

**Finance and Economics Discussion Series
Divisions of Research & Statistics and Monetary Affairs
Federal Reserve Board, Washington, D.C.**

**Housing Bust, Bank Lending & Employment: Evidence from
Multimarket Banks**

David Glancy

2017-118

Please cite this paper as:

Glancy, David (2017). "Housing Bust, Bank Lending & Employment: Evidence from Multimarket Banks," Finance and Economics Discussion Series 2017-118. Washington: Board of Governors of the Federal Reserve System, <https://doi.org/10.17016/FEDS.2017.118>.

NOTE: Staff working papers in the Finance and Economics Discussion Series (FEDS) are preliminary materials circulated to stimulate discussion and critical comment. The analysis and conclusions set forth are those of the authors and do not indicate concurrence by other members of the research staff or the Board of Governors. References in publications to the Finance and Economics Discussion Series (other than acknowledgement) should be cleared with the author(s) to protect the tentative character of these papers.

Housing Bust, Bank Lending & Employment: Evidence from Multimarket Banks*

David Glancy[†]

November 7, 2017

Abstract

I use geographic variation in bank lending to study how bank real estate losses impacted the supply of credit and employment during the Great Recession. Banks exposed to distressed housing markets cut mortgage and small business lending relative to other banks in the same county. This lending contraction had real effects, as counties whose banks were exposed to adverse shocks in other markets suffered employment declines, especially in young firms. This finding is robust to instrumenting for bank exposure to housing shocks using shocks in distant markets, exposure based on historical lending, or exposure to markets with inelastic housing supply. *JEL* Codes: E24, E44, G21.

*I thank Gauti Eggertsson, Giovanni Favara, Victoria Ivashina, Neil Mehrotra, Joe Peek and David Weil for their feedback, and Nate Baum-Snow, Greg Casey, Michelle Marcus, Sanjay Singh, Hyunjoo Yang and seminar participants at Brown University, the FDIC, the Kansas City Fed and the Federal Reserve Board for valuable comments. The analysis and conclusions in this paper are those of the author and should not be interpreted as reflecting the views of the Board of Governors or the Federal Reserve System.

[†]Federal Reserve Board of Governors. Email: David.P.Glancy@frb.gov.

1 Introduction

How did bank exposure to distressed housing markets impact credit and employment during the Great Recession? Losses on real estate loans can force banks to deleverage by contracting credit, potentially disrupting the local economy.¹ However, recent work has also highlighted numerous other ways that real estate shocks impact the economy, including by reducing housing wealth, impairing the value of a firm’s collateral or discouraging construction activity.² Consequently, it is difficult to determine the extent to which a deterioration in bank balance sheets was responsible for the lending and employment declines in weak real estate markets.

This paper examines the significance of the bank balance sheet channel using variation in the exposure of multimarket banks to real estate declines in other markets. If adverse housing shocks trigger bank losses, then borrowers located in strong markets may still face a contraction in credit if their bank is exposed to falling real estate prices elsewhere. Alternatively, if exposed banks cut lending because of low demand in distressed markets, then it would only be the local housing shocks that influence credit and employment instead of the shocks elsewhere where local banks lend.

My evaluation of the bank balance sheet channel thus amounts to testing whether the aggregate exposure of locally operating banks to real estate shocks impacts lending and the real economy, or whether it is solely the conditions in the local market that matter. This approach is enabled by two characteristics of the banking sector. First, most bank lending is done by large multimarket banks. Thus, the health of a typical borrower’s bank depends largely on conditions in other markets where the bank lends. Second, asymmetric information between a borrower’s bank and other potential lenders creates an adverse selection problem which inhibits borrowers from switching to a healthier bank. Consequently, the incidence of a shock to a bank will largely fall on the bank’s existing customers instead of on the aggregate supply of credit. Taken together, these characteristics imply that the availability of credit in a particular area will reflect conditions in different, and often distant markets, where local banks also lend.

This paper provides three main findings supporting supporting the hypothesis that bank losses impact the supply of credit and employment. First, banks active in distressed real estate markets, as measured by declines in house prices or construction employment, experience increases in loan losses as well as declines in equity and lending. Second, the lending decline isn’t driven by falling loan demand, as highly exposed banks cut mortgage and small business lending throughout their network instead of merely in the areas experiencing the ac-

¹Bank distress during the Great Recession has been shown to impact employment by reducing household credit (Mondragon, 2014), small business lending (Greenstone et al., 2014) and syndicated commercial lending (Chodorow-Reich, 2014). In previous periods, bank real estate losses have been shown to have real effects by causing bank failures (Ashcraft, 2005), declines in construction activity (Peek and Rosengren, 2000) and declines in investment from firms reliant on exposed banks (Gan, 2007).

²Midrigan and Philippon (2011); Mian et al. (2013); Mian and Sufi (2014); Eggertsson and Krugman (2012); Guerrieri and Lorenzoni (2015) argue that declining house prices reduce household wealth and the ability to borrow against home equity, thus reducing aggregate demand. Chaney et al. (2012); Fairlie and Krashinsky (2012); Adelino et al. (2013); Fort et al. (2013); Mehrotra and Sergeyev (2014) support the theory that falling house prices reduce the value of collateral to support business borrowing. Hadi (2011); Rognlie et al. (2014); Hoffmann and Lemieux (2014) emphasize the importance of declining construction activity.

tual declines. Third, conditional on the strength of the local housing market, counties whose banks are exposed to real estate shocks in other regions experience declines in employment.

I construct two measures of bank exposure to real estate losses based on the extent to which a bank operates in distressed counties. First, motivated by the findings that falling house prices impacted both the local economy (Mian and Sufi, 2014) and the supply of credit (Bord et al., 2014; Huang and Stephens, 2015), I calculate the average 2006 to 2009 house price appreciation in a bank's counties, weighted by the bank's volume of 2006 mortgage originations. Second, motivated by the finding that poor performance on construction loans disproportionately account for the elevated loan losses in areas with falling house prices, I also use a more construction specific measure.³ Namely, I calculate the change in construction employment as a percentage of employment in a bank's counties, again weighting by prior mortgage lending. A bank is thus considered to be "exposed" if it lent more in markets which subsequently experienced large declines in house prices or construction employment.

First, I find that banks in weak housing markets perform poorly. Exposed banks experience worse loan performance, declines in equity, declines in commercial lending, and are more likely to ultimately fail. This balance sheet contraction and increased risk of failure is most dramatic for banks that are oriented in construction loans, whose performance is highly sensitive to real estate shocks.

Second, I analyze the geography of the lending declines using bank-county loan origination data. If banks contract lending only in distressed counties, this would indicate low demand in these counties. However, if exposed banks cut lending throughout their branch network, this would indicate that real estate losses impact the supply of credit.

Banks don't cut lending in distressed markets. Instead, banks exposed to real estate losses in aggregate cut lending everywhere, consistent with a shock to the supply of credit. I find that a 10% decline in house prices across a bank's markets results in a 16% decline in lending to small businesses, an 11% decline in mortgage originations, and a 4 percentage point decline in the bank's acceptance rate on mortgage applications. The magnitude of these estimates is little changed when controlling for the house price decline in the county itself or when including county fixed effects.⁴

Finally, I test whether this contraction in credit has real effects. If borrowers can frictionlessly switch to healthier banks or non-bank lenders, employment might not respond to these shocks. However, given previous work demonstrating that real activity is significantly affected by bank failures (Ashcraft, 2005) and shocks to firm credit (Chodorow-Reich, 2014), these bank real estate losses have the potential to explain some of the employment losses in distressed housing markets.

I find that counties whose banks are exposed to other weak real estate markets experience declines in employment. In a county level regression of employment growth on county house price appreciation and the average multimarket exposure of local banks to house price appreciation, I find that a one standard deviation greater bank exposure to house price declines reduces local employment by 1.3% between 2007 and 2010. Furthermore, accounting for the effects of bank exposure reduces the elasticity between employment and local house

³The outside role of construction loans in causing bank loan losses in distressed housing markets is established in section 3.1.

⁴Construction shocks are found to have similar effects.

price appreciation by more than a third, indicating that bank distress contributed to the dramatic employment declines in distressed housing markets. The effect is even larger for the construction shock, with a one standard deviation greater bank exposure to construction declines reducing local employment by 1.9%.

I address potential objections to these findings using three instruments for county level bank exposure. The first objection is that controlling for the county real estate shock is insufficient for controlling for demand due to geographic spillovers. For example, declines in housing wealth in neighboring counties could influence local consumption. I alleviate this concern by instrumenting for bank exposure using only the exposure of local banks to declines in distant counties. If a local bank originates mortgages in another county hundreds of kilometers away, falling house prices in that other county will impact the health of the bank, but is unlikely to transmit to local demand as a more proximate shock would. Thus the observation that house price shocks in distant markets with common banks impact local employment should alleviate concerns about bank exposure reflecting local demand spillovers.

Second, one might object that bank market shares are endogenous. A county whose banks locate in other distressed areas may have unobserved characteristics which factor into the decision of the banks to lend there, for example a population of subprime borrowers. To overcome this concern, I instrument for bank exposure using the exposure of banks to real estate declines based on 2002 mortgage lending. Since the large spike in the share of subprime originations occurred in 2004, 2002 volumes are less likely to be driven by an endogenous response to the housing boom. I show that counties experience employment declines if their banks historically located in counties which went on to suffer real estate shocks, increasing confidence that my findings aren't due to endogenous bank market shares.

Finally, one might object that the real estate shocks themselves are endogenous. Since the supply of credit impacts house prices and construction (Peek and Rosengren, 2000; Loutskina and Strahan, 2015; Favara and Imbs, 2015), a bank may be systematically located in weak real estate markets because it is responsible for them. For example, banks which depended more on wholesale funding may have cut lending, resulting in falling house prices and employment across their markets even though losses on real estate loans didn't cause the supply shock. To overcome this, I instrument for bank exposure using the Saiz (2010) housing supply elasticity in the bank's markets.⁵ If a county suffers employment losses because local banks located in areas where geographic characteristics promoted real estate shocks, this would increase confidence that causality was running from house prices to bank lending instead of vice versa. As with the other instruments, coefficients are found to be undiminished in IV specifications relative to the OLS specifications.

Two extensions provide further clarification of the role that deteriorating bank balance sheets had in reducing the demand for labor. First, I show that young firms experience significantly larger declines in employment in counties with exposed banks than mature firms. This is consistent with a shock to the supply of bank credit since young firms are more bank dependent.⁶ Second, I show that adverse bank shocks cause wages to fall, especially for

⁵Saiz (2010) measures the housing supply elasticity due to geographic constraints on housing development. Mian et al. (2013); Mian and Sufi (2014) show that counties with an inelastic housing supply experience larger declines in house values between 2006 and 2009.

⁶Young firms have had little opportunity to retain earnings and have minimal access to direct finance, thus they tend to rely more on bank lending (Black and Strahan, 2002; Cetorelli and Strahan, 2006; Robb

younger or less educated workers. With flexible wages, a shock to the supply of credit reduces the relative demand for locally non-tradable goods and results in a shift of employment into the tradable sector (Kehoe et al., 2016). Thus, this decline in wages may have contributed to the muted response of tradable employment to housing shocks, as documented by Mian and Sufi (2014).

Overall, my findings suggest that these effects are economically large. Although caution is required in making inferences about aggregate effects from regional elasticities, even under conservative assumptions regarding the specification and the strength of general equilibrium effects, I still find that bank balance sheet shocks can account for the loss of about one million jobs.

1.1 Relation to Previous Literature

This paper contributes to several strands of the macroeconomics and finance literature. I add to a vast literature identifying how shocks to the supply of bank credit impact the economy.⁷ Additionally, I contribute to work studying the transmission of shocks through the internal capital markets of geographically dispersed banks.⁸

First and foremost, this paper fits into the literature studying the effect of credit market frictions on employment in the Great Recession. Other studies of how bank losses impacted employment have found mixed results. Chodorow-Reich (2014), using data on bank relationships in the syndicated loan market, estimate that contracting bank lending explains roughly 40% of the decline in small/medium sized firm employment following Lehman’s bankruptcy. In contrast, Greenstone et al. (2014) study regional loan supply shocks and find that falling small business lending explains less than 3% of the decline in small business employment. This divergence may be because Chodorow-Reich (2014) uses a sample of potentially highly financially dependent firms (small firms borrowing in syndicated loan markets) while Greenstone et al. (2014) study a very narrow loan category (lending to firms with less than \$1 million in revenue from banks with over \$1 billion dollars in assets). I advance this work by using nationally representative employment, but studying a shock to bank capital, which would affect lending more generally and thus has the capability of being more impactful than a decline within a particular category.⁹

Evidence on whether housing shocks impacted the economy through the bank balance sheet channel is also mixed. Huang and Stephens (2015); Bord et al. (2014); Berrospide et al. (2016) use geographic variation in bank locations to show that banks exposed to housing

and Robinson, 2014).

⁷Gertler and Gilchrist (1994); Peek et al. (2003); Ashcraft (2005); Bassett et al. (2014) find that bank credit supply shocks impact employment, income or investment, Driscoll (2004); Ashcraft (2006); Jiménez et al. (2014) on the other hand find no real effects.

⁸Peek and Rosengren (2000); Chava and Purnanandam (2011); Cetorelli and Goldberg (2012) for example study spillovers through multinational banks, while Morgan et al. (2004); Huang and Stephens (2015); Berrospide et al. (2016); Bord et al. (2014) focus on transmission within the United States.

⁹The concern with studying one category is that some of the contracting banks could be redeploying loans from small firms to either larger firms or to households instead of reducing lending in general. This reorientation of lending would only have real effects to the extent that small business lending impacts employment more than other types of lending.

shocks contracted small business lending.¹⁰ However, it is debatable whether this had real effects as Mian and Sufi (2014); Giroud and Mueller (2017) demonstrate that house price shocks predominantly impacted non-tradable employment, indicating that the shock may influence consumption rather than bank health. This paper similarly exploits geographic variation in bank locations, but does so with an eye towards real effects more so than bank market shares.¹¹ By comparing counties with similar house price shocks, but differently exposed banks, I can distinguish the employment losses due to the bank balance sheet channel from the direct effects of falling house prices.¹²

2 Data Sources

2.1 Real Estate Shocks

The primary independent variables in my study reflect the exposure of banks to different county level real estate shocks. The first measure of the strength of the local housing market is house price appreciation between 2006 and 2009:

$$\Delta \ln(HP)_c = \ln(\text{House Price})_{c,09} - \ln(\text{House Price})_{c,06}$$

House prices come from the Federal Housing Finance Agency county level house price index, a weighted, repeat-sales index constructed from single-family mortgages purchased or guaranteed by Fannie Mae or Freddie Mac.¹³

Banks in areas with falling house prices are likely to suffer greater loan losses. For one, falling house prices increase the likelihood of mortgage default, as underwater homeowners either strategically default or become unable to sell their house in the event of distress. Furthermore, defaults become more costly as the collateral securing loans lose value.

My second county level housing shock is the change in county construction employment as a fraction of 2006 employment:

$$\frac{\Delta \text{Const}}{\text{Emp}_c} = \frac{\text{ConstEmp}_{c,09} - \text{ConstEmp}_{c,06}}{\text{Employment}_{c,06}}$$

Where $\text{ConstEmp}_{c,t}$ is the mid-march employment in year t with an NAICS code of 23 and $\text{Employment}_{c,06}$ is the total 2006 employment in the county, both coming from County Business Patterns (CBP).

¹⁰Similarly, Chakraborty et al. (2016); Flannery and Lin (2015) study the effects of banks being exposed to house price growth during the boom preceding the period studied here.

¹¹Huang and Stephens (2015); Bord et al. (2014); Berrospide et al. (2016) use market fixed effects to control for demand, making the primary object of study changes in market shares instead of county level effects. Bord et al. (2014), however, also show that counties unaffected by house price declines experience employment losses if locally operating banks locate in distressed markets.

¹²Note that this review is far from exhaustive. Additionally, Ivashina and Scharfstein (2010) and Cornett et al. (2011) document a decline lending from banks with less deposit funding. Almeida et al. (2012) and Duchin et al. (2010) find evidence of financial constraints among Compustat firms, while Kahle and Stulz (2013) does not. Campello et al. (2010) uses a survey approach to identify real effects of financial constraints. Duygan-Bump et al. (2015) and Siemer (2014) find employment was most impacted in small, financially dependent firms. Goetz and Gozzi (2010) shows that MSAs with wholesale funding dependent banks experienced larger employment declines.

¹³Bogin et al. (2016) describe the construction of the index.

Declines in construction employment are taken as a proxy for the failure of construction projects. This is especially important for bank health as, outside of the largest banks with over \$100 billion in assets, construction loans made up 56% of 2009:Q4 bank non-performing real estate loans, despite making up less than 20% of the real estate loan portfolio. I also show in the next section that the relationship between falling house prices and bank performance is largely driven by construction loans.

While correlated with house price declines, the construction shock may differ in important ways.¹⁴ Areas with severe constraints on development are likely to have the most significant boom and bust in house prices. However, these constraints could mitigate the damage to bank balance sheets by prohibiting the emergence of a construction bubble.¹⁵ If construction loans were the primary catalyst for bank losses, the construction specific measure may better capture the effect.

To test how exposure to housing shocks impacted bank lending, I aggregate the county level shocks to the level of the bank holding company. My measure of bank health is an average of the county level real estate shocks, weighting by the bank’s 2006 mortgage lending in the county.¹⁶ For house price growth, this is:

$$\Delta \ln(HP)(bank)_b = \sum_{c \in C} \frac{L_{b,c,06}}{L_{b,06}} \Delta \ln(HP)_c$$

Where $\frac{L_{b,c,06}}{L_{b,06}}$ is the share of bank b ’s home purchase mortgage lending in county c . This data comes from the Home Mortgage Disclosure Act (HMDA), which reports mortgage originations for financial institutions with at least \$35 million in assets, and a branch in an MSA. “Bank” is meant broadly to include commercial banks, thrifts and credit unions. I aggregate the lending of financial institutions and subsidiaries to the level of the regulatory high holder using the concordance from Avery et al. (2009). For financial institutions which aren’t part of a bank holding company, a “bank” is defined by the institution itself and any subsidiaries in the HMDA data. The bank exposure to construction shocks, $\frac{\Delta Const}{Emp}(bank)_b$, is analogously defined as the mortgage weighted average construction shock in a bank’s markets.

In order to determine how the multimarket exposure of local banks impacted local outcomes, I further aggregate these measures of bank health to the county level. My measure of the health of the banks operating in a particular county is the average of the bank level shocks, weighting by banks’ mortgage lending in the county. For house prices this is:

$$\Delta \ln(HP)(local\ banks)_c = \sum_{b \in B} \frac{L_{b,c,06}}{\sum_{b' \in B} L_{b',c,06}} \Delta \ln(HP)(bank)_b$$

¹⁴The correlation is 0.37.

¹⁵Los Angeles County for example experienced a 35% decline in house prices, but the loss in construction employment was less than 0.9% of initial total employment. The larger construction shock occurred elsewhere in the Greater Los Angeles Area, where employment was more oriented towards construction.

¹⁶Many papers identify the area of a bank’s operations using branch deposits instead of mortgage lending. I focus on mortgage lending in order to capture wholesale lending or lending through non-bank subsidiaries, which doesn’t necessarily line up well with where banks have branches. I present results weighing by deposits later as a robustness check.

$\frac{\Delta Const}{Emp}$ (*local banks*) is defined analogously. A county is considered to be exposed to adverse real estate shocks through the banking sector (“exposed” for short) if the banks which are originating mortgages in the area are lending in counties with falling house prices or construction employment. This will reflect both the declines in the county itself, as well as declines in other counties where the locally operating banks are also lending.

2.2 Bank Outcomes

To test how bank exposure to real estate shocks impacts loan performance, equity, and lending, I use balance sheet data from the Call Reports. This data provides a quarterly snapshot of the balance sheet of commercial banks. Banks which are part of a multibank holding company are aggregated to the level of the regulatory high holder. The dependent variables of interest are the non-performing loan rates for various lending categories, and the quarterly growth rate in either commercial and industrial lending or equity.¹⁷ Additionally, I use this data to construct an indicator for whether a bank is above the mean in construction lending to bank equity in 2006:Q1. I can thus show that commercial lending or equity growth is more sensitive to real estate shocks in banks whose portfolio is concentrated in construction loans, which are particularly sensitive to housing shocks.

To study the geography of the lending declines, I use two sources for bank-county level lending. For small business lending, I use data from the Community Reinvestment Act (CRA). This includes business loan originations which are either under \$1 million in value or to firms with less than \$1 million in revenue.¹⁸ This is reported by banks with over \$1 billion in assets in 2005 dollars. The variable of interest is growth in the value of loan originations during the crisis (2008-2010) relative to the pre-crisis period (2004-2006).

For mortgage lending, I use data from the Home Mortgage Disclosure Act. Unlike the CRA data, which is aggregated to the bank-county level, HMDA is available at the loan level, and includes applications in addition to originations. The dependent variables using the HMDA data are the approval rate on mortgages applications, and the growth in the number of approved mortgage applications.¹⁹

2.3 Labor Market Outcomes

To test for real effects of the county level bank shocks, I use labor market data from the County Business Patterns (CBP) and the Quarterly Workforce Indicators (QWI). Employment growth in the baseline specifications use the CBP data, which provides mid-march employment at the county level using data from the US Census Bureau’s Business Register. Growth is measured between 2007 and 2010 to best correspond to the period of rising

¹⁷The non-performing loan rate is the ratio of the value of loans which are 90 days past due or not accruing interest to total loans for a given lending category.

¹⁸Small business lending includes business lending which is either unsecured, or secured by non-farm non-residential properties.

¹⁹The approval rate is $\frac{Accepted_{b,c}}{Accepted_{b,c} + Denied_{b,c}}$ since applications which are withdrawn or closed for incompleteness may not reflect credit supply decisions. Lending growth is the growth in approved mortgages during the crisis (2008-2010) relative to the pre-crisis period (2004-2006).

unemployment.²⁰

I use the QWI for employment data disaggregated by firm age and wage data disaggregated by worker education. QWI matches worker unemployment insurance data with employer characteristics from the Business Dynamic Statistics. Growth is again taken from quarter end 2007:Q1 to 2010:Q1. For employment, growth is calculated separately for young firms (10 years old and younger) and mature firms (over 11). For wages, I estimate the quarterly wage for a particular type of worker (e.g. college educated workers) as the quarterly payroll divided by the average of beginning and end of quarter employment. Wage growth is calculated from 2007:Q1 to 2010:Q1, either in aggregate or for a particular education category.

2.4 Summary Statistics

Table 1 presents summary statistics of the main variables of interest. Part A shows the bank and bank-county level variables. On average, banks were exposed to a 6.3% decline in house prices and a 1.1% decline in construction employment as a fraction of employment. 8.4% of the banks in the sample failed during or after the crisis. Distress seems to have been disproportionately due to construction loans, which had a 6.4% non-performing loan rate at the end of 2008, compared to only 1.7% for the rest of the portfolio.

Part B summarizes the county level data on labor market outcomes and real estate shocks. On average, the banks in a county are exposed to a decline in house prices of 12.6%, and a decline in construction employment which is 1.5% of initial employment. These shocks are larger in magnitude than the average county declines (1.8% for house prices and 1% for construction employment). This difference is due to the inclusion in the sample of small counties which typically had relatively minor housing shocks but, by virtue of accounting for a small percentage of banks' loan portfolios, largely didn't influence the bank exposure measures. Dropping smaller counties tends to strengthen my results, so I don't restrict the sample in my baseline specifications.

Employment dropped by 7.8% on average from March 2007 to March 2010. This decline was particularly dramatic for young firms, which declined by over 20%, whereas mature firms declined by less than 5%.

3 Bank Real Estate Shocks and the Supply of Credit

In this section, I first document that banks in distressed markets experience elevated loan losses and declines in equity and lending. I then use within county variation in small business and mortgage lending to rule out low demand in distressed markets as the reason for the lending declines.

²⁰The unemployment rate rose from 4.4% in March 2007, to a peak of 10.0% in October 2009, and was still elevated at 9.9% by March 2010.

3.1 Bank Level

How did operating in distressed markets impact bank balance sheets? The hypothesis proposed in this paper is that banks which originated loans in distressed housing markets experienced elevated loan losses, resulting in a deterioration in their capital position and a decline in lending. Here I show that the changes to aggregate bank balance sheets are consistent with this narrative.

Table 2 regresses various bank performance measures from the Call Reports on the real estate shock variables: $\Delta \ln(HP)(bank)$ in the top panel and $\frac{\Delta Const}{Emp}(bank)$ in the bottom. The first 3 columns present the results of univariate regressions of bank 2008 year-end non-performing loan rates on exposure to housing shocks.²¹ In column 1 of the top panel, we see that a 10% decline in house prices increases the non-performing loan rate by 0.69 percentage points, compared to a mean non-performing loan rate of 2.5%. In the next two columns, we see that the non-performance is largely driven by construction lending. The 10% shock to house prices increases the non-performing rate on construction loans by 2.0 percentage points, compared to 0.40 for non-construction loans.

Columns 4 and 5 estimate a linear probability model for whether or not the bank ended up failing between 2007 and 2016. In column 4, we see that a 10% decline in house prices increases the likelihood of failure by 4.9 percentage points, compared to a mean of 8.4%. Column 5 shows that construction oriented banks are over twice as sensitive to house price shocks. Specifically, I interact $\Delta \ln(HP)(bank)$ with an indicator for whether the bank was above the mean ratio of construction lending to capital in 2006. I find that a 10% decline in house prices increases the likelihood of failure by 5.8 percentage points for construction oriented banks, compared to 2.9 for non-construction banks.

The last four columns demonstrate that these loan losses are also associated with lower growth in equity and commercial lending. I regress the quarterly growth in equity or lending on the exposure of the bank to real estate declines and quarter fixed effects for the period 2007:Q2 to 2010:Q1.²² A 10% decline in house prices is associated with a 0.8% quarterly decline in equity, which would amount to a 9.7% decline over the 12 quarter sample period. In column 7, we see that the effect is largest in construction oriented banks who are expected to experience a 12.0% decline in equity over the 12 quarters in response to this shock, compared to 6.3% for other banks.

The last two columns show that the difference between construction and non-construction oriented banks is even clearer with commercial loan growth. Overall, the 10% shock is expected to reduce commercial loans by 1.9% over the sample period. However, when the interaction term is added, we see that this decline is entirely driven by construction oriented banks, who reduced loans by 2.6% between 2007 and 2010 in response to a 10% decline in house prices. In contrast, commercial lending in low construction banks had a negligible response to falling house prices.

The fact that falling house prices seem to predominantly impact bank performance by inducing losses on construction loans raises the question whether house prices are the ap-

²¹Qualitatively similar results are found using the quarterly net charge-off rate instead of non-performing loans. Taking non-performing loans from later in the period results in larger effects.

²²I cluster by bank and drop quarters where the bank merged with another bank. The quarterly growth rates are winsorized at the 1st and 99th percentile.

appropriate measure of local real estate conditions. Counties lacking developable land may experience a collapse in housing prices, but leave local banks relatively unscathed if the constraints on development limited construction activity during the boom. For this reason, the bottom panel estimates the same equations, but instead uses bank exposure to counties with falling construction employment as the independent variable.

The findings for the construction shock are similar to when house price declines are used. A 1 percentage point decline in construction employment as a percentage of employment typically has a slightly smaller effect than a 10% decline in house prices. This 1 percentage point decline is found to increase the non-performing loan rate by 0.5 percentage points and the probability of failure by 3.9 percentage points. Similarly, over the 12 quarter sample, the 1% construction shock is found to reduce equity and commercial lending by 6.4% and 2.6% respectively.

The difference between construction and non-construction oriented banks becomes starker when using the construction-centric real estate shock. The 1% shock raises the probability of failure by 5.1 percentage points for construction banks, versus 1.7 percentage points for non-construction banks, and reduces equity growth by 8.6% for construction banks versus 3.2% for non-construction banks. Again, commercial lending only responds to the construction shock for construction oriented banks.

In sum, banks in distressed housing markets experienced a significant deterioration in loan performance and declines in equity and commercial lending. The contraction in commercial lending, a category which excludes real estate backed loans, was largely driven by the construction oriented banks which experienced the worst loan losses and capital declines. In the next part, I use geographic variation in lending to provide evidence that these declines weren't driven by low loan demand in weak markets.

3.2 Bank-County Lending

3.2.1 Empirical Strategy

While the aggregate results show that banks exposed to housing shocks have lower lending, they aren't very informative as to whether there was a decline in the availability of credit. One explanation for the result is that falling house prices adversely affect the local economy as in [Mian and Sufi \(2014\)](#), and this reduces the demand for loans. Thus, banks possibly could have raised new equity or operated at a higher leverage ratio after experiencing the losses, but chose not to due to an absence of credit worthy borrowers seeking credit.

To understand how demand shocks would bias my estimate of how real estate shocks impact the supply of credit, I adopt a framework along the lines of [Khwaja and Mian \(2008\)](#) and [Jiménez et al. \(2014\)](#). Suppose that lending growth for a particular bank in a county, $\Delta \ln(L)_{b,c}$, depends on a bank level supply shock due to real estate losses, $Shock_b$, with an elasticity β , a county specific demand component, η_c , and an idiosyncratic error. This means that lending growth will be:

$$\Delta \ln(L)_{b,c} = \alpha + \beta Shock_b + \eta_c + \epsilon_{b,c} \tag{1}$$

Aggregating over counties, and defining $\bar{x}_b \equiv \sum_{c \in C} \frac{L_{b,c}}{\sum_{c' \in C} L_{b,c'}} x_{b,c}$ as the lending weighted average

of $x \in \{\Delta \ln(L)_{b,c}, \eta_c, \epsilon_{b,c}\}$, we have the aggregate lending growth for the bank is:

$$\overline{\Delta \ln(L)_b} = \alpha + \beta Shock_b + \bar{\eta}_b + \bar{\epsilon}_b$$

The object of interest is β , representing the causal effect of the bank shock on the supply of credit. However, the regressions of bank level lending on the shock variable as run earlier in the section will produce the coefficient: $\hat{\beta} = \beta + \frac{cov(\bar{\eta}, Shock_b)}{var(Shock_b)}$. Given that the bank shock is an average of the county level real estate shocks, any relationship between local demand and local housing shocks will bias my findings.

I address this bias with geographically disaggregated lending data in the spirit of [Huang and Stephens \(2015\)](#); [Bord et al. \(2014\)](#); [Berrospide et al. \(2016\)](#). Namely, I estimate bank-county lending as in equation 1, using the multimarket exposure of a bank to weak real estate markets to measure $Shock_b$, and either county level real estate shocks or county fixed effects to control for η_c . The primary dependent variables are the growth in small business lending or mortgage originations in county c by bank b during the crisis (2008-2010) relative to before the crisis (2004-2006). I cluster by bank and, in most specifications, restrict the sample to observations where the bank had a 2006 branch.

Intuitively, this approach tests whether banks cut lending in distressed markets, or whether banks in distressed markets cut lending through out their network. If exposed banks cut lending due to falling demand in weak housing markets, then the contraction in lending should predominantly occur in those weak housing markets. In this case, controlling for demand should eliminate the relationship between bank shocks and lending. Alternatively, if exposed banks cut lending because they take losses on their loan portfolio and need to deleverage, they should cut lending throughout their network, regardless of local real estate conditions. If the controls for demand don't meaningfully change the estimate of β , this would indicate that the bias due to falling demand in weak real estate markets is minimal.

3.2.2 Evidence for Small Business Lending

Table 3 shows that bank losses impact the supply of small business credit. In the first four columns, I test how bank exposure to weak real estate markets impacts the growth in the volume of loan originations to small firms between the pre-crisis period (2004-2006) and the crisis period (2008-2010). In the last four columns, I use a second definition of small business loan growth: the growth in the value of business loan originations under \$1 million in size.

Focusing first on the effects of exposure to house price appreciation in the top panel, column 1 shows that a 10% decline in house prices across a bank's markets reduces the growth in lending to small firms by 16%. However, as this specification doesn't include the controls for demand, the coefficient reflects both the influence house price shocks have on the supply and demand for loans.

In order to control for demand, I additionally add a control for county house price appreciation in column 2, and county fixed effects in column 3. When controls for demand are included the estimated effect *increases*, with a 10% house price shock to a bank reducing small business lending by 18%. If real estate shocks impacted the demand for loans, then the reduction in lending would be concentrated in the counties experiencing the adverse shock. The fact that exposed banks cut lending throughout their branch network, with minimal

regard to local house price appreciation, indicates that real estate shocks predominantly impact the supply of credit.²³

In column 4, I expand the sample for the fixed effect regression to include counties where the bank didn't have a 2006 branch. A 10% decline in house prices in a bank's markets is found to reduce small business lending by 25% when this non-local lending is included. The magnified effect is similar to Berrospide et al. (2016), who find that exposed banks cut mortgage lending the most in areas in which they didn't have a branch.

Similar results are found in columns 5-8, where I define small business lending as loans under \$1 million instead of loans to firms with less than \$1 million in revenue. Here, a 10% decline in house prices reduces lending by 12% when excluding the controls for demand, and 13% or 14% when the county control or fixed effects are used. Effects are again larger when the sample includes counties without a branch. $\Delta \ln(HP)(bank)_b$ is significant at the 1% level in every specification.

In the bottom panel, I use the exposure to construction declines to measure bank distress and get mostly similar findings. A 1% construction shock to a bank is found to reduce lending to small businesses by about 13%, with the inclusion of the control for county construction declines or county fixed effects having little effect on the coefficient. When I include non-local lenders, the effect is slightly smaller at 11% and becomes less significant. However, this non-local lending is likely skewed towards small business credit card loans made by large banks whose portfolios are less oriented towards construction loans.

Similar results are found when small business loans are defined by the size of the loan instead of the size of the business. With this measure, I find that a 1 percentage point decline in $\frac{\Delta Const}{Emp}(bank)$ reduces lending by 11%. As before, controlling for the county level construction shock or county fixed effects changes little.

3.2.3 Evidence for Mortgage Lending

Table 4 presents similar findings, except for mortgage lending instead of small business lending. In the first four columns, I test how bank exposure to weak real estate markets impacts the growth in the number of approved loans between the pre-crisis period (2004-2006) and the crisis period (2008-2010). In the last four, I test how these shocks impact the percentage of applications which are accepted during the crisis period.

Banks which are exposed to falling house prices accept fewer mortgage applications. A 10% decline in house prices throughout a bank's network is found to reduce the number of accepted mortgages by 11%. When controlling for county level house price declines or adding county fixed effects, the estimated effects falls to 8% or 9%. The elasticity roughly doubles when the sample expands to include counties where the bank didn't have a branch in 2006, indicating that the largest declines in lending are in the peripheral markets of banks which are exposed to falling house prices.

In the last four columns, the dependent variable is the approval rate on mortgages instead of the growth rate. The effects are generally consistent with the specifications analyzing the

²³Note that this discussion is of demand at the bank level bank. If other banks are contracting lending in an area, this would register as an increase in demand for a bank as customers try to switch. Thus loan demand may have fallen in aggregate in distressed areas, but this was offset at the bank level due to contractions at competing banks.

growth in originations. A 10% shock to house prices for a bank reduces the approval rate by 4 percentage points, with the county house price control and county fixed effects having minimal influence on this estimated elasticity. Again, effects are amplified for non-local lenders, with the 10% shock reducing the acceptance rate by 6 percentage points.

The findings using the exposure to construction declines presented in the bottom panel are similar. A 1% decline in construction employment as a percentage of 2006 employment across a bank’s network results in between an 8% and 9% decline in the number of approved loans and between a 1.9 and 2.1 percentage point decline in the approval rate on mortgages in counties where the bank has a 2006 branch. Much as with exposure to house price declines, the inclusion of the county control or fixed effects has very little influence on the predicted effect of bank exposure to construction declines on mortgage lending. The estimated effect is again greater when the sample includes counties where the bank doesn’t have a branch.

In brief, banks which are exposed to real estate declines reduce small business and mortgage loans originations through out their network, not just in the counties experiencing declines. That county controls or fixed effects have little influence on the estimated elasticity between lending and bank exposure indicates that real estate shocks predominantly impacted the supply of bank credit.

4 Impact on Employment

Having now established that the exposure of a bank to real estate shocks impacts the supply of credit (conditional on county real estate conditions), the remainder of this paper is devoted to determining effect of this credit contraction on local labor markets.

4.1 OLS, with county level controls

The simplest approach to identifying how employment is impacted by the contraction in the supply of credit is to estimate the equation:

$$\Delta \ln(Emp)_c = \beta_1 Shock(local\ banks)_c + \beta_2 Shock_c + \beta'_x \mathbf{X}_c + \epsilon_c \quad (2)$$

Where $\Delta \ln(Emp)_c$ is the employment growth between 2007 and 2010 and the dependent variables of interest are the county level real estate shocks and the average exposure of the locally operating banks to these shocks. Following [Mian and Sufi \(2014\)](#), \mathbf{X}_c is a set of controls for the share of 2006 employment in each 2-digit NAICS industry.

The assumption underlying this approach is that the control for local housing conditions adequately accounts for direct effects that house price or construction declines have on the demand for labor so that β_1 reflects the employment effects of a credit contraction. $\beta_1 > 0$ would mean that a county whose banks locate in stable housing markets would out perform other counties with similar housing conditions, but more exposed banks.

Table 5 directly estimates the relationship between employment growth and the real estate shock variables as in equation 2. When the variables of interest are included separately in columns 1 and 2, a one standard deviation decline in $\Delta \ln(HP)(local\ banks)$, .043, or a one standard deviation decline in $\Delta \ln(HP)$, .121, reduces employment by about the same amount: 1.9%. The more informative specification is in column 3, which include both

variables. $\Delta \ln(HP)(local\ banks)$ remains significant at the one percent level, although the coefficient falls from 0.45 to 0.29. A one standard deviation increase in the multimarket exposure of local banks to falling house prices, controlling for local house price appreciation, reduces employment by 1.3%. Local house price appreciation stays significant, although accounting for bank exposure causes the coefficient to fall from 0.15 to 0.09.

Counties with exposed banks might differ from other counties in ways not captured by the control for local house price appreciation. For example, exposed counties might have banks which were targeting subprime borrowers, and thus would have worse delinquency rates or more levered households.

Columns 4-7 add additional county level controls to alleviate these concerns.²⁴ In column 4, I add the 2009 mortgage delinquency rate for the county, which doesn't materially change the results. In column 5, I add the percentage of home sales categorized as distressed sales in 2009. This causes the coefficient on $\Delta \ln(HP)(local\ banks)$ to increase from 0.29 to 0.40. However, this is entirely due to the change in the sample, as the number of observations decreases from 2402 to 909 counties.

If local house price declines matter due to declines in housing wealth, then the change in house prices might not be the appropriate measure for the local housing shock. In column 6, I replace the control for local house price appreciation with a control for the percentage change in household net worth due to falling house prices from Mian and Sufi (2014). This incorporates both the house price decline in the county, as well as how levered the local households are with respect to housing. The coefficient on $\Delta \ln(HP)(local\ banks)$ remains elevated at 0.45, again due to change in sample. The housing net worth shock is also significant. However, controlling for $\Delta \ln(HP)(local\ banks)$ reduces the coefficient by half, indicating that the exposure of local banks to falling house prices may be an important omitted variable.

In the last column, I add a number of additional controls pertaining to the pre-recession county demographics.²⁵ The coefficients on both $\Delta \ln(HP)(local\ banks)$ and $\Delta \ln(HP)$ increase somewhat relative to the baseline in column 3, but the findings are largely unchanged.

The bottom panel repeats the same analysis, only using the change in construction employment as the real estate shock instead of house price appreciation. If anything, the effects are stronger than with falling house prices. The coefficient on $\frac{\Delta Const}{Emp}(local\ banks)$ when controlling for the county level construction decline is 5.1, meaning that one standard deviation decline in $\frac{\Delta Const}{Emp}(local\ banks)$ reduces employment by 2.0%. Adding the additional controls does little to change this elasticity, with the coefficient ranging from 4.3 to 5.6 and remaining significant at the 1% level in every specification.

²⁴The controls for delinquency and distressed sales in columns 4 and 5 are from the NY Fed's Community Credit Profile. The controls in columns 6 and 7 come from Mian and Sufi (2014) and are available from the replication files on Econometrics's website.

²⁵I follow Mian and Sufi (2014) and include: percentage white, median household income, percentage owner-occupied, percentage with less than a high school diploma, percentage with only a high school diploma, unemployment rate, poverty rate, and percentage urban.

4.2 Instrumental Variable Approaches

There are several reasons that one might worry that the relationship between bank exposure and employment growth reflects something besides the effect of a shock to bank balance sheets. For example, the results could be attributable to either spillovers from neighboring counties, or to the endogeneity of bank market shares or local real estate shocks. I use three instrumental variable approaches to address these concerns.

Note that rearranging the equations defining the multimarket exposure variables gives:

$$Shock(local\ banks)_c = \sum_{c' \in C} \omega_{c,c',06} Shock_{c'}, \quad \omega_{c,c',06} = \sum_{b \in B} \frac{L_{b,c,06}}{L_{c,06}} \frac{L_{b,c',06}}{L_{b,06}}$$

Namely, the exposure of a county's banks to a real estate shock is a weighted average of the shock in US counties, with the weight reflecting the share of loans that locally operating banks hold in that market.²⁶

Each instrument comes from changing either $\omega_{c,c',06}$ or $Shock_{c'}$ to remove a source of variation considered to be problematic. First, to address the issue of spillovers, I create an instrument measuring the average exposure of local banks to declines in distant counties. Second, to address the concern that market shares are the result of an endogenous response to the subprime boom, I replace the 2006 market shares with the 2002 market shares. Finally, to address the endogeneity of house price declines, I replace $Shock_{c'}$ with the housing supply elasticity from Saiz (2010).

4.2.1 Shocks from Distant Markets

Bank locations are highly spatially correlated, thus other markets that local banks operate in aren't going to be a random subset of US counties. Instead, the bank exposure measures in one county are likely to be correlated with conditions in areas near enough to the county to directly influence it. For example, falling house prices in Cambridge, MA may reduce the desired expenditure of local home owners. As some of this expenditure would have occurred over the county border in nearby Boston, it might impact non-tradable employment in Boston. To the extent that these areas have banks in common, this could bias the coefficients on the bank exposure measures.

I address this by analyzing the effects of shocks to locally operating banks which occur in distant counties. Specifically, I exclude the set of counties within d km of county c , denoted $B(c, d)$, when computing the exposure of the banks in c :

$$Shock(> dkm)_c = \sum_{c' \in C \setminus B(c,d)} \frac{\omega_{c,c',06}}{\sum_{c'' \in C \setminus B(c,d)} \omega_{c,c'',06}} Shock_{c'}$$

I then estimate equation 2 using the outside shock as an instrument. If bank exposure correlates to local employment growth due to spillovers from neighboring counties, then only using variation coming from distant areas should diminish the predicted effects. Conversely, if my findings are due to the bank balance sheet channel, then the ramifications of having

²⁶Specifically, $\omega_{c,c',06}$ is the average share of loans that banks in county c hold in c' , weighted by their market share in c .

a local bank exposed to other distressed markets shouldn't be dependent on how close the county is to that market, as the effect on bank capital would be the same. In this situation, we should see similar coefficients in the OLS and the IV approach.

Table 6 shows that spillovers from nearby markets don't account for my primary findings. In the first two columns, I present the reduced form results from regressing employment growth on the bank exposure to real estate shocks in counties more than 250km away and industry controls. The coefficients actually increase relative to the corresponding OLS specifications. I find a coefficient of 0.58 on $\Delta \ln(HP)(> 250km)$ when I exclude the control for local house price appreciation and 0.39 when I include the control. Previously, when the measure of bank exposure reflected both conditions near and far from the county, the estimated coefficients were only 0.45 and 0.29 (Table 5, columns 1 & 3). Simply put, distant shocks are found to matter more than nearby shocks, indicating that my findings aren't driven by spillovers from neighboring counties.

In the next two columns, I use the exposure to distant shocks as an instrument for $\Delta \ln(HP)(local\ banks)$. The coefficient estimates are mostly similar to those in the reduced form specification, declining slightly to 0.57 in the specification without the local control and increasing to 0.49 in the specification with it.

Some caution is required in interpreting the magnitude of these estimates. First, the variation in $\Delta \ln(HP)(> 250km)$ comes from more geographically dispersed banks. These banks may have been more sensitive to housing shocks than banks operating predominantly in one market. This would cause the local average treatment effect identified in the IV specification to be greater than the average treatment effect. Second, the sample includes numerous small counties that would likely be more sensitive to these distant shocks. Berrospide et al. (2016) shows that exposed banks disproportionately cut lending in peripheral markets. Since banks' core markets are likely to be large and urban, small counties are likely to be more sensitive to shocks occurring in more geographically dispersed banks.

To address this second point, the last four columns restrict the sample to counties within an MSA. Focusing on larger counties diminishes the effect somewhat, but results are largely similar to those in the full sample. The predicted elasticity of employment with respect to house prices exposure, controlling for local house price appreciation, is about 0.34 in the reduced form specification and 0.39 in the IV specification.

The bottom panel repeats the analysis for construction shocks occurring more than 250km away and gets similar findings. The coefficients on $\frac{\Delta Const}{Emp}(> 250km)$ in the reduced form specifications and the coefficients on $\frac{\Delta Const}{Emp}(local\ banks)$ in the IV specifications are both consistently higher than the estimates in the previous OLS approach, ranging from 7.0 in the IV specification with the control, to 7.9 in the reduced form specifications excluding the control. The estimates are virtually identical when the sample is restricted to counties in an MSA, instead of every county with house price data.

Perhaps more interesting is how these findings vary by the distance parameter. If my findings reflect local spillovers, then the estimated effect of bank exposure should decline as I identify effects from increasingly distant, and thus less economically integrated, counties. If the bank balance sheet channel drives the results, the effects of bank exposure should be invariant to the distance, possibly increasing somewhat if larger banks are more sensitive to real estate shocks.

Figures 1-3 plot how these estimates differ by distance parameter. For distances up to either 500km or where the first stage F statistical falls under 10, I calculate the bank exposure to real estate shocks coming from counties more than that distance from the county in question, and plot the coefficient from the IV specification for that distance parameter. For a distance of 0, I report the OLS coefficient. The left panel of figure 1 plots the estimated coefficient on $\Delta \ln(HP)(local\ banks)$ for each of the four specifications²⁷ for different distances, while the right does the same for $\frac{\Delta Const}{Emp}(local\ banks)$. Figures 2 and 3 present the same findings, only with the results plotted separately and including 95% confidence intervals. As the confidence intervals offer few surprises, I focus on figure 1, where it is easier to compare magnitudes across different specifications.

Three broad patterns are noticeable in figure 1. First, the estimates in the specifications with and without the controls converge as the distance parameter increases (i.e. when the effect is identified off exposure from more distant counties). Controlling for the local real estate shock reduces the predicted coefficient on both measures of bank exposure. However, by about 400km, whether or not I control for local house price appreciation or construction declines becomes mostly irrelevant. This indicates that the instrument successfully removes the variation in the exposure measures coming from local housing shocks.

Second, urban markets are more sensitive to bank shocks in general, while smaller counties seem to be more sensitive to shocks from distant markets. In the OLS specification and for low distance parameters, the coefficient estimates are larger in the urban sample. However, the estimated coefficients in full sample rise as I increase the distance parameter, suggesting that shocks to large geographically dispersed banks are particularly harmful to counties outside and MSA. If large exposed banks retrench by pulling out of smaller peripheral markets, as found by [Berrospide et al. \(2016\)](#), this could explain the pattern.

Finally, counties are generally more sensitive to bank exposure to house prices declines in distant markets, while the effects of construction shocks are maximized at intermediate distances. For the full sample, the coefficient on $\Delta \ln(HP)(local\ banks)$ increases nearly monotonically as I go from instrumenting with house prices shocks 25kms away to instrumenting with shocks 500km away. For counties in an MSA, there is a weaker but still generally upward trend when I control for local house price appreciation. In contrast, the coefficient on $\frac{\Delta Const}{Emp}(local\ banks)$ generally increases in the full sample, but levels off around 375km. For urban counties, there is a more dramatic reversal, with the estimate maximized around 75km and declining sharply after about 200km.

This pattern is broadly consistent with what would be expected based on how lending portfolios vary by bank size. Larger banks do more lending through mortgage company subsidiaries, which make riskier loans ([Demyanyk and Loutskina, 2016](#)). Similarly, large banks may have been more active in the originate-to-distribute market, and not thoroughly screening borrowers. These banks would thus take greater losses when the private label securitization market shut down and banks were forced to hold these loans on their balance sheet ([Purnanandam, 2011](#)). In contrast, mid-sized banks tended to have portfolios more oriented towards construction loans and would likely be more adversely affected by construction shocks.

While these differences in the local average treatment effects may provide a more nuanced

²⁷{No Control,Control for local shock} \times {Full Sample,Counties in an MSA}

understanding of the relationship between the health of local banks and employment growth, they shouldn't distract from the primary point. Namely, real estate shocks in distant counties with common banks transmit through the internal capital markets of banks and impact the local economy. That this predicted effect is roughly similar whether the real estate shock is nearby or far away increases confidence that the mechanism indeed runs through bank balance sheets, instead of some geographic spillover.

4.2.2 2002 Market Shares

Another concern regarding non-random bank market shares is that banks may have chosen to lend in certain counties based on unobserved characteristics related to subsequent employment declines. For example, a bank may have a high exposure to real estate declines not because of historical accident, but because it specifically chose to enter markets to cater to subprime borrowers. To address this, I compute the exposure of banks based on 2002 mortgage lending volume instead of 2006.²⁸ As the spike in private label securitization and the subprime share of mortgage originations occurred between 2003 and 2004, 2002 lending volumes are less likely to be an endogenous response to the housing boom.

Table 7 demonstrates that previous results aren't driven by banks sorting into counties during the subprime boom. In the first two columns, I present the reduced form results from regressing employment growth on the bank exposure to real estate shocks based on 2002 mortgage lending and industry controls. I find a coefficient of 0.40 on $\Delta \ln(HP)(2002 \text{ locations})$ when I exclude the control, and a coefficient of 0.26 when I control for local house price appreciation. These estimates are slightly smaller than in the baseline specification where bank exposure is computed based 2006 market shares, however they remain significant at the 1% level.

In columns 3 and 4, I use the exposure based on 2002 mortgage lending as an instrument for the exposure measures. This results in a greater predicted impact of bank exposure to house price declines than in the corresponding OLS specifications. This is somewhat unsurprising as banks which have been in the county longer have had more time to build relationships and obtain knowledge about local borrowers. Consequently, any contraction in credit from these banks would be more costly to their customers, as it would be more difficult to substitute to another lender.

If the lenders with a consistent presence in the county are disproportionately local or regional lenders, this could rekindle potential concerns about spillovers from neighboring counties. In the last four columns, I combine the previous two instruments and instrument for bank exposure with the 2002 mortgage exposure of local banks to declines in counties more than 250km away. Similar to the last section, there is a greater sensitivity to real estate declines which occur in more distant markets, alleviating concerns about local spillovers.

The bottom panel reports the findings for bank exposure to construction shocks, which follow the same general pattern. Again, the coefficients on $\frac{\Delta Const}{Emp}(2002 \text{ locations})$ in the reduced form specifications are slightly below the OLS estimates for the coefficients on

²⁸Specifically, the instrument is: $Shock(2002 \text{ locations})_c = \sum_{c' \in C} \omega_{c,c',02} Shock_{c'}$, $\omega_{c,c',02} = \sum_{b \in B} \frac{L_{b,c,02}}{L_{c,02}} \frac{L_{b,c',02}}{L_{b,02}}$.

$\frac{\Delta Const}{Emp}(local\ banks)$, while the IV estimates are slightly greater. As before, employment responds more to distant shocks, indicating that the findings aren't due to the banks which are more established in the area being more local.

4.2.3 Housing Supply Elasticity

Moving away from addressing the endogeneity of bank market shares, the endogeneity of the county level shocks themselves may be a concern. House prices and construction activity are bolstered by bank lending. As a result, if a bank systematically locates in regions facing housing shocks, then it is possible that the bank is responsible for the shocks. Thus, real estate shocks might not be driving the contraction in lending. Instead, bank lending may be falling for another reason, and driving both the real estate shocks and employment shocks.

To address this issue, I instrument for bank exposure to real estate shocks using the exposure to MSAs with an inelastic supply of housing. Saiz (2010) shows that topological characteristics in the 50km surrounding a city center influence the capacity to develop land. MSAs with a large percentage of nearby land unavailable due to hilly terrain or bodies of water have an inelastic supply of housing. The difficulty in adding new units in inelastic regions facilitated a greater boom and bust in house prices (Mian et al., 2013; Mian and Sufi, 2014). As a result, a bank which is exposed to house price declines because it located in inelastic regions is more plausibly facing an exogenous deterioration in loan performance.

Table 8 presents the findings for three different instruments relating to bank exposure to MSAs with an elastic housing supply. In the first two columns, the instrument is the average exposure of local banks to the Saiz (2010) elasticity based on 2006 mortgage lending. In columns 3 & 4, the instrument is the exposure of banks to elastic markets more than 250km from the county, and in 5 & 6 the instrument is the exposure to elastic markets based on 2002 mortgage lending.

As with the other instrumental variable approaches, the coefficient estimates are largely similar to the OLS estimates. Recall that a regression of employment growth on house price appreciation, bank exposure to house price appreciation and industry controls produces a coefficient of 0.29 on $\Delta \ln(HP)(local\ banks)$. When I estimate this equation instrumenting for $\Delta \ln(HP)(local\ banks)$ with the exposure to elastic regions, exposure to distant elastic regions, and 2002 exposure to elastic regions, I get coefficients of 0.35, 0.53, and 0.41. OLS and IV estimates are also similar when omitting the control for local house price appreciation. Thus, reverse causality between bank lending and house prices doesn't seem to drive the results.

The bottom panel presents the same analysis, only using the bank exposure to construction shocks as the endogenous variable. The presence of a first stage here may seem more theoretically ambiguous. On one hand, inelastic regions had significant declines in house prices which would encourage a reduction in construction employment. On the other, the boom in prices in inelastic regions was facilitated by a muted supply response, which amounts to an economy less oriented towards the construction sector. While it is true that the housing supply elasticity is only weakly positively correlated with the county level construction shock, the bank exposure to elastic regions is highly correlated with the bank exposure to construction shocks. Much of the large bust in construction occurred on the periphery of highly constrained regions (for example non-coastal counties in California). Due to spatial

correlation in bank locations, banks which are exposed to inelastic regions are typically exposed to construction declines, albeit possibly not through the actually constrained counties.

The construction findings largely mirror those for house price appreciation. The coefficients when instrumenting for bank exposure to construction shocks with bank 2006 mortgage originations in elastic regions are slightly larger than in the corresponding OLS specifications. Coefficients are slightly larger still in columns 5 & 6 when instrumenting with 2002 exposure to elastic markets, although still not meaningfully different from OLS. The estimated elasticity is largest when instrumenting with exposure to elastic markets more than 250kms away, but is still mostly consistent with the findings instrumenting with exposure to construction shocks in distant markets. Again, these results indicate that my findings reflect housing market distress influencing bank credit instead of the other way around.

4.3 Aggregate Effect

What are the aggregate implications of these findings? A back of the envelope calculation suggests that these bank shocks may have had a large impact on employment. The OLS regressions controlling for the county level real estate shocks produce a coefficient of 0.29 on $\Delta \ln(HP)(local\ banks)$ and 5.1 on $\frac{\Delta Const}{Emp}(local\ banks)$.²⁹ The average house price and construction shock faced by the banks in a county were -.126 and -0.015 respectively. Thus a naive estimate of the aggregate effect would predict that bank losses from falling house prices caused a 3.5% decline in employment or construction losses caused a 7.5% decline in employment.

The effect for house price shocks is large, and the effect for constructions shocks is implausibly so. Here I discuss and evaluate three factors which present a risk of inflating the estimated aggregate effect. Then, by combining conservative assumptions about the strength of general equilibrium effects and the point estimates, I calculate a rough lower bound for the aggregate effect of the bank shocks.

The first issue is that general equilibrium effects may dampen the aggregate effects from regional shocks. With mobile labor or flexible interest rates, job losses in one region may facilitate job growth in other regions, causing regional elasticities to overstate aggregate effects. In the model of [Beraja et al. \(2016\)](#), regional elasticities to a discount rate shock are 2.3 times that of an aggregate shock. This would imply that falling house prices reduced employment by 1.5% in aggregate instead of 3.5%. However, this estimate comes from a model where interest rates are set by a Taylor rule. Given that the zero lower bound likely constrained interest rate adjustments, this dampening factor is on the conservative side.³⁰

The second issue is that bank shocks may have been less important in the large counties which account for more employment. The first four columns of table 9 test the robustness of the results to placing more weight on counties with greater 2006 employment. Column 1

²⁹The IV specifications tend to predict greater effects. However, since there are reasons to believe that the local average treatment effects would exceed the average treatment effect, the OLS coefficient is likely more appropriate for this exercise. The inclusion of the endogenous county control may bias the coefficient against finding a large effect, but this is presumably less important than the bias in the opposite direction from not controlling for local shocks.

³⁰When monetary policy doesn't respond to shocks, [Beraja et al. \(2016\)](#) find that regional and aggregate elasticities are similar. Thus, the back of the envelope calculations may actually not be far off.

repeats the baseline findings, column 2 restricts the sample to the thousand largest counties, column 3 weights by 2006 employment and column 4 weights by 2006 employment, while dropping the 10 largest counties. The findings are mixed. The predicted effect of bank house price shocks is higher for the 1000 largest counties than in the baseline, while the effect is smaller and insignificant when I weight by 2006 employment. However, the insignificance from weighting seems to be driven by a few large counties; when I drop the 10 largest counties, the coefficient rebounds and become significant again. For construction shocks, the elasticity is always slightly higher when I put more emphasis on bigger counties than in the baseline. Thus it seems that heterogenous effects by county size is an unlikely driver of the high elasticity.

The last issue is that the variation in my study may come from lending which is more sensitive to real estate shocks. Mortgage lending in large banks is national in scope, with mortgage brokers or non-bank subsidiaries allowing originations to occur in areas banks don't have branches. As this lending provides little regional variation, I am largely identifying effects off of smaller regional lenders. As these smaller lenders made more construction loans, they may respond more strongly to housing shocks, especially the construction shock.

Column 5 of table 9 presents the baseline regression, but excluding national mortgage lenders from the bank exposure measure.³¹ Consistent with the claim that these lenders didn't meaningfully add to the regional variation in bank exposure, the significance of bank exposure and R^2 are little changed when excluding the large, dispersed mortgage lenders. However, the coefficient on $\Delta \ln(HP)(local\ banks)$ falls from 0.29 to 0.23 when excluding large lenders, and the coefficient on $\frac{\Delta Const}{Emp}(local\ banks)$ falls from 5.1 to 3.2. Thus if large lenders didn't respond to shocks, as might be likely for construction shocks, the overall effects would be smaller than predicted in the baseline.

A related issue is that, within banks, mortgage lending is more geographically dispersed than other types of lending. Thus it is possible that shocks matter predominantly where banks have branches, instead of where they originate mortgages. In column 6, I repeat the analysis computing bank exposure weighting by the 2006 deposits held by branches within the county instead of mortgage lending.³² The coefficients on the two bank exposure measures are only about a third of what they are when weighting by mortgage lending, and significance on $\Delta \ln(HP)(local\ banks)$ drops to 10%.

What this means for the likely aggregate effects is unclear. The reduced elasticity when using deposits instead of mortgages may be the result of measurement error or it may indicate that using mortgage lending overstates the extent to which bank shocks propagate to other areas. For exposure to house price declines, measurement error from using deposits is likely substantial as much mortgage lending in large banks is done through subsidiaries which, by virtue of being non-banks, don't appear in the branch deposit data. Consistent with deposits being a poor proxy for mortgage lending for large banks, the coefficient on bank exposure and the R^2 increases when the deposit weighted bank exposure to house price shocks excludes the national mortgage lenders (column 7). Thus for house price shocks, the mortgage weighted measure of bank exposure is likely preferable.

³¹I define a national mortgage lender as a bank which originated a mortgage for home purchase in 2000 or more counties in 2006.

³²Deposits come from the FDIC's summary of deposits, an annual survey of bank branches.

For exposure to construction shocks, the deposit weighted exposure excluding the national mortgage lenders (which made few construction loans) is likely the preferable specification. Construction lending is a more local activity and thus construction declines are more likely to hit banks with branches in a county than those with mortgages. In column 7, we have a coefficient of 1.71 on $\frac{\Delta Const}{Emp}(local\ banks)$, which suggests large effects of construction shocks, but seems more reasonable than the baseline estimate.

By combining conservative assumptions we can roughly get a lower bound of the aggregate effect of bank losses. Taking the lower bound of the 95% confidence intervals of the preferred specifications in table 9, gives a coefficient of 0.13 on $\Delta \ln(HP)(local\ banks)$ and 1.11 on $\frac{\Delta Const}{Emp}(local\ banks)$. Combined with the average exposure to falling house prices and construction declines, this results in expected employment declines of 1.6% in the house price specification, and 1.7% in the construction specification.³³ If the Federal Reserve's unconventional monetary policy operations were successful enough that general equilibrium effects estimated by [Beraja et al. \(2016\)](#) still held at the zero lower bound, this would further dampen the effects by a factor of 2.3. Thus the conservatively estimated decline in employment due to real estate shocks would be between 70 and 73 basis points. Given the March 2007 employment of 137.8 million, this amounts to about a million fewer jobs.

4.4 Extensions/Robustness

4.4.1 Effects by Firm Age

One way to validate that my measures of bank exposure actually reflect a contraction in the supply of bank credit is to demonstrate that bank dependent firms disproportionately reduce employment in exposed counties. Specifically, I repeat the previous analysis except I use the growth in employment in young firms (10 years old or younger) and mature firms (over 10 years old) as the dependent variables, instead of aggregate employment growth. As young firms are likely more reliant on local banks, I should find greater effects.

There are numerous reasons that young firms would exhibit more sensitivity to local bank shocks. First, these firms have had little time to accumulate and retain earnings, making them more dependent on external finance in general. Second, their small scale means that bond market access is likely to be infeasible, making them more dependent on bank finance in particular. Finally, the opacity of young firms exacerbates the adverse selection problem in switching banks, as incumbent banks have superior information regarding credit quality. This makes young firms more likely to be locked into their incumbent bank. Thus while mature firms may be able to function off of retained earnings or alternative sources of finance, young firms should be most dramatically affected by changes in the supply of credit from local banks.³⁴

³³For house price appreciation, this uses the estimate and standard error in column 1 of table 9 and the average bank exposure to house price appreciation in table 1b: $(0.292 - 1.96 \times 0.084) \times (-0.126) = -0.016$. For construction shocks, this uses column 7 of table 9 and the average construction exposure in table 1b: $(1.711 - 1.96 \times 0.305) \times (-0.015) = -0.017$.

³⁴There is substantial evidence in favor of these claims in the literature. [Black and Strahan \(2002\)](#); [Cetorelli and Strahan \(2006\)](#); [Robb and Robinson \(2014\)](#) discuss the importance of bank lending in facilitating entrepreneurship. [Becker and Ivashina \(2014\)](#); [Adrian et al. \(2012\)](#) document the substitution to bond finance during the financial crisis. [Sharpe \(1990\)](#); [Detragiache et al. \(2000\)](#); [Marquez \(2002\)](#) discuss the

Table 10 shows that adverse bank shocks impact employment growth more for young firms than mature firms. When omitting the control for house price appreciation in the first two columns, I find a coefficient of 0.74 on $\Delta \ln(HP)(local\ banks)$ for young firms and 0.25 for mature firms, with the difference being significant at the 1% level. In columns 3 and 4, I instrument for $\Delta \ln(HP)(local\ banks)$ using the exposure of local banks to house price appreciation in counties more than 250kms away. The elasticity for young firm employment is little changed, while the elasticity for mature firms increases to 0.41, making the difference insignificant. Given that larger/less opaque firms disproportionately borrow from larger banks (Berger et al., 2005), the increased sensitivity of mature firms to bank shocks is somewhat unsurprising, as the variation now comes from larger banks.

This greater sensitivity to bank exposure isn't due to young firms being more impacted by local house price shocks. In the final four columns, I control for county house price appreciation and get broadly similar results. When controlling for local house price appreciation, I find a coefficient of 0.63 on $\Delta \ln(HP)(local\ banks)$ for young firms and 0.04 for mature firms. Namely, only young firms respond to the bank losses, with mature firms predominantly responding to local house price shocks. The difference is again dampened in the IV specification, as mature firms are more sensitive to bank shocks coming from geographically dispersed banks.

In the bottom column, we see more dramatic differences between young and mature firms when the construction shock is used. While the difference in the elasticity for young firms and old firms was only significant in the OLS specifications with the house price shocks, the difference is significant at at least the 5% level in every specification with the construction shocks. The coefficient on $\frac{\Delta Const}{Emp}(local\ banks)$ ranges from 9.9 to 12.2 for young firms while never exceeding 5.0 for mature firms.

In short, counties whose banks were exposed to real estate losses in other markets suffered large employment declines. That these employment declines were most concentrated in bank dependent firms increases confidence that the channel of influence is indeed a contraction in the supply of credit.

4.4.2 Impact on wages

How did bank exposure to real estate declines impact wages? In addition to providing a more complete picture of how bank lending impacts local labor markets, identifying the extent of wage adjustment is also important for understanding sectoral differences in the response to housing shocks. Mian and Sufi (2014) show that housing wealth shocks impact non-tradable, but not tradable employment, consistent with falling house prices predominantly impacting consumption. However, Kehoe et al. (2016) show that a tightening of firm debt constraints will cause a reallocation to the tradable goods sector due to a "relative demand effect" whereby a shock to labor demand feeds back into demand for non-tradable goods. Thus with moderately flexible wages, a credit shock might have a negligible impact on tradable employment. This makes it important to understand if wages respond to local demand shocks as argued by Beraja et al. (2016), or if they are largely non-responsive as in Mian and Sufi (2014).

adverse selection problem in switching banks.

As with [Mian and Sufi \(2014\)](#), I test how the growth in payroll per employee responds to my measures of real estate shocks. However, instead of using the CBP, I use QWI data since it can be disaggregated by education category. This can mitigate a potential composition bias in the more aggregate measure. If temporary or low skilled workers have lower search or training costs, they could be more readily laid-off during a downturn. Wage declines could then be masked by a change in the composition of the workforce to include a higher percentage of high wage individuals.³⁵

Table 11 shows that counties with exposed banks experience wage declines, especially for young or low education workers. The first panel regresses the growth in average payroll between 2007:Q1 and 2010:Q1 on house price appreciation and bank exposure to house price appreciation. Each column presents the results for the growth in wages for a different education category. Column 1 shows that average payroll aggregated across all education categories is only weakly impacted by bank house price shocks, with a 10% shock reducing wages by less than 1.5%. However, columns 2-6 show that for most groups the drop in wages was more severe. I find that a 10% shock to local banks reduces the wage of young workers (under 25 years) by 3.4%, workers without a high school diploma by 2.4%, and high school educated workers by 1.9%. All of these effects are significant at the 1% level. Declines are less severe at the high end of the wage spectrum, with college educated workers experiencing an insignificant 0.8% decline in wages in response to a 10% shock.

In the bottom panel, a similar pattern is observed for the construction shock. A 1% shock to banks is found to reduce wages overall by 1.8%. Again, the effect is largest for young workers, and diminishes at higher education levels. The 1% shock is found to reduce wages by 5.4% for young workers, 3.1% for workers who didn't finish high school, and 2.7% for high school educated workers. The effect is 2.0% for workers with some college, and 1.0% and insignificant for college educated workers.

4.4.3 Panel Specification

Most of this paper relies on cross sectional data, studying how real estate shocks between 2006 and 2009 impact employment between 2007 and 2010. This has the advantage of allowing me to be relatively agnostic as to the timing with which shocks to banks impact the economy. However, this may invite concerns about the direction of causality as the coefficient on the independent variables may reflect the influence of employment declines on subsequent house price appreciation or construction activity.

In table 12, I switch to a panel specification, regressing county employment growth between t and $t+1$ on the county level real estate shock and bank exposure to real estate shocks between $t-1$ and t (still using 2006 mortgage originations to measure a bank's exposure to a county). All specifications include the controls for 2006 2-digit industry employment shares,

³⁵This bias is well documented in the literature analyzing wage cyclicality. Workers who enter unemployment disproportionately come from the low end of the wage distribution, causing researchers to understate the true pro-cyclicality of real wages. See for example [Bils \(1985\)](#); [Solon et al. \(1994\)](#); [Daly et al. \(2012\)](#). [Beraja et al. \(2016\)](#) solve this problem by using microdata from the American Community Surveys and using age and education dummies to purge their wage data of these individual characteristics. However, since I use county level instead of state level data, I opt to use the QWI data to avoid concerns about sampling error.

with standard errors clustered by state as in the previous sections. Additionally, I include year fixed effects, so the identification still comes from cross sectional variation. The panel runs from 2007 to 2009, so that the coefficient on the real estate shock variables are interpretable as the predicted effect of the 2006-2009 housing shock on 2007-2010 employment as before.³⁶

The main findings of the paper are robust to the use of the panel specification. In column 1, when I omit the control for local house price appreciation, I find a coefficient on $\Delta \ln(HP)(local\ banks)$ of 0.38, meaning that a 10% decline in house prices in the market of local banks over 2006-2009 would result in a cumulative decline in employment of 3.8% between 2007 and 2010. This elasticity is little changed from the coefficient in the cross sectional specification in table 5, which produced a coefficient of 0.45.

In column 2, I use local house price appreciation over the previous year as the independent variable and find a weaker role for falling house prices than before. The coefficient of 0.09 is below the coefficient of 0.15 found in the cross sectional approach. As the other specifications neglected the timing of the house price appreciation, the estimates reflected the reverse causality of falling employment impacting house price appreciation in addition to the causal effects of house price declines.

In column 3, when I include both local house price appreciation and the exposure of local banks to house price appreciation, I find that only bank exposure predicts future employment declines. The coefficient on $\Delta \ln(HP)(local\ banks)$ of 0.32 is slightly higher than in the cross sectional regression with the local control, while the coefficient on local house price appreciation falls to 0.04 and becomes insignificant. This doesn't mean that local house price shocks don't matter (contemporaneous house price appreciation correlates with employment growth), however the fact that bank exposure to house price shocks in the last year relates to future employment growth should increase confidence that the findings aren't due to reverse causality.

In the last four columns, I instrument for bank exposure to falling house prices with the exposure coming from distant markets (columns 4 & 5) or 2002 mortgage lending (columns 6 & 7), and get similar results to the cross sectional approach. When instrumenting with exposure to house price declines in counties more than 250kms away, I get a coefficient of 0.52 whether or not I control for local house price appreciation. This is similar to the cross sectional findings instrumenting with distant shocks in table 6.

When instrumenting with exposure based on 2002 mortgage originations, I again get broadly similar findings. The coefficient on $\Delta \ln(HP)(local\ banks)$ is 0.41 and 0.45 in the specifications with and without the control for local appreciation. This is broadly similar to the estimates in table 7 where I instrument using 2002 market shares and control for local house price appreciation.

The predicted effect of an adverse shock to $\frac{\Delta Const}{Emp}(local\ banks)$ is smaller in the panel specification than in the cross sectional one, but the coefficient is still statistically significant and economically meaningful. A decline in construction employment in the county in the

³⁶If β is the elasticity between $\ln(\frac{y_{t+1}}{y_t})$ and $\ln(\frac{x_t}{x_{t-1}})$, then the cumulative effect of shocks to x over the sample will be: $\sum_{t=2007}^{2009} \ln(\frac{y_{t+1}}{y_t}) = \sum_{t=2007}^{2009} \beta \ln(\frac{x_t}{x_{t-1}})$, making β the elasticity between $\ln(\frac{y_{2010}}{y_{2007}})$ and $\ln(\frac{x_{2009}}{x_{2006}})$ as before.

previous year results in rising employment in the following year, as might be expected as people who lost jobs reenter the workforce after a period of unemployment. Consequently, controlling for the local construction shock causes the predict effect of bank shocks to be greater. Focusing on the more conservative estimates omitting the county control, I find a coefficient of 2.9 on $\frac{\Delta Const}{Emp}$ (*local banks*) in the panel specification, compared to coefficients slightly above 5.0 in cross section. As before, this coefficient is higher in the IV specifications.

5 Conclusion

Determining the reason that real estate shocks translated into employment declines is difficult due to the similarity in the implications of different channels. Both declining aggregate demand and loan supply would result in falling consumption, lending and employment.

Yet despite the near observational equivalence of the channels, the policy prescriptions can vary substantially. Proponents of the demand view might favor empowering bankruptcy judges to reduce the amount of principle owed on a mortgage, a provision of the Helping Families Save Their Homes Act of 2009 which was dropped in the Senate. Those believing the banking channel might advocate for the liquidity support and capital injections as were undertaken by the government during the height of the crisis. Forced principle reductions could be counterproductive if they caused further losses to banks in areas with depressed real estate values. These starkly different policy implications of similarly plausible channels have resulted in a contentious debate regarding the policy response to the crisis.

In this paper, I demonstrate that losses to the banking system contributed to the decline in lending and employment between 2007 to 2010. Banks which were exposed to construction declines or falling house prices in other counties reduced lending locally, resulting in falling employment, especially for young firms. Various instrumental variable approaches confirm that this pattern is not driven by spillovers from neighboring counties, endogenous bank location decisions during the housing boom, or reverse causality.

While precisely determining the aggregate impact of these bank real estate shocks is infeasible using this methodology, even relatively conservative assumptions have the bank shocks experienced between 2006 and 2009 resulting in about a million fewer jobs. However, the damage could have been greater were it not for the aggressive policy responses to resuscitate the housing market and the financial system following the collapse in house prices.

References

- Adelino, M., A. Schoar, and F. Severino (2013). House prices, collateral and self-employment. Technical report, National Bureau of Economic Research.
- Adrian, T., P. Colla, and H. S. Shin (2012). Which financial frictions? parsing the evidence from the financial crisis of 2007-9. Technical report, National Bureau of Economic Research.
- Almeida, H., M. Campello, B. Laranjeira, and S. Weisbenner (2012, January). Corporate debt maturity and the real effects of the 2007 credit crisis. *Critical Finance Review* 1(1), 3–58.
- Ashcraft, A. B. (2005). Are banks really special? new evidence from the fdic-induced failure of healthy banks. *The American Economic Review* 95(5), 1712.
- Ashcraft, A. B. (2006). New evidence on the lending channel. *Journal of Money, Credit and Banking*, 751–775.
- Avery, R., K. Brevoort, and G. Canner (2009). Opportunities and issues in using hmda data. *Journal of Real Estate Research*.
- Bassett, W. F., M. B. Chosak, J. C. Driscoll, and E. Zakrajšek (2014). Changes in bank lending standards and the macroeconomy. *Journal of Monetary Economics* 62, 23–40.
- Becker, B. and V. Ivashina (2014). Cyclicalities of credit supply: Firm level evidence. *Journal of Monetary Economics* 62, 76–93.
- Beraja, M., E. Hurst, and J. Ospina (2016). The aggregate implications of regional business cycles. Technical report, National Bureau of Economic Research.
- Berger, A. N., N. H. Miller, M. A. Petersen, R. G. Rajan, and J. C. Stein (2005). Does function follow organizational form? evidence from the lending practices of large and small banks. *Journal of Financial economics* 76(2), 237–269.
- Berrospide, J. M., L. K. Black, and W. R. Keeton (2016). The cross-market spillover of economic shocks through multimarket banks. *Journal of Money, Credit and Banking* 48(5), 957–988.
- Bils, M. J. (1985). Real wages over the business cycle: evidence from panel data. *Journal of Political economy* 93(4), 666–689.
- Black, S. E. and P. E. Strahan (2002). Entrepreneurship and bank credit availability. *The Journal of Finance* 57(6), 2807–2833.
- Bogin, A. N., W. M. Doerner, W. D. Larson, et al. (2016). Local house price dynamics: New indices and stylized facts. Technical report.
- Bord, V. M., V. Ivashina, and R. D. Taliaferro (2014). Large banks and the transmission of financial shocks.

- Campello, M., J. R. Graham, and C. R. Harvey (2010). The real effects of financial constraints: Evidence from a financial crisis. *Journal of Financial Economics* 97(3), 470–487.
- Cetorelli, N. and L. S. Goldberg (2012). Banking globalization and monetary transmission. *The Journal of Finance* 67(5), 1811–1843.
- Cetorelli, N. and P. E. Strahan (2006). Finance as a barrier to entry: Bank competition and industry structure in local us markets. *The Journal of Finance* 61(1), 437–461.
- Chakraborty, I., I. Goldstein, and A. MacKinlay (2016). Housing price booms and crowding-out effects in bank lending.
- Chaney, T., D. Sraer, and D. Thesmar (2012). The collateral channel: How real estate shocks affect corporate investment. *The American Economic Review* 102(6), 2381–2409.
- Chava, S. and A. Purnanandam (2011). The effect of banking crisis on bank-dependent borrowers. *Journal of Financial Economics* 99(1), 116–135.
- Chodorow-Reich, G. (2014). The employment effects of credit market disruptions: Firm-level evidence from the 2008–9 financial crisis. *The Quarterly Journal of Economics* 129(1), 1–59.
- Cornett, M. M., J. J. McNutt, P. E. Strahan, and H. Tehranian (2011). Liquidity risk management and credit supply in the financial crisis. *Journal of Financial Economics* 101(2), 297–312.
- Daly, M. C., B. Hobijn, and T. S. Wiles (2012). Dissecting aggregate real wage fluctuations: Individual wage growth and the composition effect.
- Demyanyk, Y. and E. Loutskina (2016). Mortgage companies and regulatory arbitrage. *Journal of Financial Economics* 122(2), 328–351.
- Detragiache, E., P. Garella, and L. Guiso (2000). Multiple versus single banking relationships: Theory and evidence. *The Journal of Finance* 55(3), 1133–1161.
- Driscoll, J. C. (2004). Does bank lending affect output? evidence from the us states. *Journal of Monetary Economics* 51(3), 451–471.
- Duchin, R., O. Ozbas, and B. A. Sensoy (2010). Costly external finance, corporate investment, and the subprime mortgage credit crisis. *Journal of Financial Economics* 97(3), 418–435.
- Duygan-Bump, B., A. Levkov, and J. Montoriol-Garriga (2015). Financing constraints and unemployment: evidence from the great recession. *Journal of Monetary Economics*.
- Eggertsson, G. B. and P. Krugman (2012). Debt, deleveraging, and the liquidity trap: A fisher-minsky-koo approach*. *The Quarterly Journal of Economics*, qjs023.
- Fairlie, R. W. and H. A. Krashinsky (2012). Liquidity constraints, household wealth, and entrepreneurship revisited. *Review of Income and Wealth* 58(2), 279–306.

- Favara, G. and J. Imbs (2015). Credit supply and the price of housing. *The American Economic Review* 105(3), 958–992.
- Flannery, M. J. and L. Lin (2015). House prices, bank balance sheets, and bank credit supply.
- Fort, T. C., J. Haltiwanger, R. S. Jarmin, and J. Miranda (2013). How firms respond to business cycles: The role of firm age and firm size. *IMF Economic Review* 61(3), 520–559.
- Gan, J. (2007). The real effects of asset market bubbles: Loan-and firm-level evidence of a lending channel. *Review of Financial Studies* 20(6), 1941–1973.
- Gertler, M. and S. Gilchrist (1994). Monetary policy, business cycles, and the behavior of small manufacturing firms. *The Quarterly Journal of Economics*, 309–340.
- Giroud, X. and H. M. Mueller (2017). Firm leverage, consumer demand, and employment losses during the great recession. *The Quarterly Journal of Economics* 132(1), 271–316.
- Goetz, M. R. and J. C. Gozzi (2010). Liquidity shocks, local banks, and economic activity: Evidence from the 2007-2009 crisis. *SSRN Working Paper Series*.
- Greenstone, M., A. Mas, and H.-L. Nguyen (2014). Do credit market shocks affect the real economy? quasi-experimental evidence from the great recession and normaleconomic times. Technical report, National Bureau of Economic Research.
- Guerrieri, V. and G. Lorenzoni (2015). Credit crises, precautionary savings, and the liquidity trap.
- Hadi, A. (2011). Construction employment peaks before the recession and falls sharply throughout it. *Monthly Labor Review* 134(4), 24–27.
- Hoffmann, F. and T. Lemieux (2014). Unemployment in the great recession: a comparison of germany, canada and the united states. Technical report, National Bureau of Economic Research.
- Huang, H. and E. Stephens (2015). From housing bust to credit crunch: Evidence from small business loans. *Canadian Journal of Economics/Revue canadienne d'économique* 48(3), 853–880.
- Ivashina, V. and D. Scharfstein (2010). Bank lending during the financial crisis of 2008. *Journal of Financial economics* 97(3), 319–338.
- Jiménez, G., A. Mian, J.-L. Peydró, and J. Saurina (2014). The real effects of the bank lending channel.
- Kahle, K. M. and R. M. Stulz (2013). Access to capital, investment, and the financial crisis. *Journal of Financial Economics* 110(2), 280–299.
- Kehoe, P., E. Pastorino, and V. Midrigan (2016). Debt constraints and employment. Technical report, National Bureau of Economic Research.

- Khawaja, A. I. and A. Mian (2008). Tracing the impact of bank liquidity shocks: Evidence from an emerging market. *The American Economic Review*, 1413–1442.
- Loutskina, E. and P. E. Strahan (2015). Financial integration, housing, and economic volatility. *Journal of Financial Economics* 115(1), 25–41.
- Marquez, R. (2002). Competition, adverse selection, and information dispersion in the banking industry. *Review of Financial Studies* 15(3), 901–926.
- Mehrotra, N. and D. Sergeyev (2014). Financial shocks and job flows.
- Mian, A., K. Rao, and A. Sufi (2013). Household balance sheets, consumption, and the economic slump*. *The Quarterly Journal of Economics* 128(4), 1687–1726.
- Mian, A. and A. Sufi (2014). What explains the 2007–2009 drop in employment? *Econometrica* 82(6), 2197–2223.
- Midrigan, V. and T. Philippon (2011). Household leverage and the recession.
- Mondragon, J. (2014). Household credit and employment in the great recession. *Available at SSRN 2521177*.
- Morgan, D. P., B. Rime, and P. E. Strahan (2004). Bank integration and state business cycles. *The Quarterly Journal of Economics* 119(4), 1555–1584.
- Peek, J. and E. S. Rosengren (2000). Collateral damage: Effects of the Japanese bank crisis on real activity in the United States. *American Economic Review*, 30–45.
- Peek, J., E. S. Rosengren, and G. Tootell (2003). Identifying the macroeconomic effect of loan supply shocks. *Journal of Money, Credit and Banking* 35(6), 931–46.
- Purnanandam, A. (2011). Originate-to-distribute model and the subprime mortgage crisis. *Review of Financial Studies* 24(6), 1881–1915.
- Robb, A. M. and D. T. Robinson (2014). The capital structure decisions of new firms. *Review of Financial Studies* 27(1), 153–179.
- Rognlie, M., A. Shleifer, and A. Simsek (2014). Investment hangover and the great recession. Technical report, National Bureau of Economic Research.
- Saiz, A. (2010). The geographic determinants of housing supply. *The Quarterly Journal of Economics* 125(3), 1253–1296.
- Sharpe, S. A. (1990). Asymmetric information, bank lending, and implicit contracts: A stylized model of customer relationships. *The Journal of Finance* 45(4), 1069–1087.
- Siemer, M. (2014). Firm entry and employment dynamics in the great recession.
- Solon, G., R. Barsky, and J. A. Parker (1994). Measuring the cyclicalities of real wages: How important is composition bias? *The Quarterly Journal of Economics* 109(1), 1–25.

6 Appendix

6.1 Figures

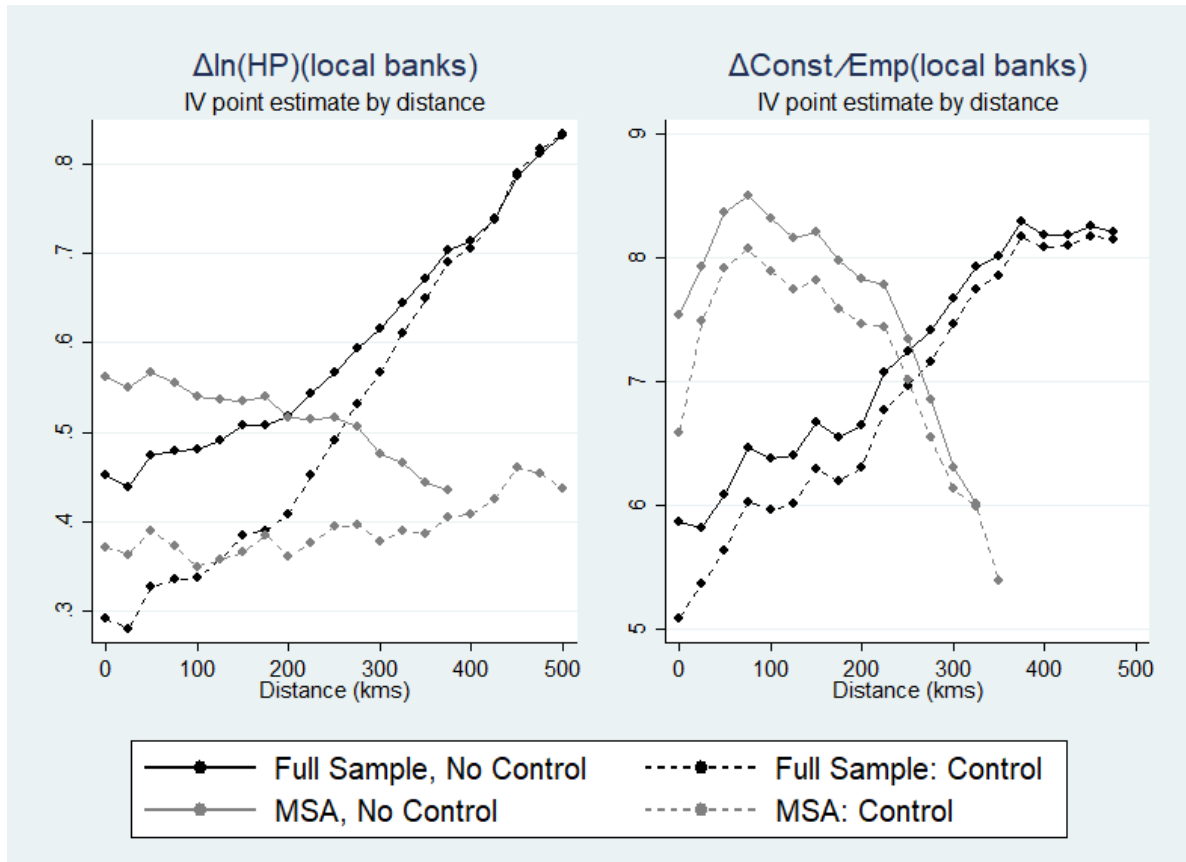


Figure 1: Effect of Bank Health: Distance Based Instruments

Notes: This figure reports coefficients from regressions of county level employment growth from 2007 to 2010 on the exposure of local banks to house price appreciation (left panel) or to construction declines (right panel), instrumenting for bank exposure with shocks coming from different distances away. For each distance parameter d on the x-axis, the instrument for bank exposure is the average bank exposure to the given real estate shock in counties more d km away. The coefficient on bank exposure is then plotted on the y-axis, with $d = 0$ plotting the OLS estimate. For each distance and real estate shock, results from 4 specifications are plotted. The solid black line presents the coefficient using the full sample of US counties, not controlling for the county level real estate shock. The dotted black lines presents results from the full sample, controlling for the county level real estate shock. The solid grey line presents the results for counties in an MSA, excluding the county level control, while the dotted grey line presents results for counties in an MSA, controlling for the local shock. Each specification additionally controls for the share of employment in 2-digit industries. Coefficients from specifications with a first stage F-statistic under 10 are suppressed.

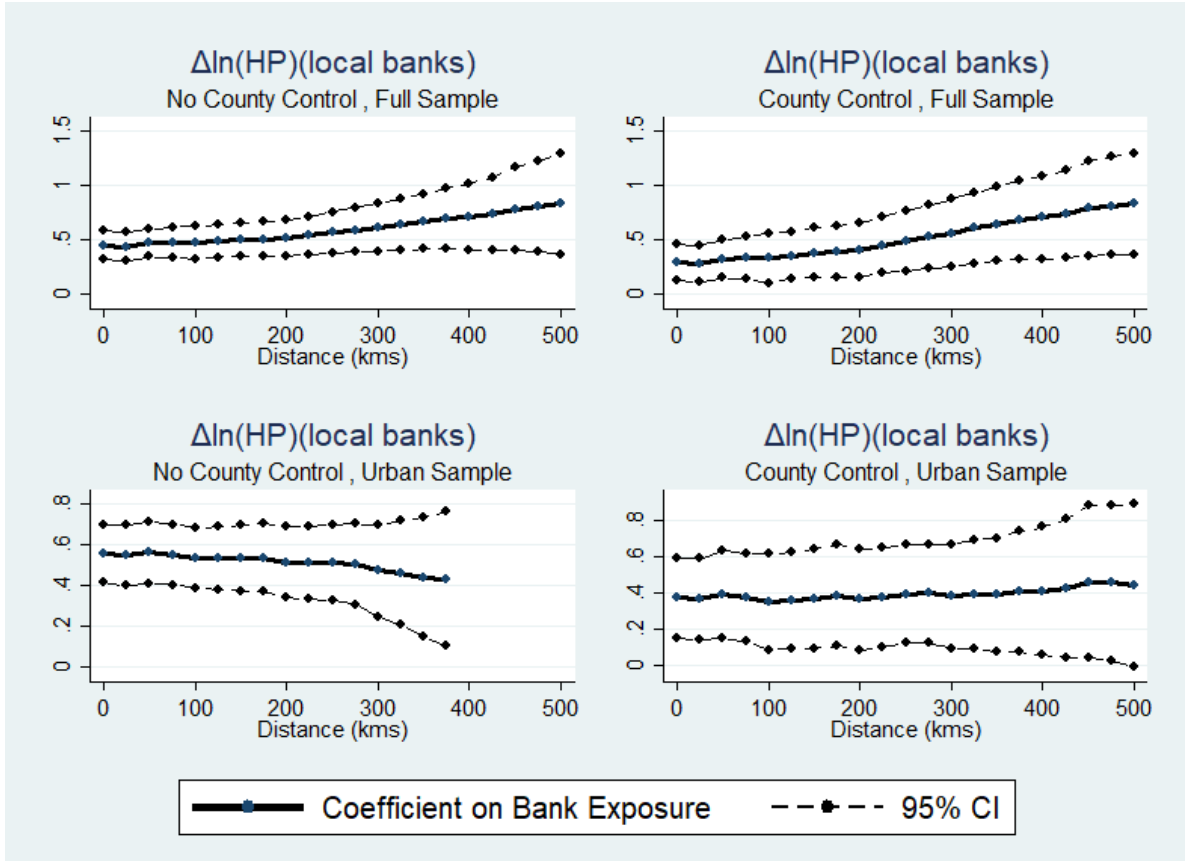


Figure 2: Effect of Bank Health: Distance Based Instruments

Notes: This figure reports coefficients from regressions of county level employment growth from 2007 to 2010 on the exposure of local banks to house price appreciation, instrumenting for exposure with shocks coming from different distances away. For each distance parameter d on the x-axis, the instrument for bank exposure is the average bank exposure to house price appreciation in counties more d km away. The coefficient on $\Delta \ln(HP)(local\ banks)$ and the 95% confidence interval is then plotted on the y-axis, with $d = 0$ plotting the OLS estimate. The top two panels use the full sample of US counties, while the bottom two restrict the sample to counties in and MSA. The left panels do not control for local house price appreciation, while the right panels do. Each specification additionally controls for the share of employment in 2-digit industries. Standard errors are clustered by state and coefficients from specifications with a first stage F-statistic under 10 are suppressed.

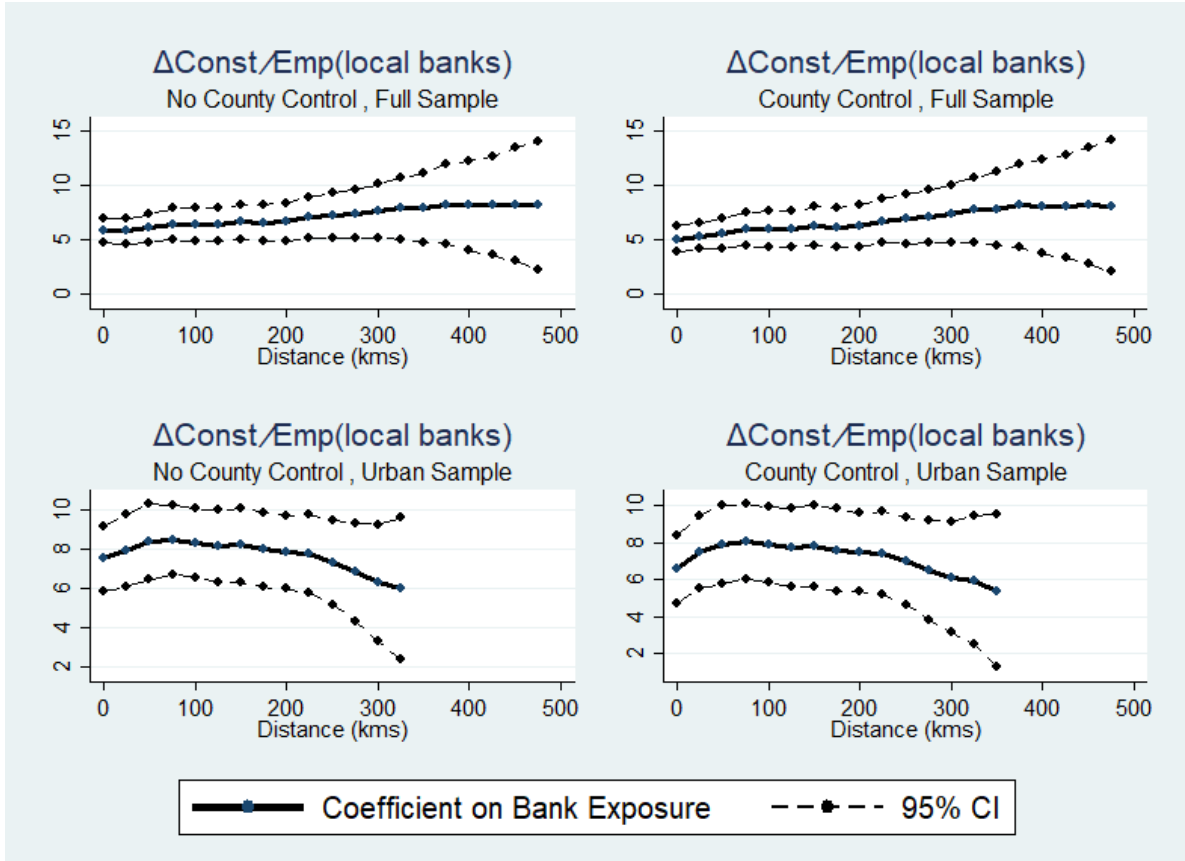


Figure 3: Effect of Bank Health: Distance Based Instruments

Notes: This figure reports coefficients from regressions of county level employment growth from 2007 to 2010 on the exposure of local banks to increases in construction employment, instrumenting for exposure with shocks coming from different distances away. For each distance parameter d on the x-axis, the instrument for bank exposure is the average bank exposure to house price appreciation in counties more d km away. The coefficient on $\frac{\Delta Const}{Emp}(local\ banks)$ and the 95% confidence interval is then plotted on the y-axis, with $d = 0$ plotting the OLS estimate. The top two panels use the full sample of US counties, while the bottom two restrict the sample to counties in and MSA. The left panels do not control for local changes in construction employment, while the right panels do. Each specification additionally controls for the share of employment in 2-digit industries. Standard errors are clustered by state and coefficients from specifications with a first stage F-statistic under 10 are suppressed.

6.2 Tables

Table 1a: Summary Statistics

	Mean	Standard Deviation	Percentile 10th	Percentile 90th	Obs
Bank Level					
<u>Bank Exposure and Survival</u>					
$\Delta \ln(HP)(bank)$	-0.063	0.132	-0.196	0.051	3275
$\frac{\Delta Const}{Emp}(bank)$	-0.011	0.014	-0.025	0.002	3275
<i>Failure Indicator</i>	0.084	0.277	0.000	0.000	3275
<u>Non-Performing Loan Rate (2008:Q4)</u>					
<i>Total</i>	0.025	0.035	0.002	0.057	3029
<i>Construction</i>	0.064	0.105	0.000	0.189	2960
<i>Non – Construction</i>	0.017	0.023	0.001	0.037	3029
<u>Quarterly Growth Rates</u>					
<i>Equity</i>	0.004	0.070	-0.046	0.053	33009
<i>Commercial Loans</i>	-0.001	0.118	-0.116	0.121	32518
Bank-County Level					
<u>Business Lending Growth</u>					
<i>To Small Firms</i>	-0.375	0.847	-1.277	0.471	7886
<i>Small Loans(\leq \$1mil)</i>	-0.242	0.768	-0.988	0.489	7967
<u>Mortgage Lending</u>					
<i>Growth in Approvals</i>	-0.078	0.690	-0.847	0.674	12936
<i>Approval Rate(08 – 10)</i>	0.794	0.136	0.611	0.950	13774

Table 1b: Summary Statistics

	Mean	Standard Deviation	Percentile 10th	Percentile 90th	Obs
County Level					
<u>Employment Growth</u>					
<i>Total (CBP)</i>	-0.078	0.087	-0.177	0.018	2402
<i>Young (QWI)</i>	-0.201	0.202	-0.419	0.011	2384
<i>Mature (QWI)</i>	-0.046	0.121	-0.175	0.075	2388
<u>Independent Variables</u>					
$\Delta \ln(HP)$	-0.018	0.121	-0.145	0.084	2402
$\Delta \ln(HP)(local\ banks)$	-0.126	0.043	-0.178	-0.071	2402
$\frac{\Delta Const}{Emp}$	-0.010	0.024	-0.032	0.009	2402
$\frac{\Delta Const}{Emp}(local\ banks)$	-0.015	0.004	-0.019	-0.010	2402
<u>Instruments</u>					
$\Delta \ln(HP)(> 250km)$	-0.166	0.024	-0.192	-0.137	2402
$\Delta \ln(HP)(2002\ locations)$	-0.127	0.047	-0.181	-0.067	2401
$\frac{\Delta Const}{Emp}(> 250km)$	-0.017	0.002	-0.019	-0.015	2402
$\frac{\Delta Const}{Emp}(2002\ locations)$	-0.014	0.004	-0.019	-0.009	2401
<u>Controls</u>					
$\Delta NetWorth$	-0.065	0.085	-0.172	0.003	943
<i>Delinquency Rate</i>	0.048	0.032	0.020	0.081	2102
<i>Distressed Sales(%)</i>	0.137	0.179	0.000	0.407	909
<u>Wage Growth</u>					
<i>Total</i>	0.007	0.083	-0.070	0.092	2388
<i>Under 25 yrs</i>	-0.040	0.104	-0.153	0.077	2388
<i>< High School</i>	0.006	0.078	-0.074	0.087	2388
<i>High School</i>	-0.001	0.071	-0.074	0.075	2388
<i>Some College</i>	-0.003	0.074	-0.077	0.079	2388
<i>College</i>	-0.017	0.119	-0.129	0.090	2388

Table 2: Real Estate Shocks and Losses on Construction Loans

<i>Dep. Variable</i>	Non-Performing Loans (2008Q4)			Failure		Quarterly Growth			
	Total (1)	Const (2)	Non-Const (3)	(4)	(5)	Equity (6)	(7)	C&I Lending (8)	(9)
Panel 1: House Price Exposure									
$\Delta \ln(HP)(bank)$	-0.0691** (0.00466)	-0.202** (0.0144)	-0.0396** (0.00308)	-0.485** (0.0358)	-0.294** (0.0492)	0.0805** (0.00627)	0.0526** (0.00697)	0.0159** (0.00567)	0.00248 (0.00765)
$\Delta \ln(HP)(bank) \times High\ Const$					-0.285** (0.0706)		0.0470** (0.0123)		0.0211+ (0.0115)
<i>High Const</i>					0.0928** (0.0107)		-0.00967** (0.00125)		-0.00591** (0.00155)
R^2	0.068	0.062	0.052	0.053	0.095	0.077	0.087	0.020	0.021
Panel 2: Construction Shock									
$\frac{\Delta Const}{Emp}(bank)$	-0.501** (0.0430)	-1.247** (0.136)	-0.250** (0.0285)	-3.875** (0.330)	-1.711** (0.434)	0.533** (0.0489)	0.269** (0.0435)	0.215** (0.0498)	0.0795 (0.0619)
$\frac{\Delta Const}{Emp}(bank) \times High\ Const$					-3.432** (0.665)		0.447** (0.0991)		0.225* (0.106)
<i>High Const</i>					0.0683** (0.0126)		-0.00749** (0.00160)		-0.00411* (0.00191)
R^2	0.043	0.028	0.025	0.040	0.083	0.067	0.076	0.020	0.021
Observations	3029	2960	3029	3275	3275	33009	33009	32518	32518

Notes: This table reports coefficients from regressions of different measures of bank performance on bank exposure to local house price appreciation (top panel) or to the change in construction employment as a percentage of employment (bottom panel). The dependent variable in columns 1-3 is the 2008 year end non-performing loan rate for the bank's entire loan portfolio (1), for construction loans (2) and for loans besides construction loans (3). In columns 4 and 5, the dependent variable is an indicator for whether the bank failed between 2007 and 2016. The remaining columns estimate the quarterly growth rate in equity (6 & 7) and commercial and industrial lending (8 & 9), from 2007:Q2 to 2010:Q1, with quarterly fixed effects clustering by bank. Columns 5, 7 & 9 additionally interact the real estate shock with the indicator for whether the bank was above the mean in construction concentration. Quarterly growth rates are winsorized at the 1st and 99th percentile and quarters surrounding a merger/acquisition are dropped. Standard errors, in parentheses, are clustered by bank in bank-quarter level regressions. +, *, ** indicate significance at 10%, 5% and 1%.

Table 3: Growth in Small Business Lending

<i>Dep. Variable</i>	Growth in Loans to Small Firms				Growth in Business Loans (\leq \$1mil)			
	Counties with a 2006 branch		Full		Counties with a 2006 branch		Full	
<i>Sample</i>	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel 1: House Price Exposure								
$\Delta \ln(HP)(bank)$	1.645** (0.462)	1.781** (0.521)	1.847** (0.519)	2.530** (0.788)	1.164** (0.366)	1.339** (0.405)	1.368** (0.417)	2.043** (0.635)
$\Delta \ln(HP)$		-0.212 (0.178)				-0.274+ (0.146)		
R^2	0.042	0.043	0.313	0.097	0.033	0.035	0.314	0.082
Panel 2: Construction Shock								
$\frac{\Delta Const}{Emp}(bank)$	12.61* (5.106)	12.58* (5.246)	14.22** (4.808)	10.72+ (6.272)	11.18* (4.368)	11.37* (4.402)	11.90* (4.653)	12.84+ (7.667)
$\frac{\Delta Const}{Emp}$		0.0434 (0.616)				-0.342 (0.549)		
R^2	0.017	0.017	0.295	0.076	0.022	0.022	0.304	0.069
County FE?			Yes	Yes			Yes	Yes
Observations	7260	7260	7260	28882	7325	7325	7325	35808

Notes: This table reports coefficients from regressions of bank \times county growth in small business originations on bank exposure to local house price appreciation (top panel) or to the change in construction employment as a percentage of employment (bottom panel). The dependent variable is the growth in the value of lending for businesses with under \$1million in annual revenue (columns 1-4), or the growth in business loans under \$1million (columns 5-8). Growth is measured as the total originations from 2008-2010 relative to originations between 2004-2006. In addition to the bank level real estate shock in every specification, I include the county real estate shock (2 & 6), or county fixed effects (3, 4, 7 & 8) to control for demand. Most specifications limit the sample to counties where the bank had a branch in 2006, except columns 4 and 8 which report the results for the full sample. Standard errors, in parentheses, are clustered by bank. +, *, ** indicate significance at 10%, 5% and 1%.

Table 4: Growth in Mortgage Lending

<i>Dep. Variable</i>	Growth in Approvals				Approval Rate(08-10)			
	Counties with a 2006 branch		Full		Counties with a 2006 branch		Full	
<i>Sample</i>	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<u>Panel 1: House Price Exposure</u>								
$\Delta \ln(HP)(bank)$	1.122** (0.290)	0.819* (0.339)	0.932* (0.449)	2.012* (0.792)	0.400** (0.0615)	0.414** (0.0773)	0.396** (0.0781)	0.587** (0.107)
$\Delta \ln(HP)$		0.435** (0.144)				-0.0197 (0.0346)		
R^2	0.038	0.042	0.216	0.084	0.115	0.116	0.334	0.128
<u>Panel 2: Construction Shock</u>								
$\frac{\Delta Const}{Emp}(bank)$	8.715** (1.684)	8.308** (1.760)	8.153** (2.390)	13.16* (5.706)	1.879** (0.440)	1.886** (0.481)	2.115** (0.539)	3.096** (0.762)
$\frac{\Delta Const}{Emp}$		0.603 (0.444)				-0.00991 (0.124)		
R^2	0.025	0.025	0.213	0.066	0.049	0.049	0.303	0.083
County FE?			Yes	Yes			Yes	Yes
Observations	12138	12138	12138	64268	12908	12908	12908	96444

Notes: This table reports coefficients from regressions of bank×county measures of the supply of mortgage credit on bank exposure to local house price appreciation (top panel) or to the change in construction employment as a percentage of employment (bottom panel). The dependent variable is the growth in the number of mortgage approvals during the crisis (2008-2010) relative to before it (2004-2006) in columns 1-4, and the approval rate of mortgages during the crisis in 5-8. In addition to the bank level real estate shock in every specification, I include the county real estate shock (2 & 6), or county fixed effects (3, 4, 7 & 8) to control for demand. Most samples limit the sample to counties where the bank had a branch in 2006, except columns 4 and 8 which report the results for the full sample. Standard errors, in parentheses, are clustered by bank. +, *, ** indicate significance at 10%, 5% and 1%.

Table 5: Impact of Bank Shocks on Employment Growth

<i>Dep. Variable</i>	Employment Growth: 2007-2010						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
<u>Panel 1: House Price Exposure</u>							
$\Delta \ln(HP)(local\ banks)$	0.452** (0.0667)		0.292** (0.0841)	0.265** (0.0848)	0.404** (0.119)	0.450** (0.104)	0.363** (0.0819)
$\Delta \ln(HP)$		0.153** (0.0310)	0.0937* (0.0381)	0.0933* (0.0462)	0.0652+ (0.0387)		0.111** (0.0359)
<i>Delinquency Rate</i>				-0.0830 (0.0973)			
<i>Distressed Sales</i> (%)					-0.0490* (0.0186)		
$\Delta NetWorth$						0.133* (0.0620)	
R^2	0.173	0.171	0.182	0.189	0.317	0.293	0.208
<u>Panel 2: Construction Shock</u>							
$\frac{\Delta Const}{Emp}(local\ banks)$	5.870** (0.600)		5.082** (0.615)	4.270** (0.655)	5.621** (0.964)	5.282** (0.869)	5.117** (0.619)
$\frac{\Delta Const}{Emp}$		0.658** (0.116)	0.364** (0.101)	0.563** (0.110)	0.637** (0.142)	0.532** (0.127)	0.368** (0.0934)
<i>Delinquency Rate</i>				-0.272** (0.0570)			
<i>Distressed Sales</i> (%)					-0.0624** (0.0147)		
$\Delta NetWorth$						0.143** (0.0413)	
R^2	0.187	0.158	0.194	0.219	0.337	0.330	0.207
Industry Controls?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Other Controls?							Yes
Observations	2402	2402	2402	2102	909	943	2399

Notes: This table reports coefficients from regressions of county level employment growth from 2007 to 2010 on the exposure of local banks to house price appreciation (top panel) or to construction declines (bottom panel). $\Delta \ln(HP)$ and $\frac{\Delta Const}{Emp}$ control for the county level house price appreciation and the change in construction employment in the county between 2006 and 2009. Every specification also controls for the share of employment in each 2 digit NAICS industry. Columns 4-7 add the following additional controls: the delinquency rate on mortgages in the county in the fourth quarter of 2008 (4), the percentage of house sales characterized as distressed sales (5), the percentage change in household net worth due to falling house prices (6), and additional demographic controls which are listed in the text (7). Standard errors, in parentheses, are clustered by state. +, *, ** indicate significance at 10%, 5% and 1%.

Table 6: Instrumenting with Shocks From Other Markets

Dep. Variable	Employment Growth: 2007-2010							
	Full Sample				Counties in an MSA			
Sample	Reduced Form		IV		Reduced Form		IV	
Specification	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<u>Panel 1: House Price Exposure</u>								
$\Delta \ln(HP)(> 250km)$	0.575** (0.108)	0.385** (0.108)			0.606** (0.148)	0.344** (0.128)		
$\Delta \ln(HP)(local\ banks)$			0.567** (0.0973)	0.490** (0.143)			0.516** (0.0949)	0.394** (0.137)
$\Delta \ln(HP)$		0.129** (0.0329)		0.0532 (0.0467)		0.134** (0.0318)		0.0732+ (0.0415)
R^2	0.156	0.181	0.170	0.177	0.189	0.244	0.245	0.256
F			128	122			73	89
<u>Panel 2: Construction Shock</u>								
$\frac{\Delta Const}{Emp}(> 250km)$	7.855** (1.377)	7.149** (1.359)			7.876** (2.480)	7.067** (2.236)		
$\frac{\Delta Const}{Emp}(local\ banks)$			7.243** (1.075)	6.966** (1.161)			7.346** (1.098)	7.018** (1.200)
$\frac{\Delta Const}{Emp}$		0.597** (0.111)		0.255* (0.122)		0.655** (0.144)		0.285* (0.142)
R^2	0.159	0.179	0.184	0.189	0.188	0.229	0.269	0.276
F			79	77			22	25
Industry Controls?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2402	2402	2402	2402	1094	1094	1094	1094

Notes: This table reports coefficients from regressions of county level employment growth from 2007 to 2010 on the exposure of local banks to house price appreciation (top panel) or to construction declines (bottom panel), instrumenting for bank shocks with the exposure of local banks to real estate shocks in counties more than 250km away. Columns 1, 2, 5, & 6 present the reduced form relationship between employment growth and the outside exposure of local banks, while the other columns present the IV estimates using the outside exposure as an instrument for the full measure of bank exposure to real estate declines. The first four columns present the results for the full sample, while the last four restrict the sample to counties in an MSA. Even numbered columns additionally control for the county real estate shock, while every specification controls for the share of employment in each 2 digit NAICS industry. Standard errors, in parentheses, are clustered by state. +, *, ** indicate significance at 10%, 5% and 1%.

Table 7: Instrumenting with Historical Bank Lending

<i>Instrument</i>	Bank exposure from 2002 locations				Bank exposure from 2002 locations, counties more than 250km away			
	Reduced Form		IV		Reduced Form		IV	
<i>Specification</i>	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<u>Panel 1: House Price Exposure</u>								
<i>Instrument</i>	0.397** (0.054)	0.256** (0.068)			0.389** (0.094)	0.253** (0.085)		
$\Delta \ln(HP)(local\ banks)$			0.558** (0.072)	0.420** (0.109)			0.646** (0.127)	0.595** (0.196)
$\Delta \ln(HP)$		0.096* (0.037)		0.067 (0.041)		0.139** (0.032)		0.031 (0.055)
R^2	0.173	0.183	0.172	0.181	0.148	0.178	0.166	0.171
F			719	702			47	52
<u>Panel 2: Construction Shock</u>								
<i>Instrument</i>	5.148** (0.569)	4.407** (0.578)			5.743** (1.205)	5.122** (1.133)		
$\frac{\Delta Const}{Emp}(local\ banks)$			6.851** (0.739)	6.100** (0.764)			7.834** (1.243)	7.524** (1.346)
$\frac{\Delta Const}{Emp}$		0.399** (0.108)		0.304** (0.100)		0.606** (0.113)		0.222+ (0.131)
R^2	0.183	0.191	0.186	0.193	0.153	0.174	0.182	0.186
F			863	600			38	36
Industry Controls?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2401	2401	2401	2401	2401	2401	2401	2401

Notes: This table reports coefficients from regressions of county level employment growth from 2007 to 2010 on the exposure of local banks to house price appreciation (top panel) or to construction declines (bottom panel), instrumenting for bank shocks with the exposure of local banks to real estate shocks based on 2002 mortgage lending. Columns 1, 2, 5, & 6 present the reduced form relationship between employment growth and the real estate exposure based on 2002 lending, while the other columns present the IV estimates using the 2002 exposure as an instrument for baseline measure using 2006 lending. In the first four columns the instrument is the multimarket exposure of locally operating banks to real estate shocks weighting by 2002 mortgage lending. In the last four columns, the instrument is the multimarket exposure of locally operating banks to real estate shocks in counties more than 250km away, weighing by 2002 mortgage lending. Even numbered columns additionally control for the county real estate shock, while every specification controls for the share of employment in each 2 digit NAICS industry. Standard errors, in parentheses, are clustered by state. +, *, ** indicate significance at 10%, 5% and 1%.

Table 8: County Growth: Housing Supply Elasticity

	Saiz Instrument		Saiz Instrument >250km		Saiz Instrument 2002 Locations	
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta \ln(HP)(local\ banks)$	0.443** (0.085)	0.347** (0.111)	0.593** (0.162)	0.530* (0.231)	0.500** (0.098)	0.409** (0.129)
$\Delta \ln(HP)$		0.082* (0.040)		0.045 (0.060)		0.069+ (0.041)
R^2	0.173	0.182	0.169	0.175	0.173	0.181
F	72	85	49	51	52	63
Panel 2: Construction Shock						
$\frac{\Delta Const}{Emp}(local\ banks)$	5.880** (1.095)	5.390** (1.149)	8.597** (2.218)	8.388** (2.381)	6.510** (1.312)	6.013** (1.397)
$\frac{\Delta Const}{Emp}$		0.346** (0.107)		0.172 (0.179)		0.309** (0.109)
R^2	0.187	0.194	0.175	0.179	0.187	0.193
F	36	34	73	75	37	34
Industry Controls?	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2402	2402	2402	2402	2401	2401

Notes: This table reports coefficients from regressions of county level employment growth from 2007 to 2010 on the exposure of local banks to house price growth (top panel) or to construction declines (bottom panel), instrumenting for bank shocks with the exposure of local banks to MSAs with geographic constraints on housing supply. In the first two columns, I instrument for the bank exposure to real estate shocks using the average exposure of local banks to the Saiz (2010) elasticity based on 2006 mortgage lending. In the middle two columns, the instrument is the bank exposure to this elasticity in counties more than 250km away. In the last two columns, the instrument is the average exposure to this elasticity based on 2002 mortgage lending. Even numbered columns additionally control for the county real estate shock, while every specification controls for the share of employment in each 2 digit NAICS industry. Standard errors, in parentheses, are clustered by state. +, *, ** indicate significance at 10%, 5% and 1%.

Table 9: Investigation of Aggregate Effects

	Alternative Weights				Alternative Health Measures		
	Baseline (1)	Largest 1000 Counties (2)	Employment Weighted (3)	Weighted Excl: 10 Counties (4)	Excl: National Banks (5)	Deposit Exposure (6)	Deposit Exposure Excl: National Banks (7)
<i>Panel 1: House Price Exposure</i>							
$\Delta \ln(HP)(local\ banks)$	0.292** (0.084)	0.383** (0.098)	0.149 (0.104)	0.208+ (0.104)	0.226** (0.050)	0.086+ (0.048)	0.129* (0.052)
$\Delta \ln(HP)$	0.094* (0.038)	0.075* (0.036)	0.105** (0.035)	0.109** (0.035)	0.068+ (0.036)	0.112** (0.040)	0.072+ (0.040)
R^2	0.182	0.305	0.361	0.345	0.184	0.173	0.177
<i>Panel 2: Construction Shock</i>							
$\frac{\Delta Const}{Emp}(local\ banks)$	5.082** (0.615)	5.670** (0.749)	5.085** (0.563)	5.411** (0.574)	3.210** (0.399)	1.740** (0.327)	1.711** (0.305)
$\frac{\Delta Const}{Emp}$	0.364** (0.101)	0.843** (0.309)	1.126** (0.194)	1.038** (0.174)	0.298** (0.091)	0.129 (0.129)	0.070 (0.137)
R^2	0.194	0.327	0.382	0.354	0.196	0.176	0.183
Industry Controls?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2402	1000	2402	2392	2401	2399	2394

Notes: This table examines factors which may cause aggregate elasticities to differ from the regional elasticities in the earlier unweighted county level regressions. The first column repeats the baseline specification regressing county level employment growth from 2007 to 2010 on the exposure of local banks to house price growth (top panel) or to construction declines (bottom panel) controlling for the county level real estate shock and 2-digit industry shares. The next three columns repeat this specification, but allow for larger counties to have more influence on the coefficients. Column 2 includes only the largest 1000 counties, column 3 weights by 2006 employment, and column 4 weights by 2006 employment, while dropping the 10 largest counties. The next four columns change the measure of exposure to real estate shocks. In column 5, the shock to local banks reflects the exposure of banks which don't have a national presence (they originated mortgages in fewer than 2000 counties). Column 6 calculates exposure based on 2006 deposits instead of mortgage lending. Column 7 also uses deposit weighted exposure, but additionally excludes national banks. Standard errors, in parentheses, are clustered by state. +, *, ** indicate significance at 10%, 5% and 1%.

Table 10: Effects by Firm Age

<i>Dep. Variable</i>	Employment Growth: 2007-2010							
	OLS		IV		OLS		IV	
<i>Specification</i>								
<i>Sample</i>	<u>Young</u>	<u>Old</u>	<u>Young</u>	<u>Old</u>	<u>Young</u>	<u>Old</u>	<u>Young</u>	<u>Old</u>
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel 1: House Price Exposure								
$\Delta \ln(HP)(local\ banks)$	0.740** (0.159)	0.249** (0.0739)	0.748** (0.257)	0.405** (0.118)	0.634** (0.158)	0.0364 (0.0991)	0.669* (0.325)	0.305+ (0.163)
$\Delta \ln(HP)$					0.0624 (0.0852)	0.125** (0.0309)	0.0552 (0.0991)	0.0698+ (0.0398)
R^2	0.041	0.101	0.041	0.099	0.042	0.110	0.042	0.105
Difference		0.49** (0.18)		0.34 (0.28)		0.60** (0.19)		0.36 (0.36)
Panel 2: Construction Shock								
$\frac{\Delta Const}{Emp}(local\ banks)$	10.81** (1.536)	3.600** (1.066)	12.18** (2.739)	4.991** (1.488)	9.905** (1.777)	2.730* (1.029)	11.86** (2.880)	4.678** (1.550)
$\frac{\Delta Const}{Emp}$					0.415 (0.367)	0.401+ (0.232)	0.303 (0.349)	0.289 (0.247)
R^2	0.055	0.106	0.054	0.104	0.057	0.110	0.056	0.107
Difference		7.21** (1.87)		7.19* (3.12)		7.18** (2.05)		7.18* (3.27)
Industry Controls?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2384	2384	2384	2384	2384	2384	2384	2384

Notes: This table reports coefficients from regressions of county level employment growth from 2007 to 2010 on the exposure of local banks to house price appreciation (top panel) or to construction declines (bottom panel). Odd columns report results for employment growth for firms which are 10 years old or younger, while even columns report results for employment growth for firms which are over 10 years old. Every specification controls for the share of employment in each 2 digit NAICS industry, while the final four columns additionally control for the county level real estate shock. This is estimated by OLS in columns 1, 2, 5 & 6, and IV in the remaining columns, instrumenting for bank exposure using the exposure to real estate shocks in counties more than 250km away. Standard errors, in parentheses, are clustered by state. +, *, ** indicate significance at 10%, 5% and 1%.

Table 11: Evidence of Wage Adjustment

	ALL	Under 25 yrs	Less Than High School	High School	Some College	College
	(1)	(2)	(3)	(4)	(5)	(6)
<u>Panel 1: House Price Exposure</u>						
$\frac{\Delta \ln(HP)}{Emp}(local\ banks)$	0.148 ⁺ (0.087)	0.338** (0.094)	0.242** (0.079)	0.187** (0.062)	0.155* (0.070)	0.075 (0.133)
$\Delta \ln(HP)$	0.065 ⁺ (0.035)	0.102** (0.033)	0.066* (0.027)	0.068* (0.029)	0.065* (0.031)	0.045 (0.047)
R^2	0.074	0.161	0.124	0.122	0.100	0.026
<u>Panel 2: Construction Shock</u>						
$\frac{\Delta Const}{Emp}(local\ banks)$	1.806 ⁺ (0.957)	5.399** (1.267)	3.050** (0.965)	2.655** (0.794)	2.048* (0.849)	0.952 (1.290)
$\frac{\Delta Const}{Emp}$	0.400** (0.079)	0.528** (0.143)	0.457** (0.143)	0.432** (0.102)	0.369** (0.079)	0.334* (0.150)
R^2	0.076	0.174	0.133	0.133	0.101	0.028
Industry Controls?	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2388	2388	2388	2388	2388	2388

Notes: This table reports coefficients from regressions of county level wage growth from 2007 to 2010 on the exposure of local banks to house price appreciation (top panel) or to construction declines (bottom panel). $\Delta \ln(HP)$ and $\frac{\Delta Const}{Emp}$ control for the county level house price appreciation and the decline in construction employment in the county between 2006 and 2009. Every specification controls for the share of employment in each 2 digit NAICS industry, as well as the county level real estate shock. Each column presents results for a different education category. Column 1 includes all workers, while the proceeding columns run the analysis for the wages of workers under 25 (column 2), workers with less than a high school education (column 3), workers who finished high school (column 4), workers with some college (column 5), and workers with a college education (column 6). Standard errors, in parentheses, are clustered by state. ⁺,*,** indicate significance at 10%, 5% and 1%.

Table 12: Evidence from Panel data

<i>Dep. Variable Specification</i>	Annual Employment Growth						
	OLS			IV			
<i>Instrument</i>				> 250km		2002 Locations	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
<u>Panel 1: House Price Exposure</u>							
$\Delta \ln(HP)(local\ banks)$	0.384** (0.0559)		0.316** (0.0774)	0.521** (0.0821)	0.519** (0.122)	0.453** (0.0648)	0.410** (0.108)
$\Delta \ln(HP)$		0.0949** (0.0186)	0.0378 (0.0256)		0.000982 (0.0343)		0.0202 (0.0308)
R^2	0.171	0.168	0.172	0.170	0.170	0.171	0.172
F				149	154	1012	1100
<u>Panel 2: Construction Shock</u>							
$\frac{\Delta Const}{Emp}(local\ banks)$	2.880** (0.405)		3.827** (0.449)	5.388** (0.900)	5.773** (0.913)	3.675** (0.423)	4.815** (0.485)
$\frac{\Delta Const}{Emp}$		-0.186** (0.0520)	-0.248** (0.0386)		-0.279** (0.0418)		-0.263** (0.0370)
R^2	0.170	0.170	0.183	0.165	0.179	0.170	0.182
F				176	176	940	630
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	7206	7206	7206	7206	7206	7203	7203

Notes: This table reports coefficients from regressions of annual county level employment growth on the exposure of local banks to house price appreciation (top panel) or to construction declines (bottom panel) during the prior year. The dependent variable is the growth in mid-march employment between the year t and $t + 1$ for years from 2007 to 2009. $\Delta \ln(HP)$ and $\frac{\Delta Const}{Emp}$ control for the county level house price appreciation and the decline in construction employment in the county between between years $t - 1$ and t . Every specification also controls for the share of 2006 employment in each 2 digit NAICS industry. The first three columns are estimated using OLS, while the last four are estimated using IV, instrumenting for bank exposure to real estate shocks using the exposure of local banks to real estate shocks over the previous year in counties more than 250 km away (columns 4 & 5) or the exposure of local banks to real estate shocks over the previous year based on 2002 mortgage market shares (columns 6 & 7). Standard errors, in parentheses, are clustered by state. +, *, ** indicate significance at 10%, 5% and 1%.