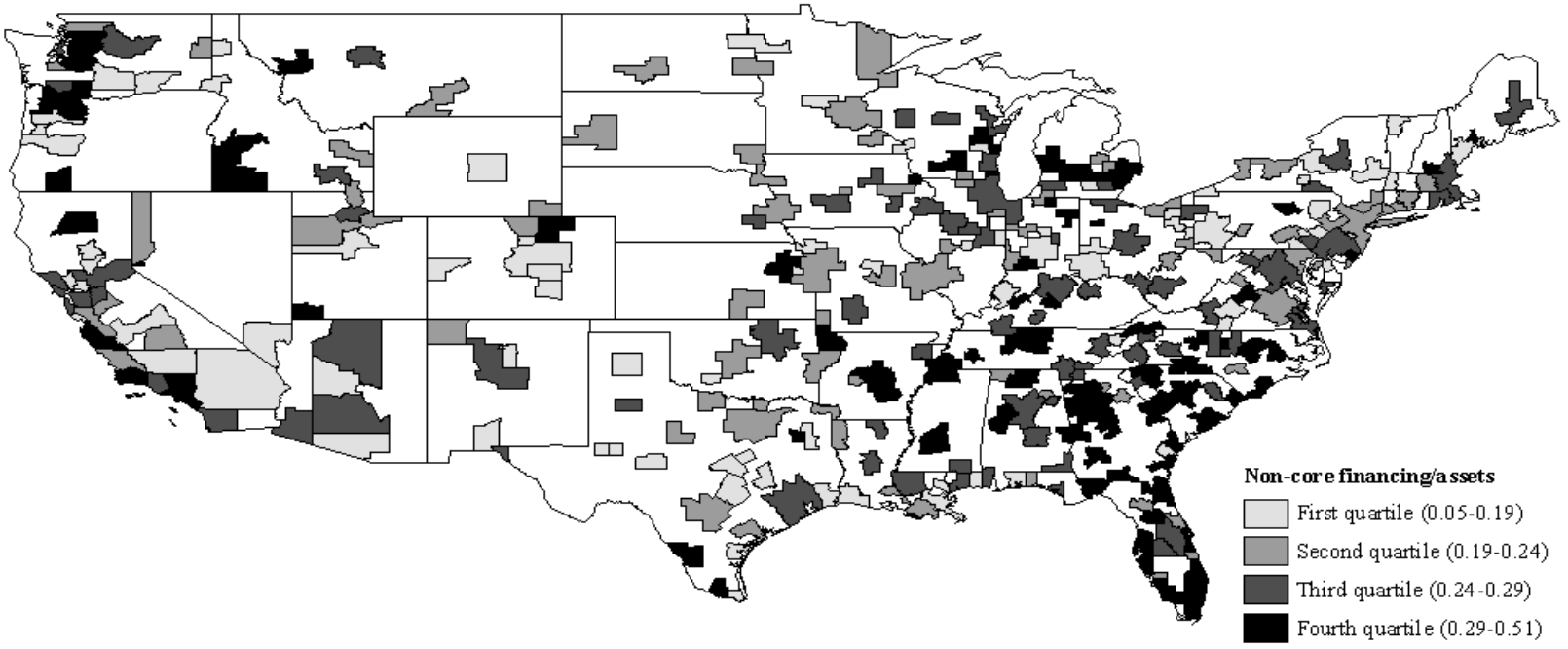


Source: Federal Reserve Board

Figure 3

Geographic Distribution of Metropolitan Statistical Areas (MSAs) according to Dependence on Wholesale Funding

This figure shows the geographic distribution of the metropolitan statistical areas (MSAs) in our sample, according to the dependence of their local banks on wholesale funding. MSAs are divided in four quantiles based on their average aggregate ratio of non-core liabilities to assets before the crisis (March 2006 - June 2008). Darker colors indicate higher ratios.



Appendix Table 1
Data Definitions

This table reports the definition of the variables used in the analysis.

Bank-level variables

Variable	Definition	Source
Percentage change in commercial and industrial (C&I) loans (%)	Quarterly change in commercial and industrial loans Calculated as: log of (C&I loans$_t$) – log of (C&I loans$_{t-1}$) Series: rcon1766	Call Reports
Percentage change in (C&I loans+other unused commitments) (%)	Quarterly change in commercial and industrial loans and other unused commitments Calculated as: log of (C&I loanst + other unused commitmentst) – log of (C&I loanst-1 + other unused commitmentst-1) Series: rcon1766 + rcon3818	Call Reports
Percentage change in (C&I loans+ other unused commitments+net loans write-offs) (%)	Quarterly change in commercial and industrial loans and other unused commitments, adjusted for net loan write-offs Calculated as log of (C&I loans$_t$ + other unused commitments$_t$ + Net loan charge-offs$_t$) – log of (C&I loans$_{t-1}$ + other unused commitments$_{t-1}$) Series: rcon1766 + rcon3818 ; net charge-offs=riad4638 - riad4608	Call Reports
Total assets	Series: rcfd2170	Call Reports
Non-core financing	Non-core liabilities, defined as the sum of total time deposits of 100,000 dollars or more, foreign office deposits, insured brokered deposits issued in denominations of less than 100,000 dollars, securities sold under agreements to repurchase, federal funds purchased, and other borrowed money. Series: rcon2604 + rcfd3190 + rcfn2200 + rcon2343 + rcfd2800 (rcfdb993 + rcfdb995)	Call Reports
Total loans	Series: rcfd1400 (rcfd2122 + rcfd2123)	Call Reports
Real estate loans	Series: rcfd1410	Call Reports
Dummy residential mortgages sold during the quarter	Dummy variable that equals one if the bank sold any residential mortgages during the quarter and zero otherwise. Covers closed end 1-4 family residential mortgages sold during the quarter, including both first and junior liens. Only available starting in the third quarter of 2006. Series: rcfdf070 + rcfdf071	Call Reports
Capital ratio	Tier 1 leverage capital ratio, defined as Tier 1 (core) capital divided by adjusted total assets Series: rcfd7204	Call Reports
Non-performing loans	Loans 90 days or more past due plus non-accruing loans Series: rcfd1403 + rcfd1407	Call Reports
Total unused commitments	Series: rcfd3423	Call Reports

Appendix Table 1 (cont.)
Data Definitions

This table reports the definition of the variables used in the analysis.

MSA-level variables

Variable	Definition	Source
MSA bank variables	MSA-level bank variables are calculated by aggregating bank-level variables up to the MSA level by taking weighted averages of bank characteristics. The weights are given by the fraction of total bank assets in an MSA represented by each bank.	Call Reports
Percentage change in employment (%)	Change in total private employment, with respect to the same quarter of the previous year. Expressed as quarterly rate. Calculated by taking log differences.	Quarterly Census of Employment and Wages (QCEW)
Percentage change in establishments (%)	Change in total private establishments, with respect to the same quarter of the previous year. Expressed as quarterly rate. Calculated by taking log differences.	QCEW
Percentage change in employment, excluding finance and construction (%)	Change in total private employment excluding employment in construction (NAICS code 23) and finance and insurance (NAICS code 52), with respect to the same quarter of the previous year. Expressed as quarterly rate. Calculated by taking log differences.	QCEW
Percentage change in establishments, excluding finance and construction (%)	Change in total private establishments, excluding establishments in construction (NAICS code 23) and finance and insurance (NAICS code 52), with respect to the same quarter of the previous year. Expressed as quarterly rate. Calculated by taking log differences.	QCEW
Percentage change in housing prices (%)	Quarterly change in Housing Price Index (HPI)	Federal Housing Finance Agency (FHFA)
Fraction of finance and insurance employment/establishments	Employment (establishments) in finance and insurance (NAICS code 52)/total private employment (establishments)	QCEW
Fraction of construction employment/establishments	Employment (establishments) in construction (NAICS code 23)/total private employment (establishments)	QCEW
Fraction of manufacturing employment/establishments	Employment (establishments) in manufacturing (NAICS codes 31-33)/total private employment (establishments)	QCEW
Financial dependence	Measure of the degree to which industries in a given MSA depend on external financing, calculated by aggregating industry-level data up to the MSA level. We first calculate the dependence on external finance of different industries following the methodology in Rajan and Zingales (1998), aggregating firm-level data from Compustat for the 1990s up to the 3-digit NAICS sector. To determine an MSA's overall degree of dependence on external finance, we then aggregate the industry data at the MSA level by calculating a weighted average of the industry financial dependence, using the fraction of total employment represented by each industry for the weights.	Compustat, QCEW
Fraction of small firm employment	Employment in firms with less than 500 employees/total employment	Statistics of U.S. Businesses (SUSB)

Appendix Table 2
Changes in Lending and Bank Characteristics Robustness - Additional Controls
Small Banks Headquartered in Metropolitan Statistical Areas (MSAs)

This table reports ordinary least square regressions of changes in bank lending on bank characteristics, using quarterly data for the period March 2006 - December 2009. Standard errors are adjusted for clustering at the bank level. The dependent variable is the percentage change in (C&I loans+other unused commitments+net loans write-offs). The crisis dummy equals one on and after September 2008 and zero before. Additional bank controls included in the regressions, but not reported in the table, are: Capital ratio, non-performing loans/total loans, total unused commitments/(total assets+total unused commitments) and the logarithm of total assets. These unreported controls are also interacted with the crisis dummy. All control variables are lagged one period. The sample covers small insured commercial banks in the 50 states of the U.S. and the District of Columbia. Small banks are defined as those below the 90th percentile of the asset size distribution in a given quarter. The sample is restricted to banks headquartered in metropolitan statistical areas (MSAs). See Appendix Table 1 for the definition of the variables. All regressions include one lag of the dependent variable. A constant is estimated but not reported. t-statistics are in brackets. *, **, *** mean significance at ten, five, and one percent level, respectively.

	Percentage change in (C&I Loans+other unused commitments+net loans write-offs)								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Non-core financing/Total assets	8.460 ***	7.258 ***	5.861 ***	7.992 ***	6.800 ***	5.292 ***	7.147 ***	5.943 ***	4.433 ***
	[6.955]	[6.473]	[4.929]	[6.698]	[6.130]	[4.524]	[6.593]	[5.903]	[4.189]
Non-core financing/Total assets * Crisis dummy	-5.052 ***	-4.487 ***	-6.558 ***	-4.489 ***	-3.983 **	-6.312 ***	-4.824 ***	-4.098 ***	-5.629 ***
	[-3.071]	[-2.833]	[-3.913]	[-2.761]	[-2.536]	[-3.820]	[-3.248]	[-2.819]	[-3.715]
Total loans/Total assets	1.096	2.260 **	0.615	1.448	2.314 **	0.800	1.692 *	2.488 ***	1.249
	[1.052]	[2.251]	[0.598]	[1.398]	[2.315]	[0.783]	[1.738]	[2.674]	[1.322]
Total loans/Total assets * Crisis dummy	0.403	-0.122	1.317	0.039	-0.085	1.118	-1.196	-0.855	0.561
	[0.274]	[-0.083]	[0.882]	[0.027]	[-0.059]	[0.750]	[-0.851]	[-0.618]	[0.406]
Real estate loans/Total loans	4.168 ***	2.103 **	3.514 ***	3.475 ***	1.719 **	3.002 ***	4.247 ***	2.591 ***	3.374 ***
	[4.457]	[2.428]	[3.931]	[3.758]	[2.009]	[3.403]	[4.676]	[3.092]	[3.945]
Real estate loans/Total loans * Crisis dummy	-4.944 ***	-3.003 **	-5.226 ***	-4.463 ***	-2.902 **	-5.207 ***	-5.534 ***	-4.110 ***	-6.648 ***
	[-3.518]	[-2.185]	[-3.675]	[-3.177]	[-2.123]	[-3.673]	[-4.012]	[-3.093]	[-4.865]
Bank-level controls	✓	✓	✓	✓	✓	✓	✓	✓	✓
MSA-time dummies	✓	✓	✓	✓	✓	✓	✓	✓	✓
Three lags of dependent variable	-	✓	-	-	✓	-	-	✓	-
Average growth rate of lending 01-05	-	-	✓	-	-	✓	-	-	✓
Non-performing C&I loans/Total C&I loans	-	-	-	✓	✓	✓	✓	✓	✓
Average interest rate on C&I loans	-	-	-	✓	✓	✓	✓	✓	✓
Fraction of small business loans	-	-	-	-	-	-	✓	✓	✓
Observations	44,734	42,491	40,628	43,832	41,741	39,863	42,059	40,083	38,184
Banks	3,565	3,486	3,043	3,545	3,471	3,033	3,493	3,425	2,989

Appendix Table 3
Changes in Lending and Bank Characteristics Robustness - LIBOR-OIS Spread
Small Banks Headquartered in Metropolitan Statistical Areas (MSAs)

This table reports ordinary least square regressions of changes in bank lending on bank characteristics, using quarterly data for the period March 2006 - December 2009. Standard errors are adjusted for clustering at the bank level. The dependent variable is the percentage change in (C&I loans+other unused commitments+net loans write-offs). The LIBOR-OIS spread is the difference between the three-month U.S. dollar LIBOR and the overnight interest swap (OIS) rate. Additional bank controls included in the regressions, but not reported in the table, are: Capital ratio, non-performing loans/total loans, total unused commitments/(total assets+total unused commitments) and the logarithm of total assets. These unreported controls are also interacted with the crisis dummy. All control variables are lagged one period. The sample covers small insured commercial banks in the 50 states of the U.S. and the District of Columbia. Small banks are defined as those below the 90th percentile of the asset size distribution in a given quarter. The sample is restricted to banks headquartered in metropolitan statistical areas (MSAs). See Appendix Table 1 for the definition of the variables. All regressions include one lag of the dependent variable. A constant is estimated but not reported. t-statistics are in brackets. *, **, *** mean significance at ten, five, and one percent level, respectively.

	Percentage change in (C&I Loans+other unused commitments+net loans write-offs)								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Non-core financing/Total assets	8.648 ***	7.394 ***	6.151 ***	8.343 ***	6.983 ***	5.773 ***	7.836 ***	6.499 ***	5.160 ***
	[7.249]	[6.502]	[5.050]	[7.091]	[6.183]	[4.762]	[7.264]	[6.284]	[4.703]
Non-core financing/Total assets * LIBOR-OIS spread	-3.966 ***	-3.748 ***	-5.384 ***	-3.881 ***	-3.477 **	-5.552 ***	-4.919 ***	-4.342 ***	-5.797 ***
	[-2.886]	[-2.697]	[-3.617]	[-2.823]	[-2.498]	[-3.737]	[-3.811]	[-3.348]	[-4.280]
Total loans/Total assets	-0.241	0.823	-0.361	0.070	0.822	-0.292	0.358	1.126	0.072
	[-0.222]	[0.783]	[-0.331]	[0.064]	[0.781]	[-0.267]	[0.354]	[1.147]	[0.072]
Total loans/Total assets * LIBOR-OIS spread	2.754 **	2.643 *	2.764 *	2.569 *	2.804 **	2.835 **	1.691	2.117 *	2.769 **
	[2.014]	[1.925]	[1.911]	[1.882]	[2.050]	[1.973]	[1.332]	[1.676]	[2.143]
Real estate loans/Total loans	3.826 ***	1.787 *	3.100 ***	3.307 ***	1.507	2.751 ***	4.445 ***	2.713 ***	3.607 ***
	[3.962]	[1.912]	[3.182]	[3.406]	[1.618]	[2.801]	[4.631]	[2.990]	[3.788]
Real estate loans/Total loans * LIBOR-OIS spread	-2.766 **	-1.452	-2.636 **	-2.825 **	-1.640	-2.988 **	-4.317 ***	-3.126 **	-5.061 ***
	[-2.225]	[-1.160]	[-2.064]	[-2.248]	[-1.311]	[-2.332]	[-3.376]	[-2.482]	[-3.846]
Bank-level controls	✓	✓	✓	✓	✓	✓	✓	✓	✓
MSA-time dummies	✓	✓	✓	✓	✓	✓	✓	✓	✓
Three lags of dependent variable	-	✓	-	-	✓	-	-	✓	-
Average growth rate of lending 01-05	-	-	✓	-	-	✓	-	-	✓
Non-performing C&I loans/Total C&I loans	-	-	-	✓	✓	✓	✓	✓	✓
Average interest rate on C&I loans	-	-	-	✓	✓	✓	✓	✓	✓
Fraction of small business loans	-	-	-	-	-	-	✓	✓	✓
Observations	44,734	42,491	40,628	43,832	41,741	39,863	42,059	40,083	38,184
Banks	3,565	3,486	3,043	3,545	3,471	3,033	3,493	3,425	2,989

Appendix Table 4

Metropolitan Statistical Area (MSA) Sample and Exposure to Wholesale Funding

This table shows the list of metropolitan statistical areas (MSAs) used in the analysis of changes in economic activity at the MSA level and their average aggregate ratio of non-core financing to assets before the crisis (March 2006 - June 2008). MSAs are ranked in ascending order according to this ratio.

Rank	MSA	Non-core financing/Total assets	Rank	MSA	Non-core financing/Total assets
1	Lewiston, ID-WA	0.050	85	Reno-Sparks, NV	0.195
2	Killeen-Temple-Fort Hood, TX	0.078	86	Houma-Bayou Cane-Thibodaux, LA	0.195
3	Danville, VA	0.086	87	Duluth, MN-WI	0.195
4	Ithaca, NY	0.089	88	Cheyenne, WY	0.196
5	Burlington-South Burlington, VT	0.098	89	Visalia-Porterville, CA	0.196
6	Casper, WY	0.098	90	Jefferson City, MO	0.196
7	Beaumont-Port Arthur, TX	0.103	91	Vero Beach, FL	0.196
8	Akron, OH	0.108	92	Saginaw-Saginaw Township North, MI	0.197
9	Pueblo, CO	0.108	93	Terre Haute, IN	0.197
10	Kennewick-Richland-Pasco, WA	0.112	94	Florence-Muscle Shoals, AL	0.197
11	Midland, TX	0.113	95	Lafayette, IN	0.199
12	Vallejo-Fairfield, CA	0.114	96	Lafayette, LA	0.200
13	Lawton, OK	0.118	97	Wichita Falls, TX	0.201
14	Anchorage, AK	0.118	98	Baltimore-Towson, MD	0.201
15	Lebanon, PA	0.119	99	Morgantown, WV	0.201
16	Colorado Springs, CO	0.123	100	San Luis Obispo-Paso Robles, CA	0.202
17	Pittsburgh, PA	0.125	101	Parkersburg-Marietta, WV-OH	0.203
18	Honolulu, HI	0.125	102	New Haven-Milford, CT	0.204
19	Santa Fe, NM	0.125	103	Hagerstown-Martinsburg, MD-WV	0.205
20	Grand Forks, ND-MN	0.127	104	Ocean City, NJ	0.206
21	Las Cruces, NM	0.128	105	Hartford-West Hartford-East Hartford, CT	0.207
22	Lake Charles, LA	0.129	106	Sherman-Denison, TX	0.208
23	Lawrence, KS	0.131	107	Farmington, NM	0.209
24	Reading, PA	0.132	108	Sioux Falls, SD	0.209
25	Santa Cruz-Watsonville, CA	0.132	109	Rapid City, SD	0.210
26	Jackson, MI	0.133	110	Omaha-Council Bluffs, NE-IA	0.210
27	St. Joseph, MO-KS	0.134	111	Wichita, KS	0.211
28	Kokomo, IN	0.136	112	Rochester, NY	0.211
29	Bakersfield, CA	0.138	113	Poughkeepsie-Newburgh-Middletown, NY	0.212
30	Odessa, TX	0.138	114	Victoria, TX	0.213
31	Corvallis, OR	0.142	115	Bridgeport-Stamford-Norwalk, CT	0.213
32	Erie, PA	0.142	116	Idaho Falls, ID	0.213
33	Denver-Aurora, CO	0.143	117	Bismarck, ND	0.213
34	Weirton-Steubenville, WV-OH	0.144	118	South Bend-Mishawaka, IN-MI	0.213
35	Corpus Christi, TX	0.145	119	Springfield, IL	0.214
36	Eugene-Springfield, OR	0.147	120	Mount Vernon-Anacortes, WA	0.215
37	Pensacola-Ferry Pass-Brent, FL	0.147	121	Oklahoma City, OK	0.216
38	Chico, CA	0.149	122	Joplin, MO	0.216
39	Pascagoula, MS	0.153	123	Kansas City, MO-KS	0.217
40	Boulder, CO	0.153	124	Flint, MI	0.217
41	Fresno, CA	0.156	125	Logan, UT-ID	0.218
42	Prescott, AZ	0.156	126	Texarkana, TX-Texarkana, AR	0.219
43	Pittsfield, MA	0.156	127	San Jose-Sunnyvale-Santa Clara, CA	0.220
44	Canton-Massillon, OH	0.160	128	Harrisburg-Carlisle, PA	0.220
45	Yakima, WA	0.160	129	Richmond, VA	0.220
46	Danville, IL	0.160	130	Rochester, MN	0.220
47	Fond du Lac, WI	0.161	131	Sioux City, IA-NE-SD	0.221
48	Austin-Round Rock, TX	0.164	132	Buffalo-Niagara Falls, NY	0.221
49	York-Hanover, PA	0.166	133	Johnstown, PA	0.221
50	La Crosse, WI-MN	0.170	134	Ames, IA	0.221
51	Columbia, MO	0.170	135	Fargo, ND-MN	0.222
52	College Station-Bryan, TX	0.171	136	Gainesville, FL	0.223
53	Hinesville-Fort Stewart, GA	0.171	137	Allentown-Bethlehem-Easton, PA-NJ	0.223
54	Fairbanks, AK	0.172	138	Deltona-Daytona Beach-Ormond Beach, FL	0.224
55	Syracuse, NY	0.175	139	Wheeling, WV-OH	0.224
56	San Angelo, TX	0.175	140	Kankakee-Bradley, IL	0.224
57	Brownsville-Harlingen, TX	0.177	141	Fort Collins-Loveland, CO	0.226
58	Portland-South Portland-Biddeford, ME	0.177	142	Janesville, WI	0.227
59	Lynchburg, VA	0.177	143	Fort Smith, AR-OK	0.228
60	St. Cloud, MN	0.178	144	Dallas-Fort Worth-Arlington, TX	0.228
61	Yuba City, CA	0.180	145	St. Louis, MO-IL	0.228
62	Provo-Orem, UT	0.180	146	Athens-Clarke County, GA	0.229
63	Albany-Schenectady-Troy, NY	0.180	147	Rockford, IL	0.229
64	Grand Junction, CO	0.182	148	Billings, MT	0.230
65	Napa, CA	0.182	149	San Antonio, TX	0.231
66	Dayton, OH	0.183	150	New York-Northern New Jersey-Long Island, NY-NJ-P	0.231
67	Dover, DE	0.186	151	Harrisonburg, VA	0.231
68	Tucson, AZ	0.186	152	Minneapolis-St. Paul-Bloomington, MN-WI	0.233
69	Riverside-San Bernardino-Ontario, CA	0.187	153	Fort Walton Beach-Crestview-Destin, FL	0.233
70	New Orleans-Metairie-Kenner, LA	0.187	154	Cleveland-Elyria-Mentor, OH	0.233
71	Indianapolis, IN	0.188	155	Abilene, TX	0.233
72	Morristown, TN	0.189	156	Gadsden, AL	0.233
73	Salem, OR	0.189	157	Hot Springs, AR	0.233
74	Coeur d'Alene, ID	0.189	158	Shreveport-Bossier City, LA	0.233
75	Las Vegas-Paradise, NV	0.189	159	Punta Gorda, FL	0.233
76	Longview, TX	0.190	160	Fayetteville, NC	0.234
77	Amarillo, TX	0.191	161	Spokane, WA	0.234
78	Waco, TX	0.192	162	Olympia, WA	0.234
79	Trenton-Ewing, NJ	0.192	163	Modesto, CA	0.235
80	Decatur, IL	0.192	164	Cedar Rapids, IA	0.236
81	Evansville, IN-KY	0.193	165	Salt Lake City, UT	0.237
82	Cincinnati-Middletown, OH-KY-IN	0.193	166	Gainesville, GA	0.238
83	Scranton--Wilkes-Barre, PA	0.194	167	Roanoke, VA	0.238
84	Worcester, MA	0.194	168	Waterloo-Cedar Falls, IA	0.239

Appendix Table 4 (cont.)
Metropolitan Statistical Area (MSA) Sample and Exposure to Wholesale Funding

This table shows the list of metropolitan statistical areas (MSAs) used in the analysis of changes in economic activity at the MSA level and their average aggregate ratio of non-core financing to assets before the crisis (March 2006 - June 2008). MSAs are ranked in ascending order according to this ratio.

Rank	MSA	Non-core financing/Total assets
169	Charleston, WV	0.239
170	Great Falls, MT	0.241
171	San Diego-Carlsbad-San Marcos, CA	0.242
172	Eau Claire, WI	0.242
173	Yuma, AZ	0.243
174	Davenport-Moline-Rock Island, IA-IL	0.244
175	Monroe, LA	0.244
176	Bloomington-Normal, IL	0.244
177	Ogden-Clearfield, UT	0.245
178	Durham, NC	0.246
179	Bowling Green, KY	0.246
180	Utica-Rome, NY	0.247
181	Tulsa, OK	0.247
182	Philadelphia-Camden-Wilmington, PA-NJ-DE-MD	0.247
183	Wenatchee, WA	0.248
184	Huntington-Ashland, WV-KY-OH	0.249
185	Champaign-Urbana, IL	0.249
186	Des Moines, IA	0.250
187	Chattanooga, TN-GA	0.251
188	Baton Rouge, LA	0.251
189	Montgomery, AL	0.251
190	Louisville, KY-IN	0.252
191	Panama City-Lynn Haven, FL	0.252
192	Albuquerque, NM	0.252
193	Hickory-Lenoir-Morganton, NC	0.252
194	Mobile, AL	0.252
195	El Paso, TX	0.252
196	Anniston-Oxford, AL	0.253
197	Asheville, NC	0.254
198	Kalamazoo-Portage, MI	0.255
199	Columbus, OH	0.256
200	Salisbury, MD	0.256
201	Youngstown-Warren-Boardman, OH-PA	0.256
202	Cleveland, TN	0.257
203	Binghamton, NY	0.257
204	Birmingham-Hoover, AL	0.258
205	Ann Arbor, MI	0.259
206	Oxnard-Thousand Oaks-Ventura, CA	0.259
207	Iowa City, IA	0.259
208	Lexington-Fayette, KY	0.259
209	Clarksville, TN-KY	0.260
210	Peoria, IL	0.261
211	Winchester, VA-WV	0.261
212	Alexandria, LA	0.261
213	Chicago-Naperville-Joliet, IL-IN-WI	0.262
214	Houston-Baytown-Sugar Land, TX	0.262
215	Virginia Beach-Norfolk-Newport News, VA-NC	0.262
216	Bremerton-Silverdale, WA	0.263
217	Orlando, FL	0.264
218	Hattiesburg, MS	0.264
219	Phoenix-Mesa-Scottsdale, AZ	0.265
220	Flagstaff, AZ	0.265
221	Dothan, AL	0.265
222	Stockton, CA	0.265
223	Green Bay, WI	0.266
224	Florence, SC	0.266
225	Johnson City, TN	0.267
226	Anderson, IN	0.267
227	Lubbock, TX	0.268
228	Jonesboro, AR	0.269
229	Lakeland, FL	0.271
230	Toledo, OH	0.271
231	Longview, WA	0.273
232	Milwaukee-Waukesha-West Allis, WI	0.273
233	Greensboro-High Point, NC	0.273
234	Sacramento--Arden-Arcade--Roseville, CA	0.274
235	Anderson, SC	0.275
236	Dalton, GA	0.276
237	Lincoln, NE	0.277
238	Santa Rosa-Petaluma, CA	0.278
239	Providence-New Bedford-Fall River, RI-MA	0.279
240	San Francisco-Oakland-Fremont, CA	0.280
241	Knoxville, TN	0.282
242	Washington-Arlington-Alexandria, DC-VA-MD-WV	0.282
243	Springfield, MO	0.283
244	Bangor, ME	0.284
245	Pocatello, ID	0.285
246	Lancaster, PA	0.285
247	Wausau, WI	0.286
248	Boston-Cambridge-Quincy, MA-NH	0.287
249	Tallahassee, FL	0.288
250	Medford, OR	0.289
251	Pine Bluff, AR	0.289
252	Kingsport-Bristol-Bristol, TN-VA	0.290
253	Bloomington, IN	0.290
254	Ocala, FL	0.290
255	Tampa-St. Petersburg-Clearwater, FL	0.291
256	Jackson, TN	0.291
257	Grand Rapids-Wyoming, MI	0.291
258	Brunswick, GA	0.291
259	Jackson, MS	0.293
260	Elizabethtown, KY	0.295
261	Gulfport-Biloxi, MS	0.295
262	Sarasota-Bradenton-Venice, FL	0.296
263	Portland-Vancouver-Beaverton, OR-WA	0.297
264	Owensboro, KY	0.297
265	Williamsport, PA	0.297
266	Boise City-Nampa, ID	0.297
267	Augusta-Richmond County, GA-SC	0.302
268	Detroit-Warren-Livonia, MI	0.302
269	Dubuque, IA	0.302
270	Memphis, TN-MS-AR	0.303
271	Tuscaloosa, AL	0.304
272	Charlottesville, VA	0.305
273	Columbia, SC	0.305
274	St. George, UT	0.305
275	Los Angeles-Long Beach-Santa Ana, CA	0.306
276	Racine, WI	0.310
277	Missoula, MT	0.310
278	Cape Coral-Fort Myers, FL	0.311
279	Sheboygan, WI	0.311
280	Nashville-Davidson--Murfreesboro, TN	0.311
281	Palm Bay-Melbourne-Titusville, FL	0.313
282	Elkhart-Goshen, IN	0.314
283	Lima, OH	0.314
284	Seattle-Tacoma-Bellevue, WA	0.314
285	Charlotte-Gastonia-Concord, NC-SC	0.316
286	Salinas, CA	0.316
287	Warner Robins, GA	0.317
288	Macon, GA	0.319
289	Madison, WI	0.320
290	Jacksonville, FL	0.320
291	Rome, GA	0.320
292	Spartanburg, SC	0.322
293	Little Rock-North Little Rock, AR	0.322
294	Greeley, CO	0.325
295	Topeka, KS	0.326
296	Manchester-Nashua, NH	0.328
297	Port St. Lucie-Fort Pierce, FL	0.329
298	Miami-Fort Lauderdale-Miami Beach, FL	0.330
299	Huntsville, AL	0.330
300	Atlanta-Sandy Springs-Marietta, GA	0.331
301	Auburn-Opelika, AL	0.333
302	Holland-Grand Haven, MI	0.337
303	McAllen-Edinburg-Pharr, TX	0.338
304	Muskegon-Norton Shores, MI	0.344
305	Decatur, AL	0.344
306	Albany, GA	0.348
307	Valdosta, GA	0.351
308	Atlantic City, NJ	0.351
309	Myrtle Beach-Conway-North Myrtle Beach, SC	0.354
310	Savannah, GA	0.355
311	Charleston-North Charleston, SC	0.358
312	Winston-Salem, NC	0.360
313	Rocky Mount, NC	0.365
314	Naples-Marco Island, FL	0.370
315	Fort Wayne, IN	0.370
316	Columbus, GA-AL	0.371
317	Greenville, SC	0.375
318	Lansing-East Lansing, MI	0.378
319	Raleigh-Cary, NC	0.379
320	Redding, CA	0.381
321	Appleton, WI	0.382
322	Carson City, NV	0.383
323	Tyler, TX	0.398
324	Fayetteville-Springdale-Rogers, AR-MO	0.411
325	Lewiston-Auburn, ME	0.415
326	Wilmington, NC	0.425
327	Santa Barbara-Santa Maria-Goleta, CA	0.435
328	Greenville, NC	0.445
329	Oshkosh-Neenah, WI	0.450
330	Burlington, NC	0.470
331	Laredo, TX	0.506

Appendix Table 5

Changes in Economic Activity and MSA Characteristics - Employment - Robustness - Additional Controls

This table reports ordinary least square regressions of changes in economic activity at the metropolitan statistical area (MSA) level on MSA characteristics, using quarterly data for the period March 2006 - December 2009. Standard errors are adjusted for clustering at the MSA level. The dependent variable is the percentage change in private employment, excluding finance and construction. The crisis dummy equals one on and after September 2008 and zero before. MSA bank variables are calculated by aggregating bank-level data to the MSA level by taking asset-weighted averages. Additional MSA bank controls included in the regressions, but not reported in the table, are: capital ratio, non-performing loans/total loans, and total unused commitments/(total assets+total unused commitments). MSA industry structure controls included in the regressions, but not reported in the table, are, separately, the fraction of employment in manufacturing, finance and insurance, and construction. These unreported controls are also interacted with the crisis dummy. All control variables are lagged one period, except for the change in housing prices for which contemporaneous values are used. See Appendix Table 1 for the definition of the variables. All regressions include one lag of the dependent variable. Geographic regions are defined on the basis of the nine U.S. Census divisions. A constant is estimated but not reported. t-statistics are in brackets. *, **, *** mean significance at ten, five, and one percent level, respectively.

	Percentage change in private employment, excluding finance and construction							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Non-core financing/Total assets	0.040	0.089	0.032	0.096	0.013	0.084	0.005	0.079
	[0.447]	[1.013]	[0.354]	[1.076]	[0.146]	[0.945]	[0.060]	[0.876]
Non-core financing/Total assets * Crisis dummy	-0.537 ***	-0.560 ***	-0.457 **	-0.517 ***	-0.451 **	-0.525 ***	-0.428 **	-0.503 ***
	[-3.099]	[-3.019]	[-2.559]	[-2.799]	[-2.572]	[-2.776]	[-2.412]	[-2.731]
Total loans/Total assets	-0.038	-0.036	-0.036	-0.052	-0.037	-0.062	-0.053	-0.059
	[-0.439]	[-0.435]	[-0.409]	[-0.607]	[-0.440]	[-0.757]	[-0.617]	[-0.686]
Total loans/Total assets * Crisis dummy	0.292	0.355 **	0.266	0.391 **	0.278	0.429 **	0.283	0.398 **
	[1.464]	[2.078]	[1.355]	[2.102]	[1.405]	[2.406]	[1.448]	[2.143]
Real estate loans/Total loans	-0.168 **	-0.040	-0.165 **	-0.050	-0.173 **	-0.066	-0.161 **	-0.054
	[-2.150]	[-0.482]	[-2.057]	[-0.556]	[-2.226]	[-0.767]	[-2.017]	[-0.613]
Real estate loans/Total loans * Crisis dummy	-0.160	-0.263 *	-0.125	-0.179	-0.171	-0.165	-0.136	-0.174
	[-0.935]	[-1.681]	[-0.717]	[-0.922]	[-1.002]	[-0.947]	[-0.775]	[-0.896]
Additional MSA bank controls	✓	✓	✓	✓	✓	✓	✓	✓
Time dummies	✓	-	✓	-	✓	-	✓	-
Region-time dummies	-	✓	-	✓	-	✓	-	✓
MSA industry structure controls	✓	✓	✓	✓	✓	✓	✓	✓
MSA change in housing prices	✓	✓	✓	✓	✓	✓	✓	✓
MSA GDP per capita and log of population	-	-	✓	✓	-	-	✓	✓
MSA log of total small bank assets	-	-	-	-	✓	✓	✓	✓
Observations	3,389	3,389	3,389	3,389	3,389	3,389	3,389	3,389
MSAs	281	281	281	281	281	281	281	281

Appendix Table 6

Changes in Economic Activity and MSA Characteristics - Employment - Robustness - LIBOR-OIS Spread

This table reports ordinary least square regressions of changes in economic activity at the metropolitan statistical area (MSA) level on MSA characteristics, using quarterly data for the period March 2006 - December 2009. Standard errors are adjusted for clustering at the MSA level. The dependent variable is the percentage change in private employment, excluding finance and construction. The LIBOR-OIS spread is the difference between the three-month U.S. dollar LIBOR and the overnight interest swap (OIS) rate. MSA bank variables are calculated by aggregating bank-level data to the MSA level by taking asset-weighted averages. Additional MSA bank controls included in the regressions, but not reported in the table, are: capital ratio, non-performing loans/total loans, and total unused commitments/(total assets+total unused commitments). MSA industry structure controls included in the regressions, but not reported in the table, are, separately, the fraction of employment in manufacturing, finance and insurance, and construction. These unreported controls are also interacted with the LIBOR-OIS spread. All control variables are lagged one period, except for the change in housing prices for which contemporaneous values are used. See Appendix Table 1 for the definition of the variables. All regressions include one lag of the dependent variable. Geographic regions are defined on the basis of the nine U.S. Census divisions. A constant is estimated but not reported. t-statistics are in brackets. *, **, *** mean significance at ten, five, and one percent level, respectively.

	Percentage change in private employment, excluding finance and construction							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Non-core financing/Total assets	0.050	0.065	0.065	0.074	0.055	0.082	0.057	0.068
	[0.579]	[0.719]	[0.755]	[0.837]	[0.627]	[0.920]	[0.657]	[0.765]
Non-core financing/Total assets * LIBOR-OIS spread	-0.408 ***	-0.401 ***	-0.398 ***	-0.377 ***	-0.414 ***	-0.411 ***	-0.410 ***	-0.383 ***
	[-3.019]	[-2.779]	[-2.831]	[-2.628]	[-3.039]	[-2.863]	[-2.968]	[-2.700]
Total loans/Total assets	0.094	0.001	0.078	0.034	0.093	0.014	0.073	0.032
	[0.985]	[0.014]	[0.823]	[0.347]	[0.982]	[0.145]	[0.764]	[0.325]
Total loans/Total assets * LIBOR-OIS spread	-0.063	0.222	-0.056	0.128	-0.062	0.192	-0.053	0.129
	[-0.385]	[1.545]	[-0.352]	[0.731]	[-0.382]	[1.197]	[-0.334]	[0.738]
Real estate loans/Total loans	0.045	0.051	0.051	0.103	0.045	0.072	0.051	0.102
	[0.534]	[0.594]	[0.587]	[1.123]	[0.539]	[0.813]	[0.596]	[1.118]
Real estate loans/Total loans * LIBOR-OIS spread	-0.521 ***	-0.332 ***	-0.509 ***	-0.421 ***	-0.521 ***	-0.370 ***	-0.500 ***	-0.421 ***
	[-4.169]	[-2.620]	[-3.984]	[-2.990]	[-4.176]	[-2.680]	[-3.951]	[-2.985]
Additional MSA bank controls	✓	✓	✓	✓	✓	✓	✓	✓
Time dummies	✓	-	✓	-	✓	-	✓	-
Region-time dummies	-	✓	-	✓	-	✓	-	✓
MSA industry structure controls	✓	✓	✓	✓	✓	✓	✓	✓
MSA change in housing prices	✓	✓	✓	✓	✓	✓	✓	✓
MSA GDP per capita and log of population	-	-	✓	✓	-	-	✓	✓
MSA log of total small bank assets	-	-	-	-	✓	✓	✓	✓
Observations	3,389	3,389	3,389	3,389	3,389	3,389	3,389	3,389
MSAs	281	281	281	281	281	281	281	281