Large Banks and the Transmission
of Financial Shocks

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An increasing amount of credit in the U.S. is provided by large geographically dispersed banks. We explore the role of large banks in propagating economic shocks across the economy. We show that in 2007 and 2008, large banks that were operating in U.S. counties most affected by the drop in real estate prices, contracted their credit to small businesses in counties that were not affected by falling real estate prices. Over the same period, local banks and large banks that were not exposed to distant real estate shocks expanded their credit in the same counties. This offsetting effect is stronger for counties with bigger spillover effects, and with more concentrated (less competitive) banking markets. However, the overall net contagion effect is large and continued for several years after the end of the recession. The results are robust across a range of filters, including exclusion of the ten largest U.S. banks from the sample.

An increasing amount of credit in the U.S. is provided by large, geographically dispersed banks. This financial integration has been shown to improve cost and access to credit (e.g., Jayaratne and Strahan, 1996 or Strahan and Rice, 2010). A less understood economic effect of large banks' geographical ubiquity is their role in the economic cycle. Local shocks that might affect regional banks can be smoothed out by large diversified banks, but large economic shocks in one part of the country may spill over through the balance sheets of large banks to otherwise unaffected areas. We study this effect in the context of the 2007-2009 financial crisis and its aftermath.

The collapse of real estate prices and the subsequent meltdown of sub-prime mortgages raised concerns about the solvency and liquidity of banks and led to the financial panic that started in late 2007 and reached its peak in fall of 2008. Although the overall effect was very large, not all geographical areas and not all banks were exposed to the initial shock. We use this variation among large geographically dispersed banks in their exposure to the initial real estate shock to isolate a supply effect. Specifically, we look at counties that *did not* experience a significant drop in real estate prices, and compare changes in lending behavior by geographically diversified banks that were and were not exposed to real estate shocks through their brunches located in *other* counties.

For large companies, the source of bank financing is unlikely to be local. In fact, loans to large companies tend to be syndicated, i.e., originated by one bank but funded by a larger group of creditors. Moreover, U.S. firms also may turn to the bond market, as suggested by Becker and Ivashina (2014). Thus, we focus on credit to small firms, that is, firms with revenues of $1 million or less. We obtain information on small business lending by county from the Federal Reserve's data on the Community Reinvestment Act (CRA). The shortfall of the CRA credit data

is that it does not identify borrowers, and so we cannot directly track an individual firm's ability to smooth credit supply shocks by borrowing from alternative sources. However, because small firms' tend to rely on local bank credit, we can use county level information to assess the economic impact.

We show that large banks played an important role in propagating through the U.S. economy the credit cycle that was driven by a boom and bust in real estate prices. Specifically, large banks that were exposed to the real estate shock through their operations in counties with a large drop in real estate prices substantially contracted their lending from 2006 to 2008 in counties that did not experience a fall in real estate. By comparison, over the same period, the lending of large healthy banks stayed the same or even increased. In the counties that fall into the top quartile of real estate depreciation (unaffected counties), between 2006 and 2008, large banks exposed to real estate shock elsewhere cut their lending by $2.4MM per county, whereas healthy banks increased their lending by $1.7MM per county. It was not until 2009 (the peak of the widespread economic recession), that healthy banks decreased their lending. Then following 2009, healthy banks' lending stayed the same, and, in some size categories, started to increase, whereas the lending of exposed banks continued to decline through 2010. The results on the extensive margin are very similar.

We also explore strategic expansion by unaffected banks, and find evidence consistent with opportunistic behavior: not only do strong banks cut their lending less (or even increase in some counties), but also their expansion in credit is most pronounced in areas where exposed banks cut their lending more, and where the local lender market was more concentrated (less competitive) originally. In addition, we show that healthy banks were able to expand substantially their deposits in the county.

Our core results are constrained to banks with dispersed geographical operation, but the findings are generalizable to small, local banks. That is, large and small banks that were initially unaffected by the distant real estate shocks, in aggregate expand their loan issuance in the 2007-2008 period as compared to 2006. All results are robust to the exclusion of the top-10 largest banks and to exclusion of banks that are enter a given county after 2002.

This paper is complementary to research on the role of multinational banks and the role they play in transmitting shocks across borders. This includes Peek and Rosengren (1997, 2000), as well as more recent papers by Acharya and Schnabl (2010), Chava and Purnanandam (2011), Schnabl (2012), Cetorelli and Goldberg (2011, 2012a, 2012b), Acharya, Afonso and Kovner (2013), and Ivashina, Scharfstein and Stein (2013).

The outline of the paper is as follows. Section I describes the data sources. Section II details the identification strategy. Section III reports the key empirical results, which demonstrate the propagation of distant shocks through the balance sheet of large banks. Section IV evaluates the robustness of the results. Section V concludes.

I. Data Sources

We compile data from five different sources. We obtain quarterly bank and bank-holding accounting data from the Federal Reserve. We use data at the bank holding company level (FRB form Y9C), or, if a holding company is not available, we use data at the bank level (Call Report level). Throughout the paper, we use the term "bank" to refer to the consolidated entity.

We use annual Summary of Deposit (SOD) data from the Federal Deposit Insurance Corporation (FDIC), measured annually as of June 30th, to ascertain the deposits of each bank across its branches in each county. We aggregate deposits data by county to the corresponding

bank holding company if the bank holding company exists, and to the corresponding commercial bank if it does not.

We obtain information on bank small business lending by county from the Federal Reserve's data on the CRA. All commercial banks and thrifts that are larger than a certain size and that are regulated by the Office of the Comptroller of the Currency (OCC), the FDIC, the Federal Reserve System, or the Office of Thrift Supervision (OTS) must report annual data on their small business lending. The data is annual and reported as of December 31st of each year. For purposes of this paper, we consider the time period of 2005 to 2012 and only include loan originations and loans to small business.[1] (The regulations implementing the CRA were last revised in 2005.)

The threshold for which banks and thrifts have to report their small business lending data by the CRA increases each year, but throughout our period of interest, banks with assets of less than $1.1 billion did not need to disclose their small business lending. Approximately 700 of the almost 8,000 banks and thrifts with deposits insured by the FDIC reported their small business lending. We further restrict our sample of banks to only include commercial banks and exclude thrifts so as to have consistent and consolidated balance sheet and income statement information at the highest holder level possible. Our final sample includes 628 commercial banks that engage in small business lending and have branches in counties that are covered by FISERV. These banks account for 72% of all bank deposits in 2006.

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[1] Small farm loans and loan purchases are small in magnitude relative to small business loan originations and including them does not qualitatively change our results.

The bank-level data is combined with annual county-level demographics data from the Census, and county-level real estate price index data from FISERV. FISERV publishes Case-Shiller house price indices using same-house repeated-sales data. Although the data is available at the zip-code level, we use the county-level information in correspondence with our data on small business lending, described above.

II.   Methodology and Empirical Design

We want to identify the contagion through the banks' balance sheet (bank lending channel) into the geographical areas that were not affected by the collapse of real estate prices. To do so, we use a difference-in-differences approach: we look at lending behavior in areas that were *not* affected by real estate price shocks, and we compare the lending behavior of banks that were exposed to *other* geographies that suffered severe drops in real estate prices to the lending behavior of unaffected banks. This approach allows us to control for any local county level effects unrelated to real estate.

To measure the real estate shock, for each county, we look at the change in the Case-Shiller single family home price index from 2006:Q2 to 2007:Q4 (*RE_SHOCK*).[2] We classify counties as either "strong", "neutral", or "depressed", by whether they are in the upper quartile, second or third quartile, or bottom quartile of the distribution of *RE_SCHOCK*, respectively. Our results are similar if the *RE_SHOCK* variable is calculated as the change from 2006:Q2 to 2007:Q3 or 2006:Q2 to 2007:Q2.

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[2] For counties that did not have county-level data but had more aggregated MSA-level data, we used the MSA-level data.

We focus on a contagion effect that is transmitted through the balance sheets of the parent banks operating in multiple counties. So, we classify banks in our sample as either "dispersed banks" or "local banks". We sort banks based on the number of counties in which they operate. Dispersed banks are in the top quartile of this distribution. Local banks are defined as those with operation in fewer than six counties, which means they are in the bottom two quartiles of the distribution of banks by number of counties. We are interested in the lending behavior of dispersed banks that have exposure to real estate shock in some, but not all, of the counties in which they operate. We classify dispersed banks as "exposed", those banks that by the number of branches in weak counties fall into the upper quartile of that distribution, and "strong", those banks whose number of branches in weak counties falls into the bottom two quartiles of the distribution.[3]

Our main analysis compares unaffected, strong dispersed banks to exposed dispersed banks. Together, the strong and exposed banks comprise 60% of all bank deposits as of 2006. As an alternative benchmark, we also look at strong local banks, which are banks that do not have branches in any weak counties.[4] The concern with smaller, local banks might be that they specialize in different type of credit than large banks. (An ideal setting would be the one used by Khwaja and Mian (2008) where borrower level data is available and the same borrower interacts with multiple banks. But such data is not available for the U.S. market.)

To test our hypotheses, we constrain our analysis to strong and neutral counties and compare small business lending by strong and exposed banks in those counties. Naturally, exposed banks

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[3] The results are robust to differing definitions of weak and strong.

[4] The results are robust to various changes in these definitions.

may reduce lending in counties that experienced a decline in real estate prices, but this may be due to a decrease in demand for loans in those counties. As we show below, however, they also constrain lending in counties that did not experience the real estate shock, a result less plausibly explained by a decline in demand. Formally, we run regressions of the form:

$$\Delta L_{il} = \alpha + \beta S_i + \gamma X_i + \delta_l + \varepsilon_{il}. \tag{1}$$

In our main analysis ΔL_{il} is the change in the amount of small business loans extended by bank i in county l between 2006 and 2008. S_i is an indicator variable that equals 1 for strong banks and 0 for exposed banks and is our main variable of interest. X_i is bank-level control variables such as assets, deposits scaled by assets and tier 1 ratio. These are discussed further in the next section. δ_l are county-level fixed effects; by including these, we make sure that we are identifying the impact of being a strong or an exposed bank on changes in lending within each county.

Table I presents summary statistics for our sample. The first point to note is that even though our samples of exposed and strong banks are both in the upper quartile of the distribution of bank size as measured by the number of counties in which banks have branches, exposed banks are on average significantly larger than strong banks. The average exposed bank has 478 branches in 94 counties and assets of $95 billion, while the average strong bank has 55 branches in 18 counties and assets of $3 billion. Exposed banks also have fewer deposits as a fraction of assets: 68% as opposed to 79% for strong banks in 2006. Similarly, they have fewer insured deposits as a fraction of deposits, higher loan commitments as a fraction of total loans, higher net charge-offs (charge-offs minus recoveries) as a fraction of loans, and higher levels of asset backed security holdings as a fraction of total assets. These differences remain and become accentuated during the crisis period, as shows the second panel of Table I, which compares the balance sheets of exposed and strong banks in June of 2008.

These patterns are not surprising, given that very large banks, which fall primarily into the exposed sample, have a different composition of assets and liabilities on their balance sheets. They are less likely to fund themselves with deposits, and more likely to use short term funding such as repos. However, our analysis not driven by the largest banks since excluding the largest 10 banks from our sample does not qualitatively change the results below.

[TABLE I]

III. Results

A. Impact on Lending

Figure 1 shows evolution of lending to small and medium firms between 2006 and 2011, in areas that did *not* experience a real estate shock. Panel A reports the total amount of lending by each type of bank. Panel B reports the mean amount of lending across banks of each type. Each panel shows four figures corresponding to: (i) all loans; (ii) loans smaller than $100,000; (iii) loans between $100,000 and $1 million; and (iv) loans larger than $1 million. All numbers are expressed as percentage of 2006 levels.

The central point that emerges from Figure 1 is the amplification of the credit cycle by banks exposed to the real estate shocks. In an average county that was *not* exposed to a collapse of real estate prices, the lending of exposed banks decreased from 2006 to 2008, while the lending of strong banks stayed the same or even increased. It was not until 2009 that strong banks decreased their lending, and this may have been due to a drop in demand, as a well in supply, since 2009 market the lowest point of the wide-spread economic recession. Further, after 2009, strong banks' lending stays the same or begins to increase, whereas the lending of exposed banks continues to decrease. The results are very similar across the two panels.

[FIGURE 1]

Table II, extends this analysis and compares the performance of strong and exposed banks in a simple univariate setting. The table compares the evolution of deposits and loans from 2006 to 2008 between the exposed and strong banks in our sample. First, we consider several measures related to deposits. Measured at a county level, exposed banks' deposits increased much more than strong banks' deposits, but this is mainly due to their larger size. In fact, deposits as a fraction of assets grew faster at strong banks. On average, the county deposits for exposed banks grew by $52MM between 2006 and 2008, whereas they grew only by $22MM for strong banks. This is consistent with bank deposits being perceived as a safe harbor in economic downturns due to the deposit insurance (Gatev and Strahan, 2006). However, deposits over assets grew by only 0.3% for exposed bank, as opposed to 0.8% for strong banks. Further, although both strong and weak banks seem to have expanded in terms of the number of their branches during the 2006 to 2008, strong banks grew more, opening on average 0.44 branches as opposed to 0.32 for exposed banks (in counties that did not experience a collapse in real estate prices). This is a substantial expansion for strong banks: scaled by the number of branches as of 2006 the expansion of strong banks is 12 times larger than that of the exposed banks.

[TABLE II]

Exposed banks contract their lending more than strong banks across all categories. For example, on average, they extend 24 fewer loans per county in 2008 than 2006, whereas strong banks decrease the number of loan they extend only by 6 loans per county. The difference is especially apparent in the loan amounts extended by the two groups of banks. In fact, for the total amount of loans and for loans greater than $100,000 in size, the exposed banks on average

contract their lending, whereas the strong banks expand their lending in these categories.[5] The difference is economically significant. Across all types of credit to small enterprise, between 2006 and 2008, exposed banks cut their lending by $2.4MM per county (8.2% drop as compared to 2006 lending amount), whereas strong banks *increased* their lending by $1.7MM per county (6.4% increase as compared to 2006 lending amount).

Table III repeats this analysis in a multivariate setting for all small business loan originations. The dependent variable is the change in small business lending from June 2006 to June 2008 on an indicator for strong bank (S_i) and the logarithm of assets measured as of June 2006. Controlling for the size of the bank, strong banks still cut their lending less than weak banks. Specification (2) adds county fixed effects (δ_l) and specification (3) also controls for each bank's deposits in that county as of June 2006. We add the county-level deposits as a county-level measure of bank size. Further, to control for differences in bank strategy, in specification (4) we control for deposits as a fraction of assets, insured deposits as a fraction of total deposits, loans as a fraction of assets and real-estate loans as a fraction of assets. Specification (5) also controls for the amount of loans that are past due as a fraction of total loans, the amount of net charge-offs (charge-offs minus recoveries) as a fraction of total loans, tier 1 ratio, and the amount of asset-backed securities as a fraction of total assets. All bank variables are measured as of June 30, 2006. Specifications (4) and (5) show that our results are not driven by differences

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[5] As a robustness test, we also consider whether in each category the dispersed banks issue more loans as a percentage of their lending in that category. The percentages are non-normal so we use a rank-sum test comparing the medians of the two groups, rather than a 2-sample *t*-test, and confirm that the dispersed banks do issue more loans (as a percentage of their 2006 lending in each category).

in strategy or differences in exposure to real estate or to the securitization market. The standard errors in all specifications are clustered at the bank level. Clustering at both the bank and county levels does not qualitatively change the standard errors or the significance of the coefficients.

[TABLE III]

The central result, the difference in lending by strong and exposed banks is economically and statistically significant and is robust across specifications. On average, a strong bank cuts its lending by $7 million less per county than an exposed bank. The control variables mainly have the signs that would be expected. The log of assets becomes significant once we control for other bank balance sheet variables.[6] Deposits-in-county in 2006 is a measure of the bank's importance in the county; the negative and statistically significant coefficient on deposits suggests that banks with more market power cut lending by more. This is something we investigate further later in the paper. Banks with a higher percentage of real estate loans cut back lending less. However, recall that the analysis is constrained to counties that were not affected by the real estate shock.

The results are very similar if we constrain the sample to loans larger than $100,000. Overall, it is loans to small enterprise in excess of $100,000 that appear to drive the result. For loans

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[6] This is due to non-linearities in the relationship between bank performance and assets. As mentioned earlier, exposed banks, which performed worse, tend to be larger. However, some of the largest exposed banks actually performed better than smaller banks, a result which is potentially explained by government policies such as TARP which were primarily targeted to large banks. As we discuss below, our results are unchanged when we run them on a constrained sample that removes the largest banks. When we do so, assets impact the change in the amount of loans in a statistically significant way.

smaller than $100,000 the difference in the drop in lending between weak and strong banks is not significant.

B. Extensive Margin

In Tables II and III , we constrain our analysis to counties and banks that do small business lending in those counties in 2006 and 2008. Thus, we underestimate the difference between strong and exposed banks because we only estimate the intensive margin of lending. If exposed banks are more likely to withdraw from counties completely, or even go bankrupt, the difference between strong and exposed banks may be even larger. Table IV begins to address this question.

First, we consider whether exposed banks are more likely to decrease the number of branches they operate in a county. The first specification of Table IV regresses the change in the number of branches in a county from 2006 to 2008 on our main variable of interest—an indicator for strong banks—and controls. The coefficient on the "Strong Bank" indicator is positive but not significant. One reason for this result is that the change in the number-of-branches variable is dispersed and non-Normal. There are some outlier bank-county observations with very high or very low values, but the majority of the bank-county observations do not change the number of branches. In specification (2), we replace this variable with a simple indicator variable that equals 1 if the number of branches increased, -1 if it decreased and 0 if it stayed the same. Again, strong banks are much more likely to expand their number of branches in the counties they are already in, and this effect is highly statistically significant.

Next, we consider the extensive margin; namely, whether strong banks are less likely to exit a county than exposed banks. We use 2 different measures of "exit." In specification (3), Table IV, exit is defined as a bank that had branches as of June 2006 but no longer has branches in that county as of June 2008. In specification (4), we consider exit from lending, so a bank is

considered to have exited a county if it originated small business loans in that county in 2006 but not in 2008. Both specification are estimated using probit. (Estimating using a logit regression produces similar results.[7]) Since probit produces inconsistent estimates when using fixed effects, we drop the county fixed effects and instead include county-level controls and clustered standard errors at both the bank and county levels. The county variables we control for include the number of households, median household income, housing density (number of houses per square mile), the change in real estate prices from 2006 to 2008, the fraction of the population in the labor force, the unemployment rate, and the fraction of the population living in poverty. The only control variable that impacts the probability of exiting a county in a statistically significant way is housing density, which is very highly correlated with the decrease in housing prices between 2006 and 2008. Strong banks are less likely to close down their branches in a county between 2006 and 2008, and are also less likely to stop lending in a county by 2008.

[TABLE IV]

C. Impact of Competition

Having established that strong banks decreased their lending less than exposed banks through the end of 2008, we now turn to the issue of competition. In panel A of Table V, we examine whether a bank's market power in a county and the competitiveness of the county impacts the differences between strong and exposed banks that we documented above. The two specifications split counties by whether the Herfindahl–Hirschman Index (HHI) of loan amount

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[7] Using a linear probability model with county fixed effects produces weaker results.

is below or above the median.[8] The first specification reports the results for competitive counties, with HHI less than the median (2,377). Note that the median in our sample is relatively high. (The Department of Justice uses an HHI of 1,800 as a rule of thumb cutoff for whether a market is competitive or not.) The second specification reports results for more concentrated counties, with HHI greater than the median.

We find that in both types of counties exposed banks with more market power cut their lending more than exposed banks with less market power. In competitive counties, on average, strong banks do not cut their lending less than exposed banks. However, strong banks with more market power do cut their lending less than strong banks with less market power. On the other hand, in more concentrated markets, strong banks on average expand their credit (as compared to exposed banks), regardless of the strong banks' market power.

[TABLE V]

Splitting the analysis by the three loan-size categories we discussed earlier—loans less than $100,000, loans between $100,000 and $1MM and loans greater than $1MM—shows similar results. (The results are omitted for brevity.)

D. The Aggregate Effect

Finally, we examine the extent to which the smaller contraction or even expansion of lending by strong banks attenuated the lending contraction of exposed banks. To do this, we consider

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[8] The Herfindahl–Hirschman Index is a commonly used measure of concentration equal to the sum of the squared market shares of market participants. The index is value is higher than 0 and is capped at 10,000.

whether strong banks were more likely to expand their lending in counties in which the exposed banks cut their lending more. To do this, we need to include county-level measures of how much the exposed banks cut lending. We cannot use county fixed effects this analysis. Instead, we use a range of country-level controls measured as of 2006. The first specification in Table IV shows that our main result continues to hold when we use county-level controls instead of county-level fixed effects. [9]

Specification (2) includes as additional variables the lending decrease from all exposed banks in the county, and the lending decrease interacted with the strong bank indicator. Specifications (3) and (4) further split the sample by whether the HHI is less than or greater than the median, respectively, as in Table V. Since we know from Table II that the lending change from exposed banks is generally negative, the coefficient on the interaction term between change in lending from exposed banks and an indicator for strong bank can be interpreted as strong bank counteracting the drop in lending from exposed banks. Not only do strong banks cut their lending less (or even increase) as we have established, they cut their lending even less (or increase more) in areas where the exposed bank cut their lending more. This effect seems to be stronger in concentrated markets. This is probably due to the fact that in concentrated counties where exposed banks cut their lending a great deal, the exposed banks have the most market power. Thus, strong banks (with less market power) in these counties increase their lending even more when a previously powerful competitor is weakend.

[*TABLE VI*]

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[9] For consistency, we only cluster errors at the bank level. However, clustering at both the bank and county level strengthens our results.

IV. Robustness of the Results

In this section, we discuss some of the robustness tests we performed. One possible problem with our analysis is that as Table I shows, the samples of strong banks and exposed banks have different characteristics. In particular, exposed banks tend to be larger and show other qualities pertaining to large banks: they are funded less by deposits and more by short term funding; they have lower capital ratios; they have higher net charge-offs and loan commitments; and they are more likely to engage in activities that are not traditional banking businesses such as trading, securitization and holding asset backed securities. Although we control for all these variables in our regressions, the criticism remains that the largest banks—the top- five or ten too-big-too-fail institutions—may be very different from even other large banks in so far as their business strategy is driven by factors not associated with traditional banking. To ameliorate these concerns, we repeat our analysis excluding the five, or even ten, largest institutions.

Although our results become weaker, it is still the case that controlling for various balance sheet variables, exposed banks reduce their lending more than strong banks. The first specification of Table VII reports our main regression of interest, the equivalent of specification (5) of Table III, excluding the ten biggest banks. We do not report the effect when splitting by the size of the loan; interestingly however the results for loans less than $100,000 become stronger.

Another, related concern is that exposed and strong banks may have different expansionary policies. For example, it could be that exposed banks only entered many of the counties we examine in the early to mid 2000s, during the real estate boom and expansionary monetary policy of the period. If they over-expanded and decided to scale back, then it is natural that from

2006 to 2008, they decreased lending in many of the counties that they had just recently entered. These might be non-core counties for the bank business, and as such it might make sense to cut the credit in such counties even if there was no shock in demand. Although this still represents a contraction in credit that is propagated intro otherwise healthy geographical areas by large dispersed banks, it is a different channel, and it might have different implications for borrowers. To alleviate this concern, we re-estimate our main results discarding observations corresponding to counties that a bank has entered since 2002 in specification (2) of Table VII. Again, it is still the case that controlling for various balance sheet variables, exposed banks reduce their lending more than strong banks.

Our last robustness compares the dispersed exposed banks with local strong banks. As mentioned earlier, the central result of our analysis is that dispersed banks that experience a negative real estate shock in some areas where they operate, reduce their lending in other areas, areas that did not experience the shock. In this way, dispersed banks are a source of contagion for reductions in loan supply. However, to properly identify this effect, we need to control for the unobservable level of demand in the counties we are analyzing. By comparing dispersed exposed banks relative to dispersed strong banks in each county, we subtract out the level of demand. However, because our group of strong banks is also dispersed, their lending behavior may respond to demand and supply shocks elsewhere, not just in the counties we analyze.

As an alternative, we compare dispersed exposed banks to local strong banks. Since these banks are by definition local, their lending reflects only the local supply and demand shocks, and since we focus on counties not impacted by the real estate shock, systematic supply shocks are not an issue. Thus, the lending of small strong banks should reflect the local demand for loans, and by comparing these banks to dispersed exposed banks, we can identify the causal effect of

exposed banks on lending. Specification (3) of Table VII reports our result for this last robustness test. The coefficient on the indicator for "Strong Bank" is positive and statistically significant.

V.   Conclusions

The years 2008-2010 were hard times. In the United States, unemployment rose to the highest levels in thirty years, and GDP per capita fell by 3% in a single year. While these adverse outcomes were broadly felt across the economy, their causes were more localized. Real estate prices collapsed in certain local markets, and the instruments that had provided financing were correspondingly less valuable. This paper studies one mechanism that propagated these local shocks into the broader economy, namely the reduction in lending in *many* markets by banks that had unusually high exposure to the *particular* markets in which the house price correction was most acute.

We find that "exposed" banks reduced their lending in local markets that had *not* experienced sharp declines in real estate prices, as compared to less exposed banks lending in the same markets. These results obtain across all sizes of small business loans and are both statistically and economically significant. Further, we find that "exposed" banks were more likely to exit, either by closing all branches in a market or by reducing loan volume to zero, markets that had not experienced real estate price declines, as compared to stronger, less exposed banks. Thus, we believe we have identified and described one transmission channel, a bank lending channel, that served to propagate the financial crisis through the broader economy.

Our results can be interpreted as describing a potential cost that may partially offset the benefits of geographically diversified branch banking. A large branch system that has exposure to many uncorrelated lending markets may be better able to weather a storm in a particular

market, compared to a smaller bank that lends only in that troubled market. On the other hand, the diversified branch system might introduce into a relatively healthy local market contagion effects from troubled far-away markets to which the diversified bank has substantial exposure.

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Figure 1
The Evolution of Credit, 2005-2012

This figure shows evolution of lending to small firms by loan size. The data is from CRA. Loan volume is indexed to 2006 level. Panel A puts higher weight on large banks; Panel B reports an equally-weighted average. The focus is on the difference between exposed and strong dispersed (i.e., matched) banks.
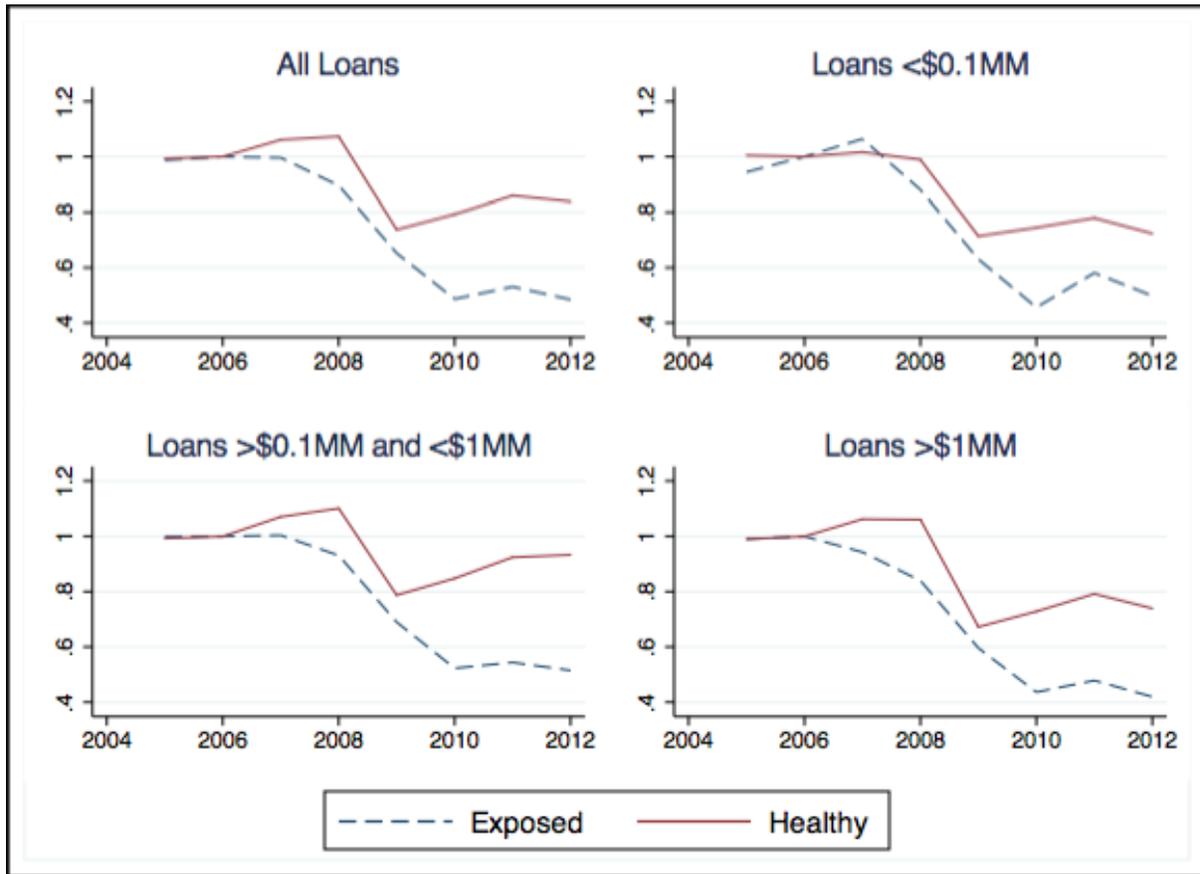
A. Total Loan Volume

Figure 1 – continued
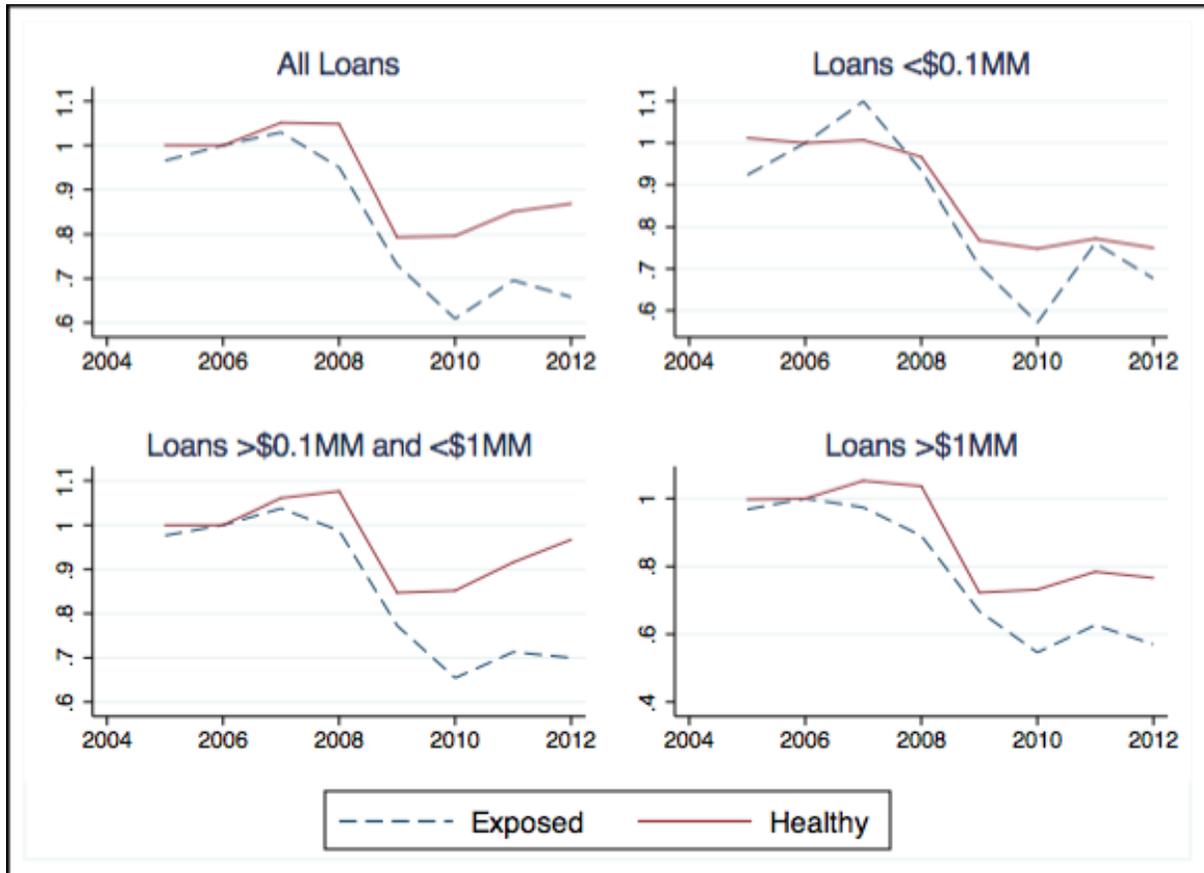
B.   Equal-Weighted Average Loan Volume

Table I
Counties not Experiencing a Real Estate Shock: Exposed Dispersed Banks vs. Strong Dispersed Banks

This table compares activities of banks exposed to a real estate shock and banks that were unaffected by a real estate shock. The analysis is constrained to counties that did not experience a collapse in real estate prices. All banks in the sample operate in other counties; they are in the top quartile of the distribution of banks according to the number of counties in which they operate. ***, ** and * indicate statistical significance at 1%, 5% and 10%, respectively.

	Exposed banks (Obs.= 73)	Strong banks (Obs. =54)	Diff.	
Number of counties with branches	94.01	18.46	75.55	***
As of December 31, 2006:				
Number of branches	478.48	54.44	424.04	***
Assets	94,911,744.45	2,497,651.50	92,414,092.95	***
Trading assets/Total assets	0.012	0	0.012	**
Deposits/Assets	0.678	0.786	-0.108	***
Brokered deposits/Total deposits	0.143	0.149	-0.006	
Insured deposits/Deposits	0.462	0.507	-0.045	***
Loans/Assets	0.651	0.677	-0.026	
Consumer loans/Loans	0.099	0.082	0.018	
Real estate loans/Loans	0.703	0.721	-0.018	
C&I loan /Loans	0.181	0.169	0.012	
Past due/Loans	0.014	0.013	0	
Commitments/Loans	0.288	0.139	0.149	***
Net charge-offs/Loans	0.001	0.001	0.001	***
Long-term debt/Liabilities	0.053	0.039	0.014	
Tier 1 capital ratio	0.121	0.115	0.005	
Leverage ratio	0.086	0.089	-0.003	
Risky assets ratio	0.141	0.13	0.011	
ABS/Assets	0.003	0.001	0.002	*
Real estate loans/Assets	0.001	0	0.001	
As of December 31, 2008:				
Number of branches	543.69	61.83	481.85	***
Assets	118,268,946.89	2,985,158.59	115,283,788.30	**
Trading assets/Total assets	0.017	0.001	0.016	**
Deposits/Assets	0.647	0.764	-0.117	***
Brokered deposits/Total deposits	0.153	0.171	-0.017	
Insured deposits/Deposits	0.632	0.673	-0.041	**
Loans/Assets	0.668	0.685	-0.017	
Consumer loans/Loans	0.09	0.074	0.016	
Real estate loans/Loans	0.693	0.734	-0.042	*
C&I loan /Loans	0.183	0.162	0.021	
Past due/Loans	0.029	0.021	0.008	***
Commitments/Loans	0.252	0.129	0.123	***
Net charge-offs/Loans	0.004	0.002	0.002	***
Long-term debt/Liabilities	0.065	0.046	0.019	**
Tier 1 capital ratio	0.107	0.113	-0.006	
Leverage ratio	0.084	0.088	-0.004	
Risky assets ratio	0.13	0.127	0.003	
ABS/Assets	0.003	0.001	0.002	***
Real estate loans/Assets	0.001	0	0.001	

Table II

Change in Deposits and Lending: Exposed Dispersed Banks vs. Strong Dispersed Banks

This table compares the evolution of deposits and loans from 2006 to 2008 for exposed and strong banks in our sample. As before, the analysis is constrained to counties that did not experience a collapse in real estate prices. ***, ** and * indicate statistical significance at 1%, 5% and 10%, respectively.

Variable	Diff.		Exposed banks		Strong banks	
			Mean	Obs.	Mean	Obs.
Number of loans to small enterprise, 2006	107.16	***	324.32	2,880	217.17	472
Amount of loans to small enterprise, 2006	4,414.55	**	30,459.71	2,880	26,045.17	472
Change between 2006 and 2008:						
Deposits/Assets	-0.005	***	0.003	2,918	0.008	534
Deposits	52,159.63	**	74,310.74	2,918	22,151.12	537
Number of branches	-0.119		0.319	2,918	0.438	537
Deposits per branch	9,235.23		11,609.89	2,918	2,374.66	537
Number of loans to small enterprise	-18.65	***	-24.34	2,678	-5.69	457
Number of loans <100K	-4.87		-9.95	2,678	-5.09	457
Number of loans >100K, <1M	-5.05	***	-2.64	2,678	2.41	457
Number of loans > 1M	-8.74	***	-11.75	2,678	-3.01	457
Amount of small loans to small enterprise	-4,146.56	***	-2,483.94	2,678	1,662.62	457
Amount of loans <100K	-443.78	***	-541.69	2,678	-97.91	457
Amount of loans >100K, <1M	-1,896.71	***	-623.74	2,678	1,272.97	457
Amount of loans > 1M	-1,806.07	***	-1,318.52	2,678	487.55	457

Table III

Non-Weak Counties: Exposed vs. Strong Banks

The analysis is constrained to counties that did not experience a collapse in real estate prices. The variable of interest is *Strong bank*, equal to 1 if a bank was not exposed to the collapse in real estate prices across the counties in which it operates. Standard errors (reported in brackets) are clustered at the bank level. ***, ** and * indicate statistical significance at 1%, 5% and 10%, respectively

Dependent variable:	Change in loan amount from 2006 to 2008				
	(1)	(2)	(3)	(4)	(5)
Strong bank (S_i)	4,181.2**	4,369.0*	5,036.2**	6,331.7**	7,152.6**
	[2,069.6]	[2,425.3]	[2,486.6]	[2,678.8]	[2,775.9]
Log(Assets), 2006	9.529	-109.1	395.0	2,157.7***	2,823.6***
	[336.6]	[382.5]	[380.8]	[680.1]	[900.6]
Log(Deposits in county), 2006	--	--	-2,154.7***	-1,965.5***	-2,014.1***
			[618.8]	[599.5]	[597.5]
Deposits/Assets, 2006	--	--	--	20,042.5	23,952.1
				[13,718.2]	[14,684.6]
Insured deposits/Deposits, 2006	--	--	--	6,506.2	-64.26
				[10,224.2]	[11,590.1]
Loans/Assets, 2006	--	--	--	-17,494.2	-17,280.8
				[11,705.2]	[11,117.3]
Real estate loans/Total loans 2006	--	--	--	23,921.8**	30,770.8***
				[9,260.8]	[10,448.4]
Net Charge-offs/Total loans 2006	--	--	--	--	115,665.8
					[818,932.1]
Past due loans/Total loans, 2006	--	--	--	--	61,916.9
					[175,357.5]
Tier 1 ratio, 2006	--	--	--	--	58,555.4
					[42,528.9]
ABS/Assets, 2006	--	--	--	--	116,779.9
					[81,634.8]
Fixed effect: County (δ_l)	No	Yes	Yes	Yes	Yes
Observations	3,135	3,135	3,128	2,849	2,849
R^2	0.007	0.160	0.182	0.201	0.207

Table IV
Extensive Margin: Exposed vs. Strong Banks

This table examines whether exposed banks are more likely to decrease the number of branches that they operate in a county. In specification (2) the dependent variable is equal to 1 if the number of branches increased, -1 if it decreased and 0 if it stayed the same. In specification (3), exit is defined as a bank that had branches as of June 2006 no longer having branches in that county in June 2008. In Specification 4, we consider exit from lending, so a bank is considered to have exited a county if it originated small business loans in that county in 2006 but not in 2008. Standard errors (reported in brackets) are clustered at the bank level. ***, ** and * indicate statistical significance at 1%, 5% and 10%, respectively.

Dependent variable:	Δ Number of branches	Δ Number of branches (rescaled)	Branches closed	Stop lending to small firms
	(1)	(2)	(3)	(4)
Strong Bank	0.239	0.144***	-0.835**	-0.605*
	[0.159]	[0.0512]	[0.394]	[0.349]
Number of households (million)	--	--	0. 389	-0.420
			[0.245]	[0.462]
Median household income ($ thousand)	--	--	-0.000361	-0.000596
			[0.0143]	[0.00838]
Number of houses per square mile	--	--	0.000143*	0.000258**
			[0.0000752]	[0.000106]
Change in real estate prices 2006Q2-2007Q4	--	--	-1.060	0.948
			[1.741]	[1.890]
Fraction of population >16 in labor force	--	--	-1.623	-4.179***
			[1.952]	[1.374]
Fraction of labor force unemployed	--	--	2.625	-7.315*
			[3.210]	[4.289]
Fraction of population below the poverty line	--	--	-4.696	-2.193
			[3.737]	[1.563]
Constant	--	--	8.174***	0.457
			[2.712]	[4.744]
Fixed effect: County (δ_l)	Yes	Yes	--	--
Observations	3,133	3,133	3,342	3,342
R^2	0.210	0.272	0.165	0.128

Table V
Impact of Competition

This table examines whether a bank's market power in a county and how competitive a county is impacts the differential behavior in credit between strong and exposed banks shown in Table III. The two specifications split the counties by whether the Herfindahl–Hirschman Index (HHI) of loan amount is below (specification 1) or above (specification 2) the median. Standard errors (reported in brackets) are clustered at the bank level. ***, ** and * indicate statistical significance at 1%, 5% and 10%, respectively.

Dependent variable:	Change in loan amount from 2006 to 2008	
	(1)	(2)
Strong Bank	2,310.7	6,418.8**
	[3,589.8]	[2,933.8]
Strong Bank x Market share,2006	43,796.8**	1,810.6
	[18,966.6]	[7,464.8]
Market share, 2006	-37,261.7**	-14,356.7**
	[16,994.4]	[5,605.5]
Fixed effect: County (δ_l)	Yes	Yes
Observations	1,596	1,259
R^2	0.207	0.293

Table VI
Did Strong Banks Make up for the Cut in Exposed Banks' Lending?

Specifications (3) and (4) further split the sample by whether the HHI is less than or greater than the median. Standard errors (reported in brackets) are clustered at the bank level. ***, ** and * indicate statistical significance at 1%, 5% and 10%, respectively.

Dependent variable:	Change in loan amount from 2006 to 2008			
	(1)	(2)	(3)	(4)
Strong Bank	4367.0*	2571.5	2308.5	3068.2*
	[2444.9]	[2157.7]	[3174.8]	[1719.1]
Lending Decrease from Exposed Banks x Strong Bank	--	-0.0947***	-0.0896***	-0.144**
		[0.0316]	[0.0340]	[0.0659]
Lending Decrease from Exposed Banks	--	0.120***	0.113***	0.176**
		[0.0241]	[0.0244]	[0.0815]
Number of households	-0.0116	0.0157	0.0143	0.0456**
	[0.00782]	[0.00975]	[0.00994]	[0.0176]
Median household income	0.0442	-0.0342	-0.0659	-0.00551
	[0.0681]	[0.0691]	[0.103]	[0.0812]
Number of houses per square mile	1.260	0.174	0.418	-0.496
	[0.810]	[0.846]	[0.892]	[1.994]
Change in real estate prices 2006Q2-2007Q4	3808.3	-4824.2	-12766.7	2417.2
	[11812.1]	[11650.5]	[18369.0]	[8596.3]
Fraction of population >16 in labor force	1490.2	5534.4	11540.8	-6750.0
	[9166.3]	[9246.0]	[16963.1]	[6330.0]
Fraction of labor force unemployed	-1474.7	5437.3	-15241.1	1538.7
	[14254.1]	[14171.7]	[42739.3]	[7008.5]
Fraction of population below the poverty line	-10066.1	-10229.4	-6013.7	-11071.0*
	[10372.8]	[9880.9]	[21065.5]	[6163.7]
Constant	-28432.5	-28408.8	-35978.3	-25990.4*
	[20951.5]	[19704.1]	[32054.5]	[14796.9]
Observations	2855	2835	1596	1239
R^2	0.062	0.157	0.161	0.193

Table VII
Robustness

This table repeats our central results, but excludes the largest institutions from the sample. Specification (1) is equivalent to specification (5) in Table 3, but excluding the ten biggest banks. Specification (2) we discard observations where a given bank had entered after 2002 (i.e., new or non-traditional markets). In table (3) we change our control group from strong dispersed banks to local banks. Since the analysis is constrained to counties which did not experienced contraction in real estate prices, local banks were also not exposed to the real estate shock. Throughout, standard errors (reported in brackets) are clustered at the bank level. ***, ** and * indicate statistical significance at 1%, 5% and 10%, respectively.

Dependent variable:	Change in loan amount from 2006 to 2008		
	(1)	(2)	(3)
Strong Bank	5,689.6*	6,386.1*	9,699.6**
	[3,382.0]	[3,441.3]	[3,744.9]
Log Assets 2006	2,515.8*	2,326.8*	1,924.8**
	[1,494.8]	[1,177.3]	[839.0]
Log(Deposits in county), 2006	-2,213.4**	-2,509.5***	-1,957.7***
	[1,101.4]	[895.8]	[614.3]
Deposits/Assets, 2006	27,616.3	30,155.0*	12,976.3
	[21,634.2]	[16,989.8]	[12,693.3]
Insured deposits/Deposits, 2006	13,737.9	-5,589.6	-10,067.6
	[17,848.1]	[12,289.5]	[12,486.7]
Loans/Assets, 2006	-7,069.5	-17,429.7	-18,777.1*
	[20,756.4]	[18,552.9]	[10,213.0]
Real estate loans/Total loans 2006	19,052.2	24,150.6*	34,817.3***
	[16,847.2]	[14,298.9]	[11,236.7]
Net Charge-offs/Total loans 2006	-150,838.7	1,112,596.1	-74,001.4
	[107,0387.5]	[1,554,634.8]	[683,434.2]
Past due loans/Total loans, 2006	-159,548.1	43,464.8	36,458.1
	[304,885.9]	[234,452.4]	[170,479.4]
Tier 1 ratio, 2006	32,877.4	4,2087.1	32,313.0
	[49,934.0]	[50,868.0]	[32,551.4]
ABS/Assets, 2006	162,541.9	191,998.2**	128,060.2
	[105,333.3]	[95,241.1]	[89,271.1]
Constant	-5,1030.3	-37,628.5	-24,627.8
	[42,512.2]	[31,131.8]	[23,472.2]
Observations	1,751	2,046	2,660
R^2	0.269	0.292	0.220