Housing Price Booms and Crowding-Out Effects in Bank Lending

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Abstract

Analyzing the period between 1988 and 2006, we document that banks which are active in strong housing markets increase mortgage lending and decrease commercial lending. Firms that borrow from these banks have significantly lower investment. This is especially pronounced for firms which are more capital constrained or borrow from more constrained banks. Various extensions and robustness analyses are consistent with the interpretation that commercial loans were crowded out by banks responding to profitable opportunities in mortgage lending, rather than with a demand-based interpretation. The results suggest that housing prices appreciations have negative spillovers to the real economy, which were overlooked thus far.

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The years leading up to the recent financial crisis have been characterized by a significant boom in real estate prices. A similar pattern has been observed in previous episodes, in which real estate prices increase leading up to a crisis and then crash at the onset of the crisis. Much has been written about the negative real effects of asset price crashes (see, e.g., Gan (2007a), Gan (2007b) and Peek and Rosengren (2000)). The logic behind this effect is that firms, which own real estate, can borrow less and invest less following the decline in the value of their assets (the *collateral channel*). In addition, banks exposed to real estate prices decrease their lending following the crash causing further deterioration in firms' access to capital and investment (the *lending channel*).

Much less is known, however, about the real effects of the boom phase in asset prices. We explore these effects in this paper. Specifically, we study the effect of housing prices on bank commercial lending and firm investment in the United States in the period between 1988 and 2006. We document a crowding-out effect, whereby the lending opportunities in the real estate market, following the boom in real estate prices, have led banks to reduce commercial lending. This has caused firms that depend on these loans to reduce investment, hence having a negative real effect.[1]

Our empirical analysis hinges on the cross-sectional differences across banks in their exposure to the real estate market. We use the location of banks' deposit branches to proxy for the location of mortgage activity, assuming that banks are more likely to invest in mortgage assets if there is larger price appreciation in the areas where they have branches.[2] We find evidence that an increase in housing prices leads to a *decrease* in commercial lending. In addition, we show that the decrease in lending translates to a real effect, as it leads to a decrease in the investments of firms that have a relationship with the affected banks.

The premise underlying this crowding-out behavior is that banks are constrained in raising new capital or selling their loans, and so when highly profitable lending opportunities arise in one sector (mortgage lending), they choose to pursue them by cutting their lending in another sector (commercial lending). We provide extensive discussion on the foundations behind these constraints and their relation to the literature in the next section. Consistent with this argument, we find that across different specifications, our crowding-out results hold much more strongly and significantly for constrained banks; these are the banks which are smaller, more levered, and less active in securitization markets. We also explore a personnel-based constraint and find similar results, which suggests that some of the crowding-out effect can also be attributed to the difficulty banks face in expanding their workforce and increasing the overall volume of their lending activities. Similarly, the results about a decrease in firms' investment following the substitution in lending

[1] Thus, in combination with the previous literature on supply side effects of price declines, our results suggest that the real effects of house price changes through the bank lending channel are asymmetric.

[2] We discuss the appropriateness of our assumption with respect to traditional mortgage lending and mortgage-backed securities in more detail in Appendix A.3.

made by banks rely on the idea that firms are constrained and cannot easily substitute bank lending for new sources of capital. Indeed, we find that our results hold much more strongly for constrained firms across different measures.

An important issue in interpreting our empirical results, as in most papers in empirical corporate finance, is endogeneity. Is the reduction in commercial loans and firm investment a result of a decrease in the supply of loans from banks due to their opportunities in real estate markets, as we argue, or does it stem from a decrease in firm investment opportunities? For firms which borrow from nearby banks, we think that endogeneity here is more likely to make it more difficult for us to find our result: Insofar as increased housing prices coincide with general economic growth, one would expect a positive relation between housing prices and firm investment opportunities. This correlation implies that, if anything, we possibly underestimate the reduction in lending and investment due to a positive real estate price shock that is unrelated to firm demand for capital.

Although omitted economic growth shocks likely provide a positive correlation between local housing prices and firm investment, one cannot rule out that firm investment is potentially negatively correlated with housing prices in the bank's location for various different reasons. Therefore, we tackle the endogeneity issue directly in various ways. To address the concern that an omitted variable increases housing prices and decreases the demand for investments at the same time, we use the instrumental variable that was developed by Saiz (2010) and used extensively since then in many papers. The instrument measures the availability of developable land in terms of topographic restrictions. To introduce time variation in the instrument, we also include a weighted average of the state-level 30-year fixed mortgage interest rate where the bank has deposits, using the bank's deposits as weights. This average mortgage interest rate is interacted with the land unavailability measure. These instruments are motivated by the idea that for a given decrease in mortgage rates, there will be an increase in housing demand. In areas where land cannot be easily developed into new housing, this increase in housing demand should translate to higher housing prices, compared to areas that can easily accommodate more housing. Further, housing elasticity differences due to the presence of undevelopable land are not related to underlying economic activity. Thus, the instruments provide a component of housing price appreciation in the bank's region that is unrelated to firm financing and investment choices except through its effect on housing prices. Our approach is similar to that taken by Chaney, Sraer, and Thesmar (2012).[3]

Using these instruments, we find much stronger effects of exogenous housing price appreciations for the firms which borrow from banks exposed to these appreciations: a one standard deviation increase in housing prices decreases firm investment by 3.106 percentage points. This decrease

[3]We discuss our instruments in more detail in Section II.E. We also explore many variations around the specification of the instrumental variables.

corresponds to 6.9% of a standard deviation for investment. This result contrasts to an insignificant estimate without instrumentation. It appears, once the endogeneity between loan supply and firm demand is addressed, that a bank's reduction in commercial lending translates into significantly reduced firm investment. Using the instruments also enables us to uncover a stronger effect on lending: With instrumentation, we find that banks decrease the amount of commercial lending by 7.9% in dollar terms.

While the instrumental variable approach addresses the concern that omitted variables affect housing prices and firm investment at the same time, it still leaves the concern that firm investment is directly reduced due to an increase in housing prices, but not via the bank lending channel. One potential reason for such an effect would be that the increase in real estate prices increases firm production costs and so decreases firm demand for investments and loans. Specific examples include increases in the cost of labor or the price of land. We address this concern in several ways.

First, there is an important separation between firm investment demands and real estate prices in our setup. It comes from the fact that we focus on housing prices in the bank's deposit locations and not the firm's location.[4] While factors entering the firm's demand for capital, such as labor costs, may be changing because of the local housing sector, our identification approach is based on tracing shocks to an individual bank's real estate exposure through the bank lending relationship to the firm's investment decisions. Any local demand factors that impact the firm are eliminated using the firm's state by year fixed effects. Hence, it is more difficult to come up with explanations for why real estate prices in the bank's location (controlling for the firm's location) will affect firm investment.[5] We bolster this argument by introducing specifications directly controlling for housing prices in the firm's location. Going further, we also consider a subsample of firm-bank pairs where the bank's deposit base and firm location are in different states. Our results remain the same.

Second, to directly address the concern that land availability and real estate prices affect firm investment due to their effect on the firm's production cost, we do two things. One, if this effect is a major driver of our results, it should affect mostly the land-intensive industries. Accordingly, we exclude firms in these industries from the sample and find that our main effect still exists for the remaining firms, for which it is unlikely to be driven by the cost explanation. Two, to the extent that the costs of firms' production are highly affected by real estate prices, it should be the commercial real estate prices they are most sensitive to and not the housing prices. Therefore, we directly introduce commercial real estate prices in the firm's location as an additional control and

[4] Although many firms borrow from nearby banks, these banks typically have geographic footprints across many states. We utilize this larger footprint and control for changes in the firm's specific location to make sure they are not driving our results.

[5] This is because it is hard to imagine why demand factors (such as labor costs) in the *firm's* location will increase in tandem with housing prices in the *bank's* location.

allow it to have a differential effect on firms depending on their land-intensiveness.[6] We find that our results persist.

Third, we investigate the behavior of other variables in the loan contracts that can help us identify whether the effect of housing prices on loans and investments is coming from the demand of firms for investment or the supply of loans by banks. An important variable is the interest rate on the loan. Our evidence shows that an increase in housing prices in the bank's location leads to an increase in the interest rate that the bank charges on its commercial loans to constrained firms. This effect is consistent with a decrease-in-supply story and not with a decrease-in-demand story. Another important variable is the size of the loan. It allows us to look within firms that use multiple lenders in the same year and measure the difference in loan size depending on the exposure of the bank to the real estate boom. Indeed, consistent with our story, we show that loans are significantly smaller from those lenders exposed to the more pricey real estate markets. These results are consistent with the literature that identifies the effects of credit-rationing in equilibrium on loan prices and loan sizes (seminal work includes Stiglitz and Weiss, 1981; Williamson, 1987). Since this difference is observed for the same firm, it cannot be explained by differences in firms' demand for investment.

Fourth, we find evidence consistent with banks choosing more profitable commercial and industrial (C&I) loans in the face of constraints and increasing housing prices.[7] More precisely, more constrained banks have higher average C&I loan profitability and this profitability is significantly more sensitive to increases in housing prices. Constrained banks appear to choose higher value commercial loans, especially when located in a strong real estate market, as our basic mechanism would imply. These results about the banks aggregate C&I loan profitability, similar to the loan-level interest rate results discussed above, do not support an alternative firm demand driven explanation. This is because a bank that faces lower demand for commercial loans, say because of an increase in labor costs, would have a less profitable C&I loan portfolio. Further, a reduction in firm demand should not lead to a difference in C&I loan profitability for constrained and unconstrained banks. However, we find results contrary to both these points suggesting that a reduction in firm demand is not driving our results.

The channel we explore in this paper is an extension of the bank lending channel, whereby shocks to banks affect their ability to lend and end up affecting the firms that borrow from them. Important papers in this literature include Bernanke (1983), Stein (1998), and Kashyap and Stein (2000). At the heart of this channel stand two important premises: One is that banks are financially

[6] More land-intensive firms have an additional negative effect because of higher costs of land, however that effect is orthogonal with the bank credit supply channel (See Appendix B.1).

[7] Here C&I loan profitability is interest and fee income on C&I loans divided by the amount of C&I loans.

constrained and the other is that firms are financially constrained. Such constraints have been thoroughly discussed and analyzed in the literature as we describe in the next section. A novel feature of our empirical analysis is that the shock to the bank is not a typical negative shock to capital, but rather a positive shock to the bank's other lending opportunities which leads to substitution away from commercial loans. This bears resemblance to the discussion in the internal-capital markets literature where constrained headquarters have to decide how to allocate resources among competing projects, as in Stein (1997), and so will allocate less to some projects when other projects appear more profitable.

Our results on the effect of housing price booms bring a very new angle to the empirical literature, which argues that asset prices have a positive relation to lending and real investment. The papers by Gan (2007a), Gan (2007b), and Peek and Rosengren (2000) mentioned above show how decreases in asset prices tighten financial constraints of banks and firms, decreasing lending, borrowing, and investment. In a similar vein, a recent paper by Chaney, Sraer, and Thesmar (2012) documents that U.S. firms owning real estate benefited from the increase in real estate prices during the period of our study due to the collateral channel. While we confirm their results in our data, we document an additional effect operating in the opposite direction: Firms that depend on bank loans are harmed by the appreciation in real estate prices if their banks had a large exposure to real estate markets. This empirical result is related to the model of Farhi and Tirole (2012) that produces a similar substitution effect. As far as we know, such an effect has not been shown empirically before.

This result has important implications for models in macroeconomics. Such models—e.g., Bernanke and Gertler (1989) and Kiyotaki and Moore (1997)—often emphasize the positive effect of an increase in asset prices on real investments. Hence, they generate amplification of shocks—a positive shock in the economy leads to an increase in asset prices enabling firms to borrow and invest more and thus magnifying the initial shock. However, we show that the opposite occurs also: positive shocks to asset prices sometimes discourage real investment, leading to a dampening of the initial shock. We discuss some basic calculations regarding the size of the macroeconomic effect in Section V.

There are also important implications for policy, as policymakers often attempt to support real estate prices in the hope that this will help boost the real economy. Our results demonstrate that this may not be the case. Our results do not say directly whether the decrease in lending and real investment following real estate price appreciation is bad for welfare and efficiency. Making such a statement would require us to know at least whether the appreciation is a result of a bubble or not. Second, the real estate market boom supported the construction sector, which may have been distortionary, but still created jobs. Further, one could argue that the policies supporting the real estate sector in the United States are driven by social goals of higher homeownership and not

purely economic goals. Instead, we just document the negative relation in our setting and argue that macroeconomists and policymakers should not assume that asset price booms translate to a boost in economic activity, as the opposite occurs in some cases.

The remaining sections are organized as follows. Section I discusses the theoretical motivation behind this work and its relation to existing empirical literature. Section II describes the data used for the analysis and key identification concerns. Section III reports the empirical results concerning the effects on firm investment and various extensions to support the main mechanism. Section IV contains results on other variables shedding additional light on the underlying forces. Section V discusses implications for the overall macro-level effects. Section VI concludes.

I Theoretical Motivation and Link to Prior Empirical Literature

I.A Foundations Behind the Mechanism

To illustrate the main idea behind the paper in the simplest way, consider a bank with the following balance sheet. On the assets side, the bank has two types of assets: mortgage loans and commercial loans. Adding more types of assets should not qualitatively affect the discussion. For the liabilities side, one can think of the usual combinations of insured deposits, non-insured debt, and equity. Our paper asks whether improved conditions and opportunities in the market for mortgage loans will cause the bank to reduce the amount of commercial loans it provides, effectively crowding out commercial borrowers who then suffer from a negative real effect for their investments.

Clearly, in a frictionless world, as in the Modigliani-Miller theory applied for banks, such an effect should not arise. The fact that banks face better opportunities in the mortgage market does not interfere with their incentive to provide loans in the commercial lending market. In such a world, banks respond to better opportunities in the mortgage market by raising more resources, either in the form of new deposits, debt, or equity, and using them to finance all positive NPV loans in both the mortgage market and the commercial lending market.

However, the vast theoretical and empirical banking literature has argued and shown that this frictionless benchmark is probably too simplistic and does not characterize bank behavior. Instead, the mechanism we describe here relies on the idea that both banks and firms are constrained in their ability to raise new funding. This mechanism might cause banks to reduce commercial lending when better opportunities arise in the mortgage market.

Guided by this literature, we now consider what a bank, which wants to expand lending activities in the mortgage market in light of a stronger housing market, can do before cutting down on commercial lending activities. First, we discuss the limitations in expanding the balance sheet and

raising new resources to support greater lending activities. Second, we discuss another possibility banks have if expanding the balance sheet is hard, which is to provide more mortgages but sell them or securitize them, and so avoiding the need to cut back on commercial loans. We discuss the limitations of this strategy as well. Third, if these two strategies are limited, we argue that banks will have to cut back on commercial loans if they want to expand their activities in the real estate market. We briefly discuss the real consequences this will have for firm investment.

I.A.1 Banks' Limitations in Raising External Capital

In a frictionless world, a bank facing improved lending opportunities in the real estate market would raise more capital in the form of new deposits, debt, or equity to finance all the profitable lending opportunities. There would be no negative effects on other types of lending. The vast literature on financial constraints, however, implies that there are costs in raising external financing and that raising external financing sometimes fails as a result. Going back to Stiglitz and Weiss (1981), we know that two frictions can lead to credit rationing: moral hazard and adverse selection. Moral hazard implies that firms have lower incentives to take value enhancing actions when they are financed with more external capital, and this limits their ability to raise external capital. Adverse selection implies that firms will have a tendency to raise external capital when they face poor prospects, and this limits their ability to raise external capital. A large theoretical literature has followed since then, including Myers and Majluf (1984), Holmstrom and Tirole (1997), and others to study the consequences of financial frictions for firms.

The argument in our paper expands the logic of financial frictions from non-financial firms to banks, stating that banks are limited in the amount of external capital they can raise to finance profitable lending opportunities for similar reasons as those for which non-financial firms are limited in raising external capital for investment opportunities. One difference between banks and non-financial firms is that banks can finance themselves with insured deposits, but this is clearly limited by the supply of deposits, reserve requirements, etc. Other than that, the connection between firm constraints and bank constraints is fairly straightforward.

Again, we are not the first to make this connection. Stein (1998), for example, provides a model where banks have inside information about the quality of their assets, limiting their ability to raise uninsured external funds. He uses this model to analyze the "bank lending channel" for the transmission of monetary policy, whereby due to the frictions in banks' ability to raise funds, monetary policy affects bank lending, and hence the real economy. Bolton and Freixas (2006) provide a more recent model where monetary policy affects the real economy via the bank lending channel, focusing on the cost of equity financing for banks, again due to asymmetric information.

Many empirical papers have indeed provided evidence consistent with this view and demon-

strating the bank lending channel. Examples include Kashyap and Stein (1995, 2000), Kishan and Opiela (2000), and Ashcraft (2006), all of which are based on the idea that banks face financial constraints, making it difficult to raise external capital for lending activities.[8] Importantly, these papers develop tests based on the premise that smaller and more levered banks are more constrained, and so their lending should be more affected by monetary and financial shocks. We rely on these measures in our paper to provide further support for the mechanism and show that it works mostly for the banks which are constrained according to these definitions.[9]

The above papers argue and show that a negative shock to the bank's financial position, e.g., due to monetary policy, will cause the bank to cut back on lending due to the fact that new external capital cannot be easily raised. In our paper, the shock is different: instead of a negative shock to the right-hand side of the balance sheet, depriving the bank of resources, we are looking at a positive shock to the left-hand side of the balance sheet, generating competition for existing resources. But the impact should be similar: If banks have a hard time raising new funds, they might have to cut investments in assets, which become relatively less attractive. Similar effects exist in the literature on internal capital markets, see, e.g., Stein (1997) and Scharfstein and Stein (2000). In this literature, a financially-constrained headquarters has to make a decision on how to allocate limited resources across different divisions. An improvement in the investment opportunities in one division will cause diversion of resources from other divisions to this division. Banks may face similar decisions and allocate resources to real estate loans at the expense of commercial loans in the face of real estate price appreciations.

I.A.2 The Limitations of Securitization and Loan Sales

A more recent development in the banking industry allows banks, which are limited in their ability to raise external capital, to expand their mortgage lending without cutting their commercial lending. They can originate mortgages and then securitize them or sell them, such that they will go off the balance sheet. This eliminates the need for the banks to expand their balance sheets. It is key to understand then why our mechanism should still exist in the era of securitization.

However, just like raising external capital is constrained due to issues of moral hazard and adverse selection, securitization is affected by similar frictions and is thus limited. Several papers

[8] See also Bernanke (1983), Ashcraft (2005), Khwaja and Mian (2008), Paravisini (2008), and Schnabl (2012) for empirical evidence on banks' financial constraints and their effect on lending.

[9] While we highlight a financial constraint as a driver for our results, it is worth mentioning that an organizational constraint can also contribute to them: Banks might be limited in expanding their lending capacity and hiring new loan officers. Thus, when lending opportunities arise in the real estate market, they choose to exploit them by diverting resources away from other businesses, such as commercial loans. We explore this dimension in our empirical analysis as well.

in the theoretical literature discuss such problems of incentives and asymmetric information in the process of securitization and loan sales; these include Pennacchi (1988), Gorton and Pennacchi (1995), Morrison (2005), and Parlour and Plantin (2008). Empirically, Keys, Mukherjee, Seru, and Vig (2010) find that securitization practices adversely affected the screening incentives of lenders. Loutskina and Strahan (2009) provide a more positive account of securitization analyzing its effect in the residential mortgage market and the way it reduces the sensitivity of banks to shocks in the availability of funds. While they find that securitization breaks the link between bank funding costs and credit supplied to the non-jumbo mortgage market, they still show that there is a connection for the less-securitized jumbo residential mortgage market.

A common feature of securitization is risk retention by banks. While keeping some of the risk associated with the securitized product on the books of the bank helps overcome the information frictions due to securitization (Leland and Pyle, 1977; DeMarzo, 2005), this security design feature again leads to banks holding capital. In some cases, the recourse to the banks' balance sheets may be close to full amount of the securitized assets (Acharya, Schnabl, and Suarez, 2013). For mortgage assets, Begley and Purnanandam (2016) show that banks take an equity tranche position to convey the unobservable quality of the MBS pool. The mean size of the equity tranche in their sample is 1.25% of the mortgage pool. In addition to equity tranche retention, banks often retain a "vertical slice" of the pool or the mezzanine tranche (which is senior to the equity tranche) based on negotiation with the investors. We calculate that the average maximum credit exposure for banks coming from these subordinated securities and other forms of recourse is about 7% of securitized assets for 1-4 family residential loans.[10] So over our sample period, those banks which securitized assets retained substantial exposure. Going forward, as required by the Dodd-Frank Wall Street Reform and Consumer Protection Act of 2010, sponsors of asset-backed securities must retain at least 5% of the credit risk of the assets underlying the securities and sponsors are not permitted to transfer or hedge that credit risk during a specified period.[11]

In addition to retaining risk, MBS securities have additional clauses to protect investors. These clauses require banks to maintain reserves for loss provisions on their balance sheet. An important clause is the "put-back" clause which allows the investors to sell the securities back to the originator at par in certain circumstances such as if the appraised value of the property is misrepresented.

[10]This statistic is calculated from 2001 through 2006 for the sample of bank holding companies (BHCs) in the Call Report universe which report some securitization activity and is the sum of retained interest-only strips, standby letters of credit, subordinated securities, and other residual interests. Average maximum credit exposure for other securitized assets are: home equity lines (8.4%), credit card receivables (4.9%), auto loans (6.7%), other consumer loans (6%), C&I loans (6.8%), and all other loans and leases (12.1%).

[11]Not surprisingly, the rule also provides certain exemptions. See the OCC briefing at `http://www.occ.treas.gov/news-issuances/bulletins/2015/bulletin-2015-8.html` and SEC announcement at `https://www.sec.gov/rules/final/2014/34-73407.pdf`.

The liabilities can be significant. Following the subprime crisis, a J.P. Morgan survey estimated the total liability to the finance industry due to this clause to be between $55 billion and $120 billion.[12] Thus, securitization and loan sales still result in banks maintaining some exposure to the originated securities, imposing balance sheet constraints.

Looking at our sample period, securitization is certainly present, but limited. Using the Flow of Funds data, we calculate that at the height of securitization in our sample (2006), 49.0% of all mortgages were securitized.[13] For the majority of our sample, the securitization rate is lower. For example, total mortgage securitization is 44.3% in 1998 and 28.7% in 1990. More striking is how concentrated this activity is among a small set of financial institutions. In our sample period, we find that less than 0.83% of bank holding companies in the Call Report universe actively securitize and less than 20.7% of bank holding companies even sell loans to other parties.[14] In general, it seems that the process of originating, securitizing, and marketing these loans clearly involves substantial barriers, whether due to cost, expertise, or the illiquidity of the market (reflecting problems of moral hazard and adverse selection). It seems that only more reputable large banks are able to alleviate their balance sheet constraints through loans sales and securitization. For many banks, the cost of securitization may be higher than the cost of raising additional capital and keeping new loans on the balance sheet. We explore this dimension in the paper to show that our results come more so from banks which are not active in securitization, as one should expect.

I.A.3 The Real Effect of Bank Lending

Putting together the points above, banks which want to expand their real estate lending, and face limitations in raising new external capital and selling or securitizing loans, will be forced to cut back on other types of loans that become less attractive. In our example, these are the commercial loans, which are the focus of our empirical analysis.

The final question is why this should affect the real investment of firms that borrow from these banks. Here, we will just mention a long line of literature establishing the dependence of firms on banks and the fact that many firms cannot easily substitute bank financing for other sources of financing. Hence, if their banks cut back on commercial lending, they will see real negative consequences in their investment activities. Papers in this line of work include: Faulkender and Petersen (2006), Sufi (2009), Leary (2009), Lemmon and Roberts (2010), and Chava and

[12] See CNBC article at `http://www.cnbc.com/id/39870708` and a November 2010 U.S. Congressional Oversight report at `https://www.gpo.gov/fdsys/pkg/CPRT-111JPRT61835/pdf/CPRT-111JPRT61835.pdf`.

[13] The securitized amount is calculated by adding the mortgage assets held by Agency- and GSE-backed mortgage pools and ABS issuers.

[14] We calculate the number of securitizers using our *Securitization Activity* variable described in Section II. The number of loan sellers is calculated from the number of BHCs which report non-zero loan sale income.

Purnanandam (2011). Again, we utilize this dimension in our empirical analysis by sorting firms into constrained and unconstrained firms, and showing that the effect exists only for the former.

I.B Broader Connection to the Literature

The literature highlights two channels via which asset price increases can alleviate financial constraints and boost investments. Both these channels are present in Holmstrom and Tirole (1997). The first one is the balance sheet channel or the collateral channel. Firms owning real estate, for example, will be able to post more collateral and raise more capital for investment when prices of real estate go up. Empirical evidence in support of this channel has been provided by Gan (2007a) and more recently by Chaney, Sraer, and Thesmar (2012). The second channel is the bank lending channel, according to which banks benefit from the increase in real estate prices, alleviating their capital constraints and allowing them to lend more. This effect has been documented empirically on the downside—a crash in real estate prices makes banks more constrained and leads them to cut lending—by Peek and Rosengren (2000) and Gan (2007b) in the context of the collapse of the Japanese real estate market in early 1990s and more recently by Cuñat, Cvijanović, and Yuan (2013) in the context of the U.S. housing market crash in the late 2000s.

To the best of our knowledge, our paper is the first to show a negative real effect of housing price appreciation. Our mechanism relies on banks' financial constraints and the lending channel, like the papers mentioned above, but the implications for the real effects of housing price appreciation are completely different. Due to substitution between different types of lending, banks move away from commercial lending into real estate lending, hurting firms in the process. As such, our results have important implications for understanding the role of asset prices for the real economy and the potential for amplification or mitigation of shocks.

In particular, a large literature in macroeconomics going back to Bernanke and Gertler (1989) and Kiyotaki and Moore (1997) discusses amplification due to the balance sheet channel. More recently, Gertler and Kiyotaki (2010) and Rampini and Viswanathan (2010) add a financial intermediary into such models and analyze additional amplification that may arise due to the lending channel. Overall, the message in these models is that an increase in asset prices increases firms' debt capacity and promotes real investment, which serves to amplify the initial shock that led to the increase in asset price. These conclusions are supported by the vast empirical evidence mentioned above, such as Chaney, Sraer, and Thesmar (2012). Our analysis is conducted for the same period as Chaney, Sraer, and Thesmar (2012) and demonstrates that the bank lending channel and balance sheet channel work in opposite directions in this case. Further, we find that the two effects are comparable in magnitude. Hence, amplification is not the only possible outcome. Some asset price increases hurt the ability of firms to borrow and invest, and so when building a macroeconomic

model, it is important to account for this channel as well.

Our effect is also related to the theory of bubbles, which represent one kind of an asset price boom. In Tirole (1985), bubbles might crowd out productive real investments by increasing interest rates and making firms want to invest less. Moreover, in the presence of credit constraints, the increase in interest rates following a bubble might aggravate the credit rationing for financially-constrained firms (i.e., firms with severe moral hazard problems and lack of internal capital), reducing productive investments further. This effect is termed the "leverage effect" by Farhi and Tirole (2012). They analyze the negative effect that asset price bubbles might have on investment and efficiency due to the leverage effect and contrast it with the positive effect that asset price bubbles may have due to the liquidity effect (similar to the positive effects of asset price appreciations discussed above). They provide results on which firms are more likely to benefit from a bubble and when. Our results are consistent with their leverage effect, although we do not take a stand on whether housing price appreciations in our sample were a bubble.

Our paper may also carry important insights for policymakers. Much effort has been devoted in the recent financial crisis and its aftermath to supporting asset prices and real estate prices in particular. The rationale being that this support will generate positive spillovers to the rest of the economy. We show, however, that this is not always the case, and in some instances, an increase in real estate prices might lead banks to shift resources away from commercial firms and towards real estate, generating negative spillovers. This finding is consistent with the theoretical analysis of Bleck and Liu (2013), who show that in an economy with two sectors, the injection of liquidity by the government may hurt the more constrained sector, due to a crowding-out effect that we capture in our empirical analysis.

Finally, our paper is related to the quickly growing literature studying the impact of the U.S. real estate boom on the larger economy. One paper in this literature is Chaney, Sraer, and Thesmar (2012), which we discussed already. In a related paper, Cvijanović (2014) investigates the impact of the collateral channel on the firm's capital structure decisions and finds results consistent with the firm's real estate collateral alleviating credit frictions. Adelino, Schoar, and Severino (2015) find increases in small business starts and self-employment in areas with large housing price appreciations. Not finding the same effects for larger firms in the same industries, they conclude that individual homes serve as an important source of collateral. Mian and Sufi (2011) find a housing-credit effect of consumers increasing consumption from rising home equity values. Loutskina and Strahan (2015) consider the role of financial integration among banks in amplifying housing price shocks during this period. They find that banks move mortgage capital out of low-appreciating housing markets and into high-appreciating housing markets within their own branch networks. Taken together, these papers suggest banks had an active role in the housing boom, and serve as

a complement to our finding of the movement of bank capital away from commercial lending and into mortgage lending.

II Data

Ultimately we are interested in how housing price changes where the bank operates affect the borrower firm through the bank lending channel. To understand how this channel affects the firm's investment activity, the terms of credit for the borrowing firm, and the bank's own balance sheet, we use three different data panels. Our panels run from 1988 through 2006. Since we use lagged data in many specifications, our earliest data goes back to 1987.

Our first panel, which we use to investigate the effect of the lending channel on firm investment (Section III), is constructed at the firm-bank-year level (*relationship panel*). In this panel, firm-bank observations are included for each year of the lending relationship. With this panel we measure the impact of bank lending on firm activity over the life of the firm-bank relationship, both for years in which new loans are taken and for years in which firms are utilizing already borrowed capital.

Our second panel, which is used in our analysis of loan interest rate spreads (Section IV.A) and loan amounts (Section IV.B and Appendix B.3), is constructed at the loan package-year level (*loan panel*). As this panel is focused on the effect of housing prices on the origination terms of the bank's commercial loans, this panel only includes observations from the year that the loan packages are originated.

Our third panel is used to investigate the effect of housing prices on the bank holding company's overall balance sheet (Section IV.C). Because we are considering the balance sheet of the entire holding company, this panel is constructed at the bank-year level (*all banks panel*). As we do not require any firm or loan terms data for this panel, we can look at a much larger sample of BHCs than the other panels. We also use this panel in Section II.E to investigate how our instrumental variables affect housing prices in the banks' deposit locations.[15]

In what follows, we describe the data that comprises these three panels in the following order: what firm data we use (Section II.A); the loan terms data and how we determine relationships between firms and banks (Section II.B); what bank data we use (Section II.C), and specific discussion of the housing price data and other macroeconomic data we use (Section II.D). Lastly, we discuss some challenges to identification and how we address them (Section II.E).

[15] Additional technical details of the three panels are discussed in Appendix A.1.

II.A Firm Data

Our firm data comes from Compustat. We use several firm-specific variables in our analysis. These variables include investment, market-to-book ratio, cash flow, firm size, book leverage, and Altman's Z-score. As we are focusing on how financial intermediaries affect borrowing firms' investment decisions, we exclude any borrowing firms that are financial companies. Also included is a measure of the market value of the firm's buildings. Following Chaney, Sraer, and Thesmar (2012), the measure gives the approximate market value of a firm's real estate assets, scaled by the prior year's net property, plant, and equipment amount. We also include a measure of the share of capital income that is attributable to land (*Industry Land Intensity*). This measure is the average of the asset share in industry capital for land from 1987–2006, and is available at the NAICS level from the Bureau of Labor Statistics. Section III.C and Appendix B.1 use this measure to address the concern that firms decrease investment in response to an increase in their cost of production because of the higher price of land. Panel A of Table I includes the summary statistics for these variables. Variable definitions and details on variable construction for these and other variables are included in Appendix A and Table A1.

II.B Loan Data and Relationships Between Firms and Banks

We use the DealScan database, which provides information on syndicated and sole-lender loan packages, to determine our firm-bank relationships. DealScan provides loan origination information, which gives us information on the borrower and the lender (or lenders in the case of a loan syndicate) for a given package of loans. We consider the presence of any loan between the bank and borrowing firm to be evidence of a relationship. In the case of syndicated loans with multiple lenders, we consider the relationship bank to be the one which serves as lead agent on the loan. The length of the relationship is defined as follows: it begins in the first year that we observe a loan being originated between the firm and bank and ends when the last loan observed between the firm and bank matures, according to the original loan terms. Firms and banks are considered in an active relationship both in years that new loans are originated and years in which no new loan originations occur with that bank. As one additional step, we match specific lenders in DealScan to their parent bank holding companies from the Call Report data. Panel A of Table I provides statistics on length and number of relationships. The median relationship lasts five years and contains two distinct loan packages. Further details of the matching process are included in Appendix A.2.

In addition to borrower and lender information, DealScan provides the terms of the loan package, including the size, interest rate, maturity, and type of loan or loans being originated. This information is central to our *loan panel*. The summary statistics for these variables are included in

Panel A of Table I. If a loan package has more than one facility, the interest rate and loan maturity are determined by averaging the individual facilities by their respective dollar amounts. Indicators for whether a loan package is for the purpose of a takeover or acquisition or contains a revolving credit line are included as well.

II.C Bank Data

As mentioned in the prior section, we match specific lenders in DealScan to their parent bank holding companies' Call Report data, allowing us to incorporate bank balance sheet data. For our analysis we use Call Report data from the fourth quarter of each year, aggregated to the bank holding company (BHC) level.[16] A bank's real estate exposure is measured by the following variables: mortgage-backed securities (MBS), unsecuritized non-commercial real estate loans, and commercial mortgages. Our analysis also considers commercial and industrial (C&I) loans and consumer loans. Consumer loans include all loans to individuals not secured by real estate, such as auto loans, credit card debt, and other personal loans. These bank loan variables are all scaled by the bank's total assets and their summary statistics are reported in Panel B of Table I.

We include a measure of C&I loan profitability, which is interest and fee income divided by the total amount of C&I loans. We also include four additional bank variables: the bank's size, equity ratio, net income, and cost of deposits, which are defined in Table A1. We use these four variables to control for broad differences in bank holding companies and whether they are likely to be capital constrained.

To further measure the presence of capital or personnel constraints at bank holding companies, we introduce two additional variables. The first is an indicator for whether banks report securitization activity, the reasoning being that banks that actively securitize their loans can free up capital and are less constrained. The second is a measure of employee growth at the bank holding company level. Details on construction of the employee growth variable are provided in Appendix A.2.

In the cross-section of bank holding companies, it is likely that the largest bank holding companies are significantly less constrained than the smaller bank holding companies. Table II lists the bank holding companies in decreasing order of size (as measured by total deposits) at the end of our sample period in 2006. The three largest bank holding companies—Citigroup, Bank of America, and JPMorgan Chase—each have over $695 billion in deposits and have branches in as many as 30 states at this time. These three banks account for about 40% of the firm-bank-year observations in our main panel (*relationship panel*). For these largest national banks, it is less likely that they face the same kind of capital constraints as other banks. In our analysis, we allow these banks to

[16] Although the Call Report data is available at a finer level, we believe this aggregation is best because the entire bank holding company's balance sheet may influence loan activity.

have a differential effect.[17]

II.D Housing Exposure of Banks and other Macroeconomic Variables

An important variable of interest is the weighted index of housing prices per bank holding company. We use the state-level House Price Index (HPI) from the FHFA as the basis for this variable. To determine the exposure of each bank holding company to different state-level housing prices, we use the Summary of Deposits data from June of the prior year, aggregated to the BHC level. Using the percent of deposits in each state as weights, we create a measure of housing prices which is specific to each bank and each year. For example, a bank that in June 2003 had 75% of its deposits in California and 25% of its deposits in Arizona would have a 2003 price index which is a combination of 75% of California's 2003 fourth-quarter state-level price and 25% of Arizona's 2003 fourth-quarter state-level price. Additional details of the variable's construction are provided in Appendix A.3.[18]

Our bank-specific housing price index is scaled such that an index value of 100 corresponds to $50,000 in year 2000 dollars. The average annual return on the bank-specific housing price index in our sample is about 6.25%. Figure 1 presents both the level of our index and the annual changes in our index for each bank. The figure shows an upward trend in housing prices over our sample period, but also substantial cross-sectional variation across bank holding companies.

In Figure 2, we plot the relation between banks' real estate-related lending (both MBS and unsecuritized), commercial and industrial lending, and housing prices, using a local polynomial regression. We focus on the effect of changes in housing prices on a given bank's holdings by considering within-bank variation only, using the sample of the 106 BHCs we match to Compustat borrowers. The standard deviation of the housing price index is about 104 points ($52,000 in year 2000 dollars), so we plot about one standard deviation above and below each bank's average housing price index level. The top panel shows that the percentage of MBS and other real estate loans (excluding commercial mortgages) is generally increasing in the prior year's housing prices in the states where banks have their deposit bases. If the housing prices in the bank's region change from one standard deviation below the bank's average to one standard deviation above the bank's average, the percentage of the bank's assets that are in real estate-related lending increases by

[17] Although we believe that the three banks we treat separately are truly distinct both in terms of their size and their national presence, our analysis does not depend on this distinction. We can include the fourth and fifth largest bank holding companies from Table II—Wachovia and Wells Fargo—and find results at similar levels of statistical and economic significance.

[18] We choose to conduct our analysis at the state level rather than the MSA level. About 20% of the total summary of deposits data does not belong to a specific MSA but is captured at the state level. In unreported robustness tests, we consider housing price indices and bank deposits at the MSA level and obtain similar results.

about 12.5 percentage points.

The lower panel of Figure 2 plots the relation between the within-bank variation in C&I loans and the within-bank variation in housing prices in a bank's depository region. Here, we see a negative relation between the prior year's housing prices and the percentage of assets committed to C&I loans. As in the top panel of Figure 2, we plot one standard deviation on either side of the bank's average housing price level. If housing prices in a bank's region change from one standard deviation below the bank's average to one standard deviation above the bank's average, the fraction of C&I lending decreases by about 2.3 percentage points. Figure 2 suggests banks are, on average, increasing real estate lending and decreasing commercial lending as housing prices increase in the bank's deposit area. In Section IV.C (Table X), we investigate the relation between bank assets and housing prices more formally in a multivariate setting.

In our various specifications going forward, we include year fixed effects or the firm's state by year fixed effects to capture national or regional macroeconomic changes that may affect our results. To control for additional regional differences in economic conditions, we also include the annual change in the state unemployment rate where the firm is located and the annual change in the state unemployment rate where the bank is located.[19] We use these variables to control for regional macroeconomic changes that would affect the supply and demand of commercial and industrial loans. The prevailing state-level 30-year fixed mortgage interest rates are also included for use in the instrumental variables specifications.[20] We discuss the mortgage rate variable further in Section II.E.

II.E Identification Strategy

There are two additional identification concerns that we address in our empirical approach. The first concern is that housing prices are likely correlated with unobserved economic shocks. In this case, the omitted economic shocks would bias our estimate of how housing prices affect bank lending and firm investment. The second concern is that housing prices may factor into firm investment decisions for reasons unrelated to the bank lending channel (e.g., as an input cost for production). In that case we would be attributing our findings to changes in the credit supply from banks when they are instead driven by changes in firm demand.

To address the first concern of an omitted variable bias, we use an instrumental variables approach. Our instrument set is a measure of land area that is unavailable for residential or commercial real estate development (Saiz, 2010), the state-level 30-year mortgage rate, which measures housing

[19] For the bank-specific unemployment rate, the amount of deposits from the prior year's summary of deposits data is used to create an average change in unemployment rate where the bank operates.

[20] State-level mortgage rates are available from HSH Associates on its website, `http:\www.hsh.com`.

and mortgage demand for consumers in the states where the bank operates, and the interaction of the land unavailability and mortgage rate measures.[21] Using the deposit weights for each BHC's exposure to different states, we calculate the percentage of unavailable land and average mortgage rate in each BHC's region of operation.[22] Although we use state-level mortgage rates for our main analysis, in Appendix B.2 we substitute them for national mortgage rates and find similar results. The instruments are designed to capture variation in housing prices that is not correlated with local economic conditions. For similar housing demand shocks, areas with less available land will realize more of the housing demand in the form of higher prices rather than as additional housing construction. Interacting this unavailability measure with the mortgage rate captures the housing price dynamics further. As mortgage rates decrease (and housing demand increases), areas with less available land will see a relatively higher increase in housing prices than areas with more available land.

The instruments provide variation in housing prices that is exogenous to these unobserved local economic shocks. However, our second concern—the extent that housing prices directly influence firm decisions—is not addressed by our instrumental variables approach. This concern is not unique to our paper, as it applies to prior papers that use similar instrument sets, whether for firm investment (Chaney, Sraer, and Thesmar, 2012) or employment growth (Adelino, Schoar, and Severino, 2015; Loutskina and Strahan, 2015).

We address this concern in a few ways. First, we stress that our housing price variable is calculated at the *bank*, rather than firm, location. The majority of bank holding companies in our main sample are operating across multiple states.[23] Further, the inclusion of firm's state by year fixed effects removes any differences in investment across firms due to local economic conditions. The cost of real estate in the firm's state would be one such condition. In Section IV.A, we investigate the impact of bank housing prices on the interest rates paid for new commercial loans. We find that firms which borrow from banks with exposure to higher housing prices pay *more* for new loans, which is consistent with a reduction in the supply of capital from banks rather than falling firm demand for commercial borrowing. Similarly, we find for firms with multiple lenders, loan amounts are smaller from banks with higher housing price exposure. Also, constrained banks which are exposed to higher housing prices have higher average C&I loan profitability. These

[21] Saiz (2010) calculates slope maps for the continental United States using U.S. Geological Survey (USGS) data. The measure is the share of land within 50 km of each MSA that has a slope of more than 15% or is covered by lakes, ocean, wetlands, or other internal water bodies. We use a version that is averaged to the state-level by using population figures (from the 2000 Census data) to determine the appropriate weights for different MSAs.

[22] Our state-level mortgage rates are specific to each BHC and are the deposit-weighted average of the rate across all states in the BHC's deposit area.

[23] The median number of states is four, with less than 18% of bank holding company observations operating in only one state.

findings point to a capital supply effect.

To further separate this potential firm demand channel from our bank lending channel, we perform some additional analysis. In Section III.C, we run specifications that include the firm's state housing prices directly and specifications that use firm's county by year fixed effects as a finer control for local demand conditions. We exclude firms from the most land-intensive industries and re-run the analysis on a subsample of observations for which the borrowing firm and lending bank are operating in separate states.[24] In Appendix B.1, we use the price of commercial real estate in the firm's state and the importance of land for different firms to directly consider the economic importance of this potential firm demand channel.

The summary statistics for our instruments are presented in Panel B of Table I. Table III presents the effect of the included instruments on housing prices in our sample. The regression specification considers the housing price index for bank j at time t:

$$\begin{aligned}\text{Housing Prices}_{jt} = \alpha_j + \gamma_t + \kappa_1 \text{Land Unavailability}_{jt} + \kappa_2 \text{Mortgage Rate}_{jt} \\ + \kappa_3 (\text{Land Unaval.} \times \text{Mortgage Rate})_{jt} + \kappa_4 \text{Other Controls}_{jt} + \varepsilon_{jt}. \quad (1)\end{aligned}$$

The unit of observation is a bank-year, where the bank observation is at the holding company level. We include BHC fixed effects (α_j) and year fixed effects (γ_t) in the specifications. We also include four other bank-specific variables (size, equity ratio, net income, cost of deposits) and the change in the unemployment rate in the bank's states as additional controls. Here we use the *all banks panel* discussed in Section II.

Finally, we stress that Table III is not the set of estimates used as a first stage for our later specifications—rather it demonstrates the effect of the instruments on the endogenous variable of interest. Instead, a distinct first-stage regression (limited to the specific sample and including all relevant control variables) is performed for each instrumental variables regression. Table A2 in Appendix A.4 presents the first-stage regressions associated with the main results of the paper (Section III.A).

For a one standard deviation increase in the land unavailability (11.7%) in the bank's states of operation, the bank's housing price index increases by 32.99 points (Column 1).[25] In real terms, this change is about $16,495 in year 2000 dollars and is statistically significant at the 1% level. The land unavailability measure for specific banks is clearly relevant for housing prices in the same areas.

[24] Specifically, we exclude observations if the state where the firm is located (data from Compustat) overlaps with any of the five most significant states for the bank's operations, as measured by percent of total deposits.

[25] The standard deviation for land unavailability is different here than in Table I because here we use the *all banks panel* and not the *relationship panel*.

Column 2 introduces the state-level 30-year fixed mortgage rate and the interaction between the mortgage rate and land unavailability measure as additional instruments. We find an increase in the state-level mortgage rate to be associated with an increase in the bank's housing price index. This result is initially counterintuitive, as we expect mortgage rates and housing demand to move in opposite directions. However, in the presence of year fixed effects, which remove the average annual level of the mortgage rate, this variable becomes a measure of the dispersion of mortgage rates across states. The positive coefficient implies that states with higher mortgage rates are associated with higher housing prices than states with lower mortgage rates at that time. This result would be consistent with local housing demand shocks increasing both housing prices and the state-level mortgage rate relative to other states.[26]

The coefficient for the interaction term between land unavailability and the state-level mortgage rate is negative and statistically significant at the 1% level. This negative coefficient is consistent with the idea that for a given decline in mortgage rates, prices should increase more in areas with more undevelopable land. Thus, a more negative interaction term (larger rate drop times higher positive land unavailability measure) is associated with a higher positive price increase, and hence the negative coefficient.[27]

To account for the sharper increases in housing prices in the later part of the sample (Figure 1), in Column 3 our instruments have differential effects on housing prices for different parts of our sample. Specifically, we split the sample into two parts: 1987–1998 and 1999–2005.[28] We see that the marginal effects of land unavailability and the land unavailability and mortgage rate interaction term are much stronger in the later part of the sample.

As discussed in Section II.C, large national banks may be less constrained and thus have a differential effect on borrowing firms' investment. Therefore, in IV specifications where we split the three largest banks (*National Banks*) from the remaining sample, we instrument the interaction of the *National Banks* indicator with the housing price variable (*National Banks* $\times$ *HPI, Bank's State(s)*) as well. In these specifications, we include the interaction of the *National Banks* indicator with *Land Unavailability, Bank's State(s)* and *Land Unavailability* $\times$ *Mortgage Rate* as additional instruments.[29] These instruments are in addition to the three main instruments (*30-Year Mortgage*

[26] If this specification is run without year fixed effects, a decrease in mortgage rates is associated with a statistically significant increase in housing prices, which suggests that this effect operates on the aggregate level.

[27] Because this variable comes from a combination of variation in land unavailability and mortgage rates, the inclusion of year fixed effects does not alter the identifying variation as dramatically as it does for the state-level mortgage rates. Its magnitude is similar in a specification without year fixed effects.

[28] The sample for our results in Section III is 1988–2006. For our main results, we use housing prices at a one year lag, so 1988 is the first year for the dependent variables. For this specification, however, we do not need lagged data, and therefore the dependent variable starts in 1987.

[29] For all our IV specifications with these two endogenous housing price variables, this version of the paper utilizes a streamlined set of instruments. An earlier version of this paper used a larger instrument set which included the

Rate, Bank's State(s), *Land Unavailability, Bank's State(s)*, and *Land Unavailability* × *Mortgage Rate*) discussed earlier.

In Table III, land unavailability and its interaction with state-level mortgage rates are clearly relevant to housing prices in that area.[30] Appendix B.2 considers some alternative specifications with this instrument set that generate similar results. These instruments address the specific concern that some unobserved economic shock is both increasing housing prices (through increased housing demand) and firm-level investment opportunities. As discussed above, we undertake additional steps to address the second concern—that our housing variable is not capturing the bank's actions but rather changes to the firm's demand for capital.

III Empirical Results

Section III.A presents our main result that the housing boom had a negative real effect for firms through the lending channel. Section III.B divides banks and firms based on the likelihood of being constrained in terms of raising external capital to provide further evidence that our main result is driven by rationing on the part of banks. Section III.C further addresses the concern that real estate prices are affecting the firm for reasons unrelated to the lending channel.

III.A Firm Investment

Table IV reports results for investment regressions for firms with bank relationships using our main panel (*relationship panel*). The regression specification estimates the impact of various characteristics on the investment at time t of firm i that borrows from bank j:

$$\begin{aligned}\text{Investment}_{ijt} = \alpha_{ij} + \gamma_t + \beta_1 \text{Housing Prices}_{jt-1} + \beta_2 \text{Firm Variables}_{it-1} \\ + \beta_3 \text{Bank Variables}_{jt-1} + \beta_4 \text{Macro Variables}_{ijt-1} + \varepsilon_{ijt}. \qquad (2)\end{aligned}$$

The unit of observation is at the firm-bank-year level and the panel's construction is discussed in more detail in Section II. This panel structure allows us to observe firm investment policy in the years when a new loan is originated and in the years when there is an ongoing lending relationship.

interaction of the *National Banks* indicator with *30-Year Mortgage Rate, Bank's State(s)* as an additional instrument. The results are of similar economic and statistical significance with either instrument set.

[30] Using only the land unavailability measure without bank fixed effects, year fixed effects, or other controls gives an adjusted R^2 of .14. Including the state-level mortgage rates and the interaction term increases the adjusted R^2 to .42. The remaining variation explained in Table III is coming from the bank fixed effects, year fixed effects, and other control variables.

Throughout our analysis, we include lagged market-to-book, lagged firm size, and contemporaneous cash flow as control variables. Across all our analysis, we include the following bank-level variables—the bank's size, equity ratio, net income, and cost of deposits—to control for differences in the condition of banks. Any persistent differences among firms, and more specifically a firm's relation with a particular bank, are captured by firm-bank fixed effects, α_{ij}. To remove large economic shocks that may bias our results, we include year fixed effects (γ_t) or firm-state by year fixed effects. Finally, to capture any more localized economic effects, the change in the state unemployment rate in both the firm's state and bank's states of operation are also included at a one-year lag.[31]

To facilitate comparison of the economic importance of different variables, all independent variables are scaled by their sample standard deviations. The dependent variable, the ratio of investment to lagged net PP&E, is scaled by 100 to provide a percentage-like interpretation to the various coefficients.

As discussed in Section II.E, it is plausible that housing prices may be endogenous to the firm's investment decision. Specifically, if the bank's regional housing prices are correlated with any omitted variables related to the commercial lending of the bank or the investment opportunities of the borrowing firm, the estimate of the effect of the bank's housing exposure may be biased. We believe the source of the bias is likely positive, as housing prices are generally positively correlated with economic growth. Columns 1 and 2 of Table IV confirm this supposition. In Column 1, which runs the regression without instrumentation, the effect of housing prices in the bank's state is not significantly different from zero. Column 2 uses the instruments discussed in Section II.E and shows that a one standard deviation increase in housing prices (about \$52,000 in year 2000 dollars) is associated with a 3.106 percentage point decrease in investment.[32] This effect is statistically significant at the 5% level and corresponds to 6.9% of a standard deviation in investment.

The evidence in Column 2 of Table IV shows that firms are on average negatively impacted by the housing price boom through the lending channel. This result suggests that for many banks, capital constraints are such that some credit rationing occurs for the borrowing firms. If this rationing occurs, we should expect this effect to be significantly weaker for banks that are not

[31] We have included GDP growth rates in the firm's and bank's states, but it does not have any significant effect in the presence of year fixed effects, so we omit them.

[32] As discussed in Section II.E, the three instruments are the measure of land unavailability in the bank's region, the prevailing average state-level 30-year fixed mortgage rate in the bank's region, and the interaction of the two variables. We split the land unavailability measure (and therefore the interaction term as well) into two periods: 1988–1999 and 2000–2006. This is sufficient to capture the differences in the two periods. We choose to leave the 30-year mortgage rate as a single variable, but it can be split as well. The first-stage regressions for Table IV are presented in Table A2 in Appendix A.4. The Kleibergen-Paap Wald F-statistics show that weak instruments are not a concern in these regressions.

significantly constrained. As discussed in Section II.C, Citigroup, Bank of America, and JPMorgan Chase operate on such a large scale that they should be the least constrained of the BHCs in our sample. In Columns 3 and 4 of Table IV, we allow for housing prices for these banks to have a differential effect on firm investment. The variable *National Banks* $\times$ *HPI, Bank's State(s)* is the interaction of an indicator for the three largest bank holding companies with their respective housing price indices.[33]

For the smaller, more regional banks, we indeed find a stronger effect. In our instrumented specification (Column 4), a one standard deviation increase in housing prices corresponds to a 9.08 percentage point decrease in investment. At the same time, for the largest national banks, the difference in the housing effect is a positive and statistically significant 4.70 percentage points. Combining the housing price estimate and the interaction term, the net effect of housing prices on firm investment is a negative 4.38 percentage points ($-9.08 + 4.70 = -4.38$), and the total effect is statistically different from zero at the 5% level. The effect of housing prices on investment is strongest for firms which borrow from more regional banks, equating to 20% of a standard deviation using the results from Column 4. Firms which borrow from the large national banks still on average experience a small negative effect on investment. This result is driven by the first half our sample period, when the largest bank holding companies are closer to the rest of the sample in terms of size and geographic reach. We are able to find significant results, though at lesser magnitudes, in our non-instrumented specification (Column 3) as well.

Columns 5 and 6 go one step further and introduce firm's state by year fixed effects, which control for any local economic conditions in the firm's state. These fixed effects address the concern that housing prices in the firm's state (and not the bank's states) are yielding our results, and more specifically that the firm's demand for capital (and not the bank's supply of capital) drives our findings. Without instrumentation, firms borrowing from the smaller banks are associated with a 4.21 percentage point decrease, which is significant at the 5% level. In Column 6, where the housing price variables are instrumented by the land unavailability measure, state-level mortgage rates, and their interaction, this effect more than doubles in magnitude. Among the smaller banks, the increase in housing prices is associated with a 9.62 percentage point decrease in investment. In sum, the lending channel works in a significantly negative direction during this housing boom and carries substantial economic significance for the borrowing firms.

[33] Although the indicator variable is included in the specifications as well, it is absorbed by the firm-bank fixed effects.

III.B Constraints at the Bank and Firm Level

The driving mechanism for our results, discussed in Section I.A, is the presence of constraints that: (i) prevent banks from meeting C&I loan demand in the face of strong mortgage demand, and (ii) prevent firms from being able to raise capital from sources other than their constrained bank. We also investigate if constraints on the availability of skilled personnel are contributing to our results.

The national/regional bank split in Section III.A is one approach to test for constraints at the bank level, but further investigation is warranted. In Table V, we consider three additional measures to capture differences in the capital available to banks: bank size, bank leverage, and whether the bank actively securitizes loans. Larger bank holding companies should have more ready access to capital than smaller bank holding companies. Bank holding companies with more equity capital (less leverage) should be able to engage in more commercial lending than highly levered bank holding companies, as capital requirements will be less of a binding constraint. Banks that are active securitizers should be able to free up capital for additional loans and therefore are less likely to restrict additional lending.

III.B.1 Bank Capital Constraints

Table V splits the sample (*relationship panel*) into constrained and unconstrained groups of banks, and uses the instrumented specification with the full set of controls, firm-bank fixed effects, and firm's state by year fixed effects as described in Section III.A. Treating BHCs in the largest quintile by deposits as unconstrained and the remaining BHCs as constrained, we see significant differences in the effect of housing prices on firm investment. Firms borrowing from the constrained banks have a marginal effect of -25.68 percentage points (Column 1), compared to -6.56 percentage points for the unconstrained banks (Column 2). Both estimates are statistically significant, as is the difference between them.

Using bank leverage as the measure of constraints, in Columns 3 and 4 we again find significant differences between bank holding companies. We consider BHCs in the lowest tercile of equity ratios (highest leverage) as constrained and the remaining BHCs as unconstrained. Firms that borrow from constrained banks have a marginal effect of housing prices on investment of -38.42 percentage points, compared to a still-significant -4.82 percentage points for unconstrained banks. The difference between the coefficients for the two samples is significant at the 5% level.

Columns 5 and 6 divides our sample using our securitization activity indicator. We find that the marginal effect of housing prices for the constrained (non-securitizing) banks is a statistically significant -11.93 percentage points, compared to a statistically significant -5.60 percentage points for the unconstrained (securitizing) banks. Although the difference between the two estimates is not

significant at conventional levels, it strongly suggests the firms that borrow from non-securitizing banks see larger capital reductions. Across the different measures of capital constraints, the negative investment effect for firms is concentrated in those bank holding companies that are likely more capital constrained.

Another potential friction driving the effect could be organizational or personnel constraints. In Columns 7 and 8 of Table V, we divide banks by employee growth rates. Additional details of how employee growth is measured is given in Appendix A.2. To make sure we are not capturing differences in economic conditions in the firm's location, we exclude the individual firm's state from the bank's employee growth calculation and use a one year lag.

We find for the constrained banks (employee growth in the bottom two quintiles), housing prices have a marginal effect of -28.73 percentage points on firm investment. For the remaining, unconstrained banks, we find a marginal effect of -4.85 percentage points, which is not statistically significant.[34] The difference between them is statistically significant at the 1% level. The results suggest that firms which borrow from banks with higher employee growth rates are less sensitive to housing prices than firms which borrow from banks with low employee growth rates. This finding is consistent with personnel constraints playing a role in credit rationing.

III.B.2 Firm Capital Constraints

The mechanism behind our effect also requires binding capital constraints at the firm level. We use a few different variables to capture differences in constraints: firm size, bond ratings, and the presence of a credit line. Table VI presents the instrumental variables specification with the full set of controls (as in Table IV) for each subsample (*relationship panel*).

Hadlock and Pierce (2010) show that firm size is an important predictor of financial constraints. Columns 1 and 2 classify firms that are in the lowest tercile by firm size (as measured by book assets) as constrained and firms in the highest size tercile as unconstrained. There are statistically and economically significant differences in the effect of housing price increases on investment. For constrained firms which borrow from the more regional banks (Column 1), the marginal effect is a 19.12 percentage point decrease in investment, compared to an insignificant 1.01 percentage point increase for unconstrained firms. This difference in coefficients is significant at the 1% level. For small firms that are more constrained due to lack of access to internal and external capital, the negative bank lending channel effect is significant.

Columns 3 and 4 of Table VI split the sample according to whether a firm has a bond rating, including a speculative or investment grade one. The constrained subsample (no rating) in Column 3

[34]The median employee growth rate is -6.7% for the constrained banks and 5.7% for the unconstrained banks.

has a large negative coefficient associated with housing prices in the bank's states (-11.74 percentage points), where the coefficient for the unconstrained subsample (bond rating present) in Column 4 (-3.78 percentage points) is not significant. Both of these effects are for the subsample of firms that borrow from the smaller, more regional banks.

One additional channel that may mitigate financial constraints would be the presence of a credit line. To the extent that firms do not use all of their credit line immediately, its presence may weaken the rationing they receive when housing prices increase. We therefore use the DealScan loan package data to see if an existing package contains a credit line.[35] Columns 5 and 6 classify firms as constrained or unconstrained depending on whether they have a credit line. We find that for firms without a credit line (Column 5), the marginal effect of housing prices on investment is large at -37.37 percentage points and significant at the 5% level. For the firms with a credit line (Column 6), the marginal effect is still significantly negative but smaller in terms of economic magnitude, at -7.43 percentage points. It is important to note that while a credit line mitigates the effect somewhat, housing prices still have a substantial negative effect on investment even for firms with access to credit lines.

III.C Firm Demand and Land Intensity

One concern discussed in Section II.E is that our housing price measure is capturing differences in the cost of land among firms or some other component of firm demand for investment. In the specific case of the cost of land, firms decrease investment in response to an increase in their cost of production due to the higher price of an input, namely land. We do not believe this effect is driving our results for a couple reasons. First, we measure our housing prices at the bank, rather than firm, level. Second, many of our specifications use firm's state by year fixed effects, which capture shocks to the economic conditions of the firm—including changes in real estate prices.

To further check that our results are not driven by some omitted firm demand factor related to housing prices, we run additional specifications presented in Table VII. Columns 1 and 2 of Table VII include the housing price index in the state where the firm operates as an additional control.[36] The estimated effect of housing prices in the bank's states on firm investment remains significantly negative and similar in magnitude to the results in Table IV. This result suggests that our main housing price variable is indeed capturing the lending bank's activity and not the firm's local real estate conditions. Alternatively, Columns 3 and 4 use fixed effects at the firm's county-

[35] While undrawn credit lines are a better measure of constraints, we only have data on the presence but not the utilization of credit lines.

[36] Because the index varies at the firm-state level, we use year fixed effects rather than firm's state by year fixed effects for these specifications.

year level as a finer control of local demand. We find results similar to our main specifications in Table IV.

As an alternative approach, we consider a subsample where the state location of the borrowing firm does not overlap with any of the top five states for the BHC, as measured by the concentration of its deposits. The results are presented in Columns 5 and 6 of Table VII. Again, the results are largely similar to those of the main sample.[37]

Finally, we exclude firms that rank in the top tercile by land intensity. Our land intensity variable captures the share of capital income that is attributable to land and is discussed in more detail in Section II.A. This eliminates firms for which local land values could be an important concern for production and investment.[38] The results, presented in Columns 7 and 8 of Table VII, are largely similar to our main results in Table IV.

Although we do not believe our main results are driven by these alternative firm demand explanations, next we attempt to measure the effect of local real estate prices on firm investment directly. To quantify the importance this channel, we include both the cost of commercial real estate in the firm's state and the importance of land to the firm's capital income (as captured by our land intensity measure). The results are presented in Table B1 in Appendix B.1. Across all specifications our measure of commercial real estate, an office price index, is not significant.

Section II.E discusses potential endogeneity issues and our instrumental variables approach in detail. Table B2 in Appendix B.2 presents a few alternative specifications to demonstrate the robustness of our main results to different variable specifications. Columns 1 through 3 of Table B2 maintain our use of lagged deposit weights for variable construction and use alternate instrument specifications. Columns 4 and 5 use different assumptions about bank deposits to construct our main variables and instruments.

[37] As discussed in Section II.E, this version of the paper has streamlined the set of instruments for the IV specifications with both the *Housing Price Index, Bank's State(s)* and *National Banks* $\times$ *HPI, Bank's State(s)* variables. A larger set of instruments used in a previous version of the paper yields results that are of similar economic and statistical significance. An exception is Column 6 of Table VII, where the result with the larger instrument set is statistically significant at the 10% level with a similar economic magnitude.

[38] This cut excludes firms in the following industries with the following intensity measures: farming (47.1%); amusements, gambling, and recreational (39.2%); warehousing and storage (34.8%); construction (31.4%); funds, trusts, and other financial vehicles (31.1%); social assistance (25.8%); accommodation (24.1%); other services, except government (22.7%); hospitals and nursing and residential care facilities (22.7%); food services and drinking places (19.2%); educational services (17.1%); petroleum and coal products (16.4%); retail trade (15.4%); forestry, fishing, and related activities (14.7%); waste management and remediation services (12.1%); real estate (10.2%); wholesale trade (9.3%); information and data processing services (9.0%); mining, except oil and gas (8.8%); truck transportation (8.4%); nonmetallic mineral products (7.9%); administrative and support services (7.7%); rental and leasing services and lessors of intangible assets (7.3%); furniture and related products (5.9%). The average share of capital income attributable land for the full sample is 6.62%. It drops to 2.66% after the exclusion of these industries.

IV Additional Evidence: Effects on Other Variables

Section III documents the effect of the bank lending channel on firm investment. Here, we discuss two main mechanisms through which the lending channel operates: interest rates (Section IV.A) and loan amounts (Section IV.B). Finally, Section IV.C provides supporting evidence that banks shift capital away from commercial lending towards real estate lending as housing prices increase.

IV.A Loan Interest Rate

If the investment results in Section III are driven by banks engaging in credit rationing, we may expect an increase in the price of credit. A decrease in the price of credit, alternatively, is consistent with firms decreasing demand in response to higher housing prices. One element of the price of credit that we can measure is the interest spreads on loans.

We investigate the effect of housing prices on loan interest rates using the *All In Drawn Spread* variable from DealScan, which is a standardized spread over LIBOR, inclusive of annual fees. Observations in these specifications are from the *loan panel* and are discussed in more detail in Section II. The specification estimated is as follows:

$$\begin{aligned}\text{All In Drawn Spread}_{ijt} = \alpha_j + \gamma_t + \delta_1 \text{Housing Prices}_{jt-1} + \delta_2 \text{Firm Variables}_{it-1} \\ + \delta_3 \text{Bank Variables}_{jt-1} + \delta_4 \text{Macro Variables}_{ijt-1} + \delta_5 \text{Loan Characteristics}_{ijt} + \varepsilon_{ijt}. \qquad (3)\end{aligned}$$

The control variables in this regression are similar to our investment results with a few exceptions: we include lagged Altman's Z-score and lagged book leverage to control for differences in firm credit quality, and include the amount and maturity of the loan package to control for observable differences in loan terms. We also include indicators for whether the loan package is for the purpose of a takeover or acquisition and if the package contains a revolving credit line, given these loan types may entail different amounts and pricing.

Across all specifications, we include bank-level fixed effects (α_j) and year-level (or firm-state by year level) fixed effects (γ_t). Firm-bank-package observations are only included in this panel if firms originate a new loan package with the specific bank, as opposed to having an outstanding relationship as in Section III.A. In our sample, 1,987 of the 4,812 firms do not have more than one observed loan package across all banks. The firms with one loan package tend to be smaller (average asset size of \$1.1 billion versus \$3.8 billion for the other firms) and are less likely to have an investment-grade bond rating (6% are investment grade versus 25% for the other firms). To avoid excluding these firms from the analysis, we do not include firm fixed effects. Similarly, to avoid losing observations from DealScan lenders that only issue one package, we choose to have

bank-level fixed effects at the bank holding company level.

In Table VIII, we follow the same constrained/unconstrained firm splits as in Table VI. Columns 1 and 2 of Table VIII consider the effect of housing prices on loan spreads for the smallest and largest terciles of firms in our sample. We find a large and significant increase in loan spreads for the smallest firms and an insignificant change for the largest firms. This difference likely stems from the presence of constraints: if banks raise interest rates for larger firms, these firms can seek outside financing options from other banks or the public debt markets instead. We do not see meaningful differences between the regional and national banks as far as loan pricing is concerned.

Columns 3 and 4 use the presence of public bond ratings as a measure of constraints. We again find that for those firms without any bond rating (Column 3), loan spreads significantly increase with the housing prices in the bank's states. We do not find a significant effect for those firms with a bond rating (Column 4). Finally, Columns 5 and 6 look at whether the presence of credit lines affects pricing.[39] Although we find a strong positive estimate on loan spreads for those firms without a credit line, it is not statistically significant because of the large standard error. Across our sample, the firms that we expect to be more credit constrained (and therefore have fewer alternative financing options) are the ones that experience higher loan spreads following higher housing prices for their banks. Such increases are consistent with credit rationing on the part of banks which are exposed to higher housing prices.

IV.B Loan Amounts for Borrowers with Multiple Lenders

If the housing boom is partially crowding out commercial borrowing and investment through the lending channel, we expect a decrease in the size of loans being given to firms. In Appendix B.3, we find evidence of reductions in commercial loans for banks exposed to higher housing prices when we consider the sample of all firms (Table B3). One additional concern is that there may be matching between lower quality banks and lower quality borrowers. If this matching is pervasive and also correlates with housing prices, then it may affect our results.

To remove the possibility that the lower loan amounts are coming from lower demand from worse borrowers, in Table IX we look at a subsample of firms in the *loan panel* which have multiple lenders. For 2,606 observations across 945 firms there are at least two loans generated from different

[39]The *Revolving Credit Line* variable is not used here as we divide the sample based on the presence of a credit line.

BHCs in a given year. For these firms, we run the following specification:

$$\text{Loan Amount}_{ijt} = \alpha_j + \gamma_{it} + \vartheta_1 \text{Housing Prices}_{jt-1} + \vartheta_2 \text{Bank Variables}_{jt-1} + \vartheta_3 \text{Macro Variables}_{ijt-1} + \varepsilon_{jt}. \quad (4)$$

This specification is similar to the interest rate specifications except it includes firm-year fixed effects (γ_{it}) instead of the usual firm control variables. This removes any firm-specific variation and compares loan sizes within a given firm in a given year. Firm-year fixed effects also require firms to undertake loans with different lenders in a given year. Because this subsample of firms have relationships with multiple banks, the firms have stronger bargaining power against specific banks. Hence, a test of the presence of credit rationing in lending to these firms is a conservative test of credit amount rationing across all firms. Our dependent variable, *Loan Amount*, is scaled by lagged net PP&E and multiplied by 100 to aid in comparison with our investment results in Section III.A. As our main housing price variable, we use an indicator for whether the BHC has above median housing prices in a given year.

In Table IX, we find that within a given firm-year, the banks with higher housing prices give smaller loan amounts. In Column 1, the average difference is -101.3 percentage points, as scaled by lagged net PP&E. When instrumenting the high housing price variable (Column 2), the difference in loan amounts between higher and lower housing price banks is -149.1 percentage points, which is significant at the 5% level. Within the same firm, the banks exposed to higher housing prices are significantly reducing loan amounts to borrowers. This approach helps address the concern that the results are driven by firm-specific demand changes related to housing prices and confirms our broader loan size analysis in Appendix B.3.

IV.C Bank Activity

IV.C.1 Bank Asset Holdings

Figure 2 suggests that banks increased real estate lending and decreased commercial lending in response to increasing housing prices. To more formally investigate how housing prices affect banks' balance sheets, we use the following regression specification for bank j in year t:

$$\text{Bank Asset}_{jt} = \alpha_j + \gamma_t + \lambda_1 \text{Housing Prices}_{jt-1} + \lambda_2 \text{Bank Variables}_{jt-1} + \lambda_3 \text{Macro Variables}_{jt-1} + \varepsilon_{ijt}. \quad (5)$$

Bank observations in this panel are grouped at the bank holding company level. Throughout this section, we use the third panel that incorporates data of all banks (*all banks panel*). The panel construction is discussed in more detail in Section II. We include BHC fixed effects (α_j), year fixed

effects (γ_t), and the same bank-specific controls as in prior specifications with one modification: to avoid a mechanical correlation between bank size and loan amounts, we exclude all the loan types being considered from the bank's total assets when calculating bank size.[40] Because we are considering changes in holdings at the bank-level, we cannot use firm's state by year fixed effects in these specifications. Table X focuses on the following classes of bank assets in log amounts: real estate assets (MBS, traditional loans, and commercial mortgages), commercial and industrial loans, and non-mortgage consumer loans.[41]

Columns 1 and 2 of Table X present the marginal effect of housing prices on the amount of real estate loans without and with instrumentation, respectively.[42] Given the inclusion of bank-level fixed effects, the effect of housing prices is interpreted as changing the dollar amount of these loans within a given bank. We find that for a one standard deviation increase in housing prices in a bank's states, the amount of non-securitized real estate loans increases by 8.5% ($e^{0.0812} - 1$). The instrumented specification suggests an even larger effect, although less precisely estimated. The estimates for MBS holdings (Columns 3 and 4) are positive as well, but not statistically significant. Commercial mortgages (Columns 5 and 6) are increasing in magnitudes similar to residential mortgage lending, and are statistically significant. For residential mortgage lending, banks are increasing their loan assets in response to housing prices. This finding confirms the positive relation between housing prices and real estate lending found in Figure 2. At the same time, banks are also increasing commercial mortgage lending at a similar magnitude. This finding is consistent with the collateral channel presented in Chaney, Sraer, and Thesmar (2012), which we explore further in Appendix B.4.

Column 7 of Table X considers the effect of housing prices on the amount of commercial and industrial loans. In the non-instrumented specification, we find a one standard deviation increase in housing prices increases the dollar amount of C&I loans by 2.6% ($e^{-0.026}-1$). Due to the endogeneity concerns discussed in Section II.E, estimates of the effect of housing prices on commercial loan activity are likely biased in a positive direction. Namely, an omitted regional, positive economic shock will both increase housing prices and commercial loan demand.

Column 8 instruments the effect of housing prices on C&I loans.[43] The marginal effect of hous-

[40] This ensures that we do not have loan value as a component on both the left hand side and the right hand side variables.

[41] Because this panel is constructed from a larger sample of BHCs than the main investment regressions, its summary statistics are slightly different than those presented in Table I. The sample standard deviation for housing prices is 87.08.

[42] For IV specifications involving real estate loans, MBS, or commercial mortgages, we only rely on the land unavailability instrument to be conservative. The reason is that the exclusion restriction may not hold for the mortgage interest rate instrument for these assets. Mortgage interest rates may directly affect the prices and thus the holding of these three asset classes outside the channel of housing prices.

[43] We use the land unavailability measure, the average state-level 30-year mortgage rate where the bank operates,

ing prices on commercial lending is -7.9% ($e^{-0.0821} - 1$) and is significant at the 10% level. When instrumented, C&I loans decrease in dollar terms in response to increasing housing prices. This result is consistent with a negative lending channel effect for firms, especially since the instrumentation better isolates the bank's choice of capital supply from other effects.

In Columns 9 and 10 we consider the effect of housing prices on the fraction of non-real estate consumer lending. This asset category includes auto loans, student loans, credit card debt, and other forms of personal loans. Because any positive omitted economic shocks likely increase other forms of consumer loan demand, we expect a similar positive bias. In both specifications, consumer loans significantly decrease when housing prices in the bank's region increase. Rather than increasing all types of consumer loan activity with higher housing prices, banks appear to shift into mortgage lending at the expense of other forms of consumer debt. Taken together, banks respond to higher prices in housing markets by increasing real estate loans and decreasing other consumer and C&I loans.

The channel we consider requires banks to face constraints which cause them to substitute away from C&I and consumer lending in the face of increasing housing prices. In Columns 11 through 14 of Table X, we repeat the analysis for C&I and consumer lending focusing on bank holding companies which are below the median in terms of total deposits. These banks, which are more likely to face these constraints, should show even stronger substitution effects. This is indeed the case: for a one standard deviation increase in housing prices, these banks reduce C&I lending by 16% ($e^{-0.174} - 1$) (Column 12). This effect is significant at the 5% level and is twice as large in magnitude as the equivalent effect for the entire bank sample (Column 8). We also find strong negative effects in consumer lending for the more constrained banks. While we find banks reducing non-real estate lending in response to increasing real estate prices across the entire sample, the effects are even more pronounced among the more constrained banks.

IV.C.2 Profitability of C&I Loans

Important to our argument is the premise that constrained banks shift lending to the most attractive opportunities. In such a case, we should expect that constrained banks neglected low NPV C&I loans to focus on mortgage loans which appeared to have a higher NPV ex ante. If the decrease in C&I lending is due to bank capital supply constraints and not decreased loan demand, the most constrained banks (which cut back on the worst loans) should have more profitable C&I loan portfolios.

Table XI compares the average C&I loan profitability (interest income on C&I loans divided

and their interaction as instruments. As with our main investment regressions, we find economically and statistically similar results if we treat the state-level 30-year mortgage rate as an additional control, rather than as an instrument.

by the amount of C&I loans) across banks. Controlling for year fixed effects and other bank characteristics, the bank holding companies that are below the median level of deposits (and likely are more constrained) have on average 60 basis point higher loan profitability than the above median, less constrained, banks (Column 1).[44]

Columns 2, 3, and 4 include the housing price variable. In the instrumented specification (Column 3), a one standard deviation increase in housing prices leads to an increase of C&I loan profitability of 20 basis points. This finding is consistent with banks cutting back on the least profitable commercial loans in the face of increased real estate activity. If this increase is related to increased real estate lending and capital constraints at the bank level, this effect should be stronger for constrained banks with increasing housing prices. In Column 4, the housing price variable is interacted with the constrained bank indicator. For the constrained banks, a one standard deviation increase in housing prices is associated with a 22.3 basis point increase in C&I loan profitability. This finding is over and above the 16.6 basis point result for the non-constrained banks, and is statistically significant at the 5% level. The finding that constrained banks (as measured by deposit size) have higher C&I loan profitability is consistent with their limited capital being allocated to higher profit loans. Paired with the result that this increase in loan profitability is positively related to housing prices further suggests that the decrease in C&I lending is driven by banks limiting capital rather than a decrease in borrower demand.

V Macroeconomic Implications

The results in Sections III and IV suggest that banks move capital away from commercial lending and toward mortgage lending when situated in stronger housing markets. Firms are unable to replace the capital that banks reallocated to the housing sector from the commercial and industrial sector, leading to a net negative impact on firm investment levels. This phenomenon is especially true for smaller firms and more constrained banks. This section discusses the macroeconomic importance of our mechanism, taking into account the potential offsetting effect of the collateral channel. Appendix B.4 considers the role of the collateral channel as documented in Chaney, Sraer, and Thesmar (2012) in detail.

Column 6 of Table IV shows that a one standard deviation increase in housing prices within a bank, which is about $52,000 in year 2000 prices, reduces firm investment by 9.62 percentage points for firms borrowing from regional banks and by 2.60 percentage points for firms that obtain loans

[44]This sample is all bank holding companies that have a non-zero C&I loan profitability. Because banks with less than $300 million in total assets did not have to separately report income for C&I loans until 2001, the sample size is smaller. The average loan profitability is 7.99% and standard deviation is 2.52%.

from the three largest banks. The three largest banks have 40% of the firm-bank-year observations in our dataset. Putting a weight of 0.6 on -9.62 and a weight of 0.4 on -2.60, we obtain an average reduction in investment of 6.81 percentage points as a fraction of lagged net PP&E. Since the mean investment is 29.7 percentage points as a fraction of PP&E in our sample, this translates into a 22.9% reduction in investment.

To measure the impact of the increase in housing prices on an aggregate level, we next conduct some simple back of the envelope calculations. We obtain aggregate non-financial corporate business capital expenditure from the Fed Flow of Funds. We use GDP implicit price deflator (GDPDEF) series to adjust for inflation, where the index is 100 for year 2009 (GDP used is 14,418 billion dollars).

For the whole sample period of 1988–2006, the average annual capital expenditure of non-financial corporate business is 1,063 billion U.S. dollars. However, not all non-financial firms borrow from banks and are affected by the bank lending channel. To get some measure of how prevalent our effect is, we calculate that our sample covers about 23% of the broader non-financial Compustat universe. This likely underestimates the number of firms affected, as only the subset of firms that are linked to banks through the DealScan loan data are captured. Nevertheless, 23% of 1,063 billion U.S. dollars gives us about 244.5 billion U.S. dollars of capital expenditure affected by the bank lending channel.

Using the average reduction in investment of 22.9% and the affected subset of aggregate capital expenditure data, our results suggest that a one standard deviation increase in housing prices reduces annual firm investment by about 56.0 billion U.S. dollars. Using the average GDP during our sample (11,224 billion U.S. dollars), this reduction in investment is equivalent to 0.50% of the GDP, which is significant given average capital expenditure as a fraction of GDP is 9.47%.

To be conservative, we are not using a multiplier of private investment here. It is also important to note that this is a partial equilibrium calculation. While the gross effect of our channel is large, it is reduced by two opposing forces: the collateral channel (discussed in Appendix B.4) and increased investment in housing and related activities. Because these effects are not perfectly equal in magnitude, there will still be aggregate changes in investment. Further, these forces will distort investment in the cross-section of firms apart from any aggregate effects.

Chaney, Sraer, and Thesmar (2012) show that firms are able to obtain more financing if they have collateral available to pledge, and this helps firms invest more. However, the ability to obtain financing in this case is not driven by the value of the project, but by the value of the collateral. In Column 2 of Table B4 in the Appendix, we find that a one standard deviation increase in the market value of buildings leads to a 4.75 percentage point increase in investment in our sample. Similar to the bank lending channel effect, we calculate that about 23% of the non-financial Compustat

universe has some real estate collateral. Combining this number with the average reduction of 6.81 percentage points that we had before, we obtain an estimate of -2.06 percentage points as a fraction of PP&E. This translates to a 6.94% reduction in investment given the mean investment level of 29.7% as a fraction of PPE in our sample. Using the same 244.5 billion U.S. dollars subset of capital expenditure data as above, this is approximately a 17 billion dollar reduction in investment or 0.15% of the average GDP during the sample period. Construction activity as a result of real estate appreciation would provide an additional positive effect to GDP—measuring the exact magnitude of such an effect is beyond the scope of this paper.

VI Conclusion

There is an established literature that considers the effect of crashes in asset prices (and real estate prices in particular) on the broader economy. One channel of particular importance is the bank lending channel, through which asset price crashes affect the economy further through a contraction in bank activity. The role of the bank lending channel in the presence of an asset price boom has not been empirically documented to the best of our knowledge. This gap is what our paper seeks to fill.

We find negative real effects for firms through the bank lending channel. In the presence of a housing boom, banks increase mortgage lending. For many banks, capital constraints are sufficiently binding that this increase comes at the expense of other activity, such as commercial lending. Firms which borrow from these banks are crowded-out as a result. Ultimately, we find these firms reduce their investment levels as compared to their peers. This is especially true for those firms without ready access to other sources of capital.

Consistent with a crowding-out effect, we find that these firms pay higher interest rates on their loans and receive smaller loan amounts. We also rule out that our findings are being driven by the changes in real estate prices directly affecting the firms' demand for capital and investment.

The positive spillover effects of strong housing prices on the larger economy are often discussed. Policymakers argue supporting such markets will increase consumer wealth, consumer demand, and real economic activity. While some positive effects are certainly present, it is important to consider the potential negative effects on real activity. If banks are interested in capitalizing on these supported markets at the expense of commercial lending, firms may be unable to increase investment, and real activity may suffer. As such, the direction and magnitude of bank lending channel effects should be an important consideration for policy action.

References

Acharya, Viral V., Philipp Schnabl, and Gustavo Suarez, 2013, Securitization without Risk Transfer, *Journal of Financial Economics* 107, 515–536.

Adelino, Manuel, Antoinette Schoar, and Felipe Severino, 2015, House Prices, Collateral and Self-Employment, *Journal of Financial Economics* 117, 288–306.

Ashcraft, Adam B., 2005, Are Banks Really Special? New Evidence from the FDIC-Induced Failure of Healthy Banks, *American Economic Review* 95, 1712–1730.

Ashcraft, Adam B., 2006, New Evidence on the Lending Channel, *Journal of Money, Credit and Banking* 38, 751–775.

Begley, Taylor, and Amiyatosh Purnanandam, 2016, Design of Financial Securities: Empirical Evidence from Private-label RMBS Deals, LBS and University of Michigan Working Paper.

Bernanke, Ben S., 1983, Nonmonetary Effects of the Financial Crisis in the Propagation of the Great Depression, *American Economic Review* 73, 257–276.

Bernanke, Ben S., and Mark Gertler, 1989, Agency Costs, Net Worth, and Business Fluctuations, *American Economic Review* 79, 14–31.

Bharath, Sreedhar T., Sandeep Dahiya, Anthony Saunders, and Anand Srinivasan, 2011, Lending Relationships and Loan Contract Terms, *Review of Financial Studies* 24, 1141–1203.

Bleck, Alexander, and Xuewen Liu, 2013, Liquidity Flooding, Asset Prices and the Real Economy, HKUST and UBC Working Paper.

Bolton, Patrick, and Xavier Freixas, 2006, Corporate Finance and the Monetary Transmission Mechanism, *Review of Financial Studies* 19, 829–870.

Chaney, Thomas, David Sraer, and David Thesmar, 2012, The Collateral Channel: How Real Estate Shocks Affect Corporate Investment, *American Economic Review* 102, 2381–2409.

Chava, Sudheer, and Amiyatosh Purnanandam, 2011, The Effect of Banking Crisis on Bank-Dependent Borrowers, *Journal of Financial Economics* 99, 116–135.

Chava, Sudheer, and Michael R. Roberts, 2008, How Does Financing Impact Investment? The Role of Debt Covenants, *Journal of Finance* 63, 2085–2121.

Cuñat, Vicente, Dragana Cvijanović, and Kathy Yuan, 2013, How Did US Banks React to Capital Losses Induced by Real Estate Prices?, UNC and LSE Working Paper.

Cvijanović, Dragana, 2014, Real Estate Prices and Firm Capital Structure, *Review of Financial Studies* 27, 2690–2735.

DeMarzo, Peter M., 2005, The Pooling and Tranching of Securities: A Model of Informed Intermediation, *Review of Financial Studies* 18, 1–35.

Demiroglu, Cem, and Christopher James, 2012, How Important is Having Skin in the Game? Originator-Sponsor Affiliation and Losses on Mortgage-backed Securities, *Review of Financial Studies* 25, 3217–3258.

Farhi, Emmanuel, and Jean Tirole, 2012, Bubbly Liquidity, *Review of Economic Studies* 79, 678–706.

Faulkender, Michael, and Mitchell A. Petersen, 2006, Does the Source of Capital Affect Capital Structure?, *Review of Financial Studies* 19, 45–79.

Gan, Jie, 2007a, Collateral, debt capacity, and corporate investment: Evidence from a natural experiment, *Journal of Financial Economics* 85, 709–734.

Gan, Jie, 2007b, The Real Effects of Asset Market Bubbles: Loan- and Firm-Level Evidence of a Lending Channel, *Review of Financial Studies* 20, 1941–1973.

Gertler, Mark, and Nobuhiro Kiyotaki, 2010, Financial Intermediation and Credit Policy in Business Cycle Analysis, in Benjamin M. Friedman, and Michael Woodford, eds.: *Handbook of Monetary Economics* (Elsevier, Amsterdam).

Gorton, Gary B., and George G. Pennacchi, 1995, Banks and Loan Sales: Marketing Non-Marketable Assets, *Journal of Monetary Economics* 35, 389–411.

Hadlock, Charles J., and Joshua R. Pierce, 2010, New Evidence on Measuring Financial Constraints: Moving Beyond the KZ Index, *Review of Financial Studies* 45, 1909–1940.

Holmstrom, Bengt, and Jean Tirole, 1997, Financial Intermediation, Loanable Funds, and the Real Sector, *Quarterly Journal of Economics* 112, 663–691.

Kashyap, Anil K., and Jeremy C. Stein, 1995, The impact of monetary policy on bank balance sheets, *Carnegie-Rochester Conference Series on Public Policy* 42, 151–195.

Kashyap, Anil K, and Jeremy C. Stein, 2000, What Do a Million Observations on Banks Say about the Transmission of Monetary Policy?, *American Economic Review* 90, 407–428.

Keys, Benjamin J., Tanmoy Mukherjee, Amit Seru, and Vikrant Vig, 2010, Did Securitization Lead to Lax Screening? Evidence from Subprime Loans, *Quarterly Journal of Economics* 125, 307–362.

Khwaja, Asim Ijaz, and Atif Mian, 2008, Tracing the Impact of Bank Liquidity Shocks: Evidence from an Emerging Market, *American Economic Review* 98, 1413–1442.

Kishan, Ruby P., and Timothy P. Opiela, 2000, Bank Size, Bank Capital, and the Bank Lending Channel, *Journal of Money, Credit and Banking* 32, 121–141.

Kiyotaki, Nobuhiro, and John Moore, 1997, Credit Cycles, *Journal of Political Economy* 105, 211–248.

Kleibergen, Frank, and Richard Paap, 2006, Generalized reduced rank tests using the singular value decomposition, *Journal of Econometrics* 133, 97 – 126.

Leary, Mark T., 2009, Bank Loan Supply, Lender Choice, and Corporate Capital Structure, *Journal of Finance* 64, 1143–1185.

Leland, Hayne E., and David H. Pyle, 1977, Informational Asymmetries, Financial Structure, and Finanical Intermediation, *Journal of Finance* 32, 371–387.

Lemmon, Michael, and Michael R. Roberts, 2010, The Response of Corporate Financing and Investment to Changes in the Supply of Credit, *Journal of Financial and Quantitative Analysis* 45, 555–587.

Loutskina, Elena, and Philip E. Strahan, 2009, Securitization and the Declining Impact of Bank Finance on Loan Supply: Evidence from Mortgage Originations, *Journal of Finance* 64, 861–889.

Loutskina, Elena, and Philip E. Strahan, 2015, Financial Integration, Housing, and Economic Volatility, *Journal of Financial Economics* 115, 25–41.

Mian, Atif, and Amir Sufi, 2011, House Prices, Home Equity-Based Borrowing, and the US Household Leverage Crisis, *American Economic Review* 101, 2132–2156.

Morrison, Alan D., 2005, Credit Derivatives, Disintermediation, and Investment Decisions, *Journal of Business* 78, 621–648.

Myers, Stewart C., and Nicholas S. Majluf, 1984, Corporate financing and investment decisions when firms have information that investors do not have, *Journal of Financial Economics* 13, 187–221.

Paravisini, Daniel, 2008, Local Bank Financial Constraints and Firm Access to External Finance, *Journal of Finance* 63, 2161–2193.

Parlour, Christine A., and Guillaume Plantin, 2008, Loan Sales and Relationship Banking, *Journal of Finance* 63, 1291–1314.

Peek, Joe, and Eric S. Rosengren, 2000, Collateral Damage: Effects of the Japanese Bank Crisis on Real Activity in the United States, *American Economic Review* 90, 30–45.

Pennacchi, George G., 1988, Loan Sales and the Cost of Bank Capital, *Journal of Finance* 43, 375–396.

Rampini, Adriano A., and S. Viswanathan, 2010, Financial Intermediary Capital, Duke University Working Paper.

Saiz, Albert, 2010, The Geographic Determinants of Housing Supply, *Quarterly Journal of Economics* 125, 1253–1296.

Scharfstein, David S., and Jeremy C. Stein, 2000, The Dark Side of Internal Capital Markets: Divisional Rent-Seeking and Inefficient Investment, *Journal of Finance* 55, 2537–2564.

Schnabl, Philipp, 2012, The International Transmission of Bank Liquidity Shocks: Evidence from an Emerging Market, *Journal of Finance* 67, 897–932.

Stein, Jeremy C, 1997, Internal Capital Markets and the Competition for Corporate Resources, *Journal of Finance* 52, 111–133.

Stein, Jeremy C., 1998, An Adverse-Selection Model of Bank Asset and Liability Management with Implications for the Transmission of Monetary Policy, *RAND Journal of Economics* 29, 466–486.

Stiglitz, Joseph E., and Andrew Weiss, 1981, Credit Rationing in Markets with Imperfect Information, *American Economic Review* 71, 393–410.

Sufi, Amir, 2009, The Real Effects of Debt Certification: Evidence from the Introduction of Bank Loan Ratings, *Review of Financial Studies* 22, 1659–1691.

Tirole, Jean, 1985, Asset Bubbles and Overlapping Generations, *Econometrica* 53, 1499–1528.

Williamson, Stephen D., 1987, Costly Monitoring, Loan Contracts, and Equilibrium Credit Rationing, *Quarterly Journal of Economics* 102, 135–145.

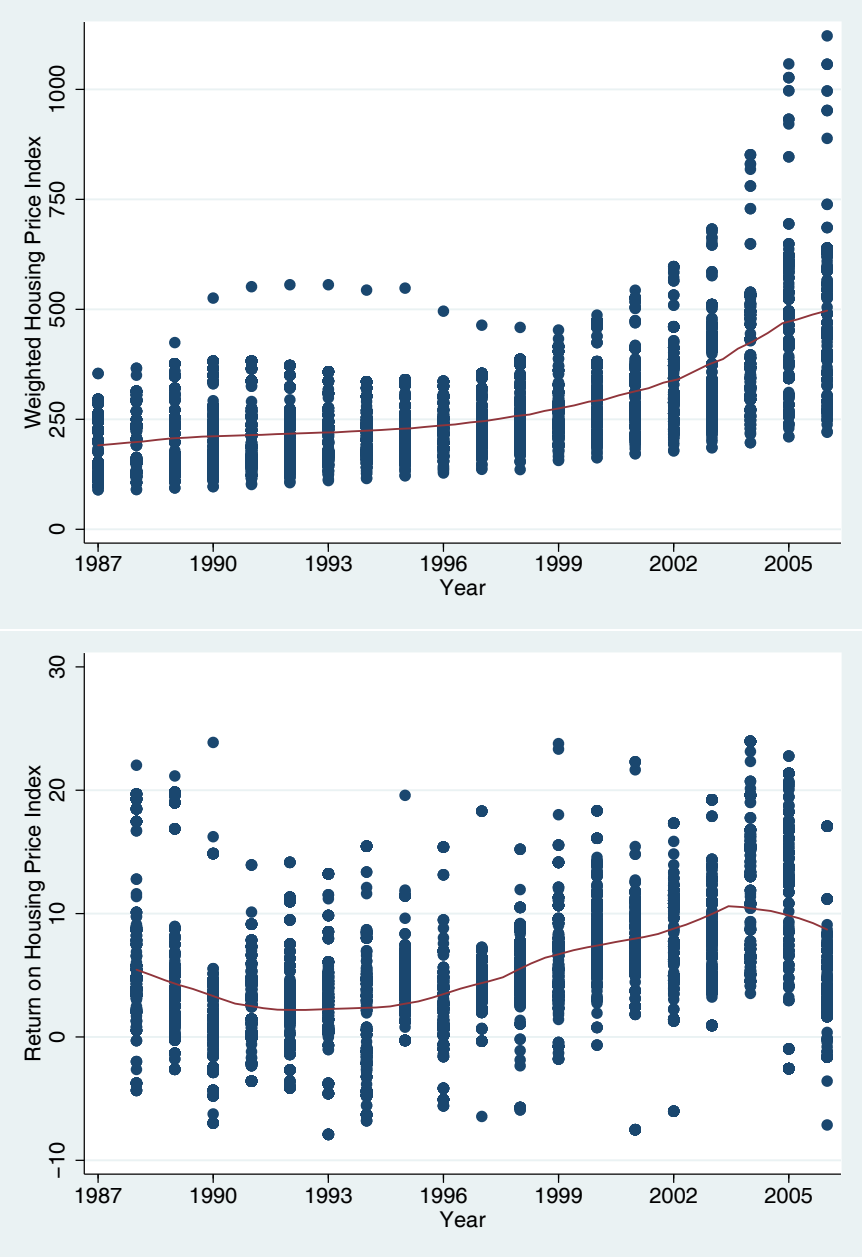

Figure 1: Housing prices in banks' deposit areas. This figure plots the weighted housing price index (top) and return on the weighted housing price index (bottom) in the locations where the bank has depository branches.

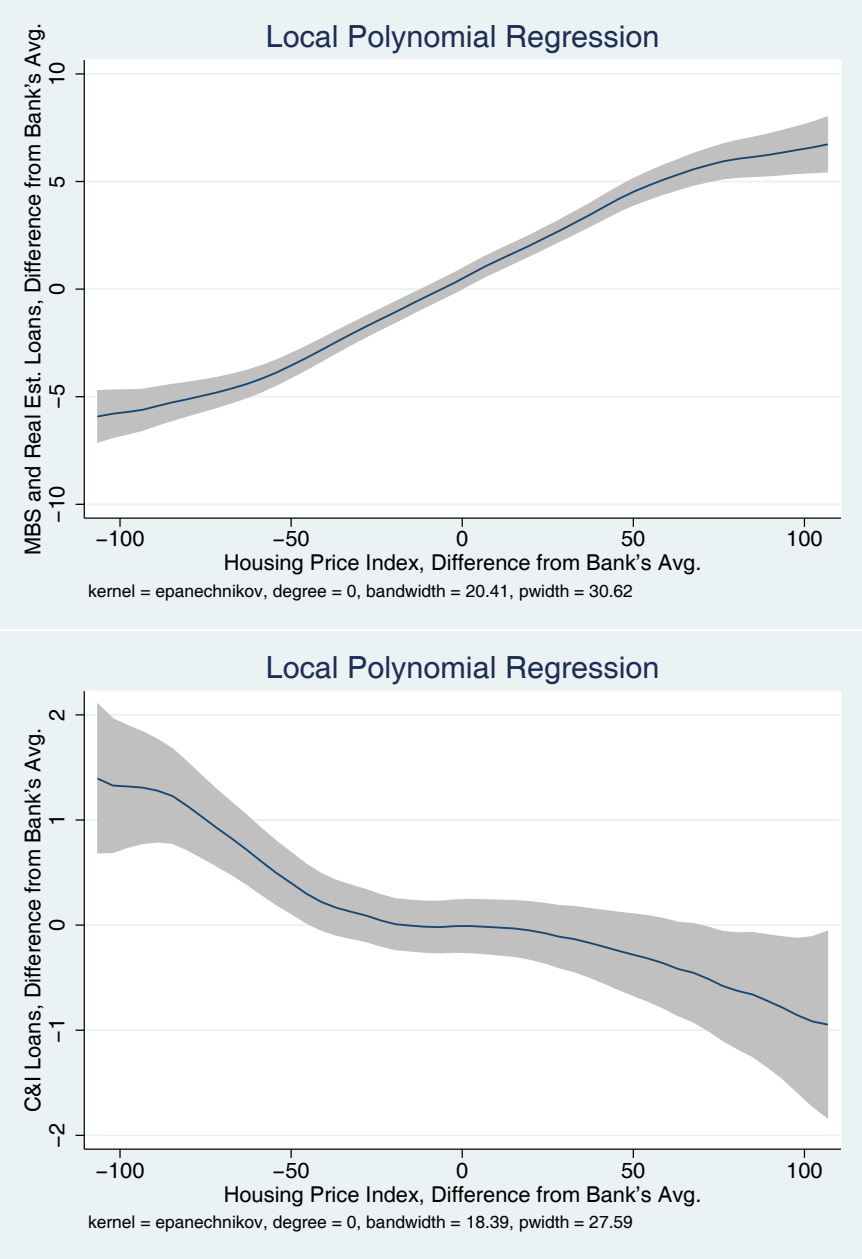

Figure 2: Relation between the housing price index and either MBS and real estate loans or C&I loans, demeaning each variable at the bank level. The top figure plots the fraction of the bank's total assets that are MBS and real estate loans (excluding commercial mortgages) against the prior year's housing prices where the bank has depository branches, relative to the bank's average levels. The bottom figure plots the fraction of the bank's total assets that are C&I loans against the prior year's housing price index where the bank has depository branches, relative to the bank's average levels. Both loan variables are scaled by 100. 95% confidence intervals provided for the local polynomial regression estimates.

Table I: Summary Statistics

This table presents summary statistics of the merged sample of bank holding companies and borrowing firms as obtained from Call Report, Dealscan, and Compustat databases. Panel A presents the summary statistics for the firm variables, the borrower-lender relationships, and the loan characteristics. Panel B presents the summary statistics for the bank balance sheet variables, housing price variables, and other macroeconomic variables used in the analysis. All firm, loan, and bank ratio variables are scaled by 100.

Panel A: Firm, Relationship, and Loan Variable Statistics						
	Mean	Std Dev	25th Pctile	Median	75th Pctile	# Obs.
Firm Variables						
Investment	29.7	45.3	10.5	18.5	32.7	60,995
Market to Book	1.68	1.45	1.05	1.33	1.83	53,404
Cash Flow	38.5	99.4	9.76	24.9	54.7	61,523
Firm Size	6.50	2.04	5.10	6.44	7.85	62,947
Book Leverage	34.6	27.1	17.2	31.4	45.9	62,780
Altman's Z-Score	1.28	3.19	0.69	1.49	2.35	59,155
Market Value of Buildings	1.28	2.27	0.30	0.69	1.31	19,436
Industry Land Intensity	6.62	7.60	2.40	3.30	8.80	62,538
Length/Frequency of Firm-Bank Relationships						
Length of Relationship	5.17	3.66	3	5	7	14,363
Number of Loan Packages	2.33	1.87	1	2	3	19,085
Loan Facilities per Loan Package	1.40	0.75	1	1	2	19,085
Number of Firm-Bank Relationships						
DealScan Lenders per Borrower	2.87	1.82	1	2	4	14,363
Bank Holding Companies per Borrower	2.45	1.53	1	2	3	12,881
Borrowers per DealScan Lender	316.7	375.8	62	181	457	14,363
Borrowers per Bank Holding Company	750.8	684.4	222	466	1800	12,881
DealScan Lenders per Bank Holding Company	21.9	18.3	7	15	33	654
Loan Characteristics						
All In Drawn Spread (bps)	181.7	131.5	75	162.5	262.0	21,523
Loan Amount	281.1	761.0	26.0	78.8	211.8	19,831
Maturity (months)	41.7	27.2	18	36	60	21,523
Takeover Loan	0.16	0.36	0	0	0	21,523
Revolving Credit Line	0.85	0.36	1	1	1	21,523

Table I—*Continued*

Panel B: Bank, Housing, and Macroeconomic Variable Statistics						
	Mean	Std Dev	25th Pctile	Median	75th Pctile	# Obs.
Bank Variables						
MBS	8.60	7.81	2.38	6.86	12.3	1,498
Real Estate Loans	20.0	10.4	13.1	19.2	25.9	1,498
Commercial Mortgages	8.97	5.90	4.82	8.04	11.7	1,498
C&I Loans	16.4	7.52	11.3	15.7	20.2	1,498
Consumer Loans	9.17	5.90	4.33	8.97	13.1	1,498
C&I Loan Profitability	7.21	2.40	5.72	7.35	8.67	1,497
Bank's Size	16.3	1.62	15.2	16.2	17.5	1,498
Bank's Equity Ratio	8.19	2.10	6.92	7.88	8.99	1,498
Bank's Net Income	1.08	0.49	0.90	1.12	1.33	1,498
Bank's Cost of Deposits	3.29	1.50	2.35	3.13	4.10	1,498
Securitization Activity	0.24	0.43	0	0	0	1,241
Employee Growth	8.81	40.5	-5.85	0.78	9.84	1,298
Housing Variables						
Housing Price Index, Bank's State(s)	298.5	104.0	230.2	272.2	349.1	66,443
Return on Housing, Bank's State(s)	6.25	7.59	2.23	5.48	10.00	65,477
Land Unavailability, Bank's State(s)	24.5	8.46	19.8	23.0	28.9	66,425
Office Price Index, Firm's State	166.3	77.6	120.9	141.2	190.2	70,578
Macroeconomic Variables						
Change in Unemp. Rate, Firm's State	-0.075	0.82	-0.60	-0.30	0.30	63,903
Change in Unemp. Rate, Bank's State(s)	-0.062	0.79	-0.58	-0.20	0.20	66,443
30-Year Mortgage Rate, Bank's State(s)	7.58	1.22	6.73	7.43	8.15	66,107

Table II: Bank Size and States of Operation

The table reports statistics on bank holding companies that operate between 1988 and 2006. *Total Deposits* are in billions USD for the year 2006. *Number of States* is the number of states the bank holding company has branches with deposits in 2006. The top 30 bank holding companies reported below are in decreasing order of total deposits in the year 2006.

Bank Holding Company	Total Deposits	Number of States
CITIGROUP INC.	841.36	14
BANK OF AMERICA CORPORATION	772.27	30
JPMORGAN CHASE & CO.	695.15	26
WACHOVIA CORPORATION	356.10	16
WELLS FARGO & COMPANY	327.19	23
U.S. BANCORP	135.94	26
SUNTRUST BANKS, INC.	126.57	12
HSBC HOLDINGS PLC	110.58	10
ROYAL BANK OF SCOTLAND GROUP PLC, THE	101.94	13
NATIONAL CITY CORPORATION	86.95	7
BB&T CORPORATION	83.59	12
STATE STREET CORPORATION	78.25	1
FIFTH THIRD BANCORP	72.08	10
ABN AMRO HOLDING N.V.	69.23	3
PNC FINANCIAL SERVICES GROUP, INC., THE	68.21	10
BANK OF NEW YORK COMPANY, INC., THE	67.54	8
KEYCORP	61.70	13
BNP PARIBAS SA	46.35	17
COMERICA INCORPORATED	45.88	6
NORTHERN TRUST CORPORATION	43.76	15
ALLIED IRISH BANKS, P.L.C.	40.34	7
MARSHALL & ILSLEY CORPORATION	34.43	7
BANK OF MONTREAL	30.46	5
MELLON FINANCIAL CORPORATION	28.86	7
HUNTINGTON BANCSHARES INCORPORATED	25.55	6
COMPASS BANCSHARES, INC.	23.30	6
DEUTSCHE BANK AKTIENGESELLSCHAFT	18.56	2
COLONIAL BANCGROUP, INC., THE	16.25	5
BOK FINANCIAL CORPORATION	12.46	6
COMMERCE BANCSHARES, INC.	11.75	4

Table III: Housing Price Regression

Columns (1) through (3) are panel fixed effect regressions. *Housing Price Index, Bank's State(s)* is the bank's specific housing price index, using state-level deposits as weights. All continuous independent variables scaled by their respective standard deviations. Standard errors are clustered by bank holding company and year.

	Housing Price Index, Bank's State(s)		
	(1)	(2)	(3)
	Coefficients for Full Sample		*Coefficients for Full Sample*
Bank's Size	21.38***	15.29***	12.72***
	(5.303)	(3.563)	(3.147)
Bank's Equity Ratio	2.309**	2.138**	1.940**
	(0.927)	(0.851)	(0.801)
Bank's Net Income	1.646***	1.820***	1.414***
	(0.439)	(0.491)	(0.386)
Bank's Cost of Deposits	2.264	1.886	1.712
	(1.471)	(1.305)	(1.199)
Change in Unemp. Rate, Bank's State(s)	1.501	1.584	1.939
	(2.101)	(1.960)	(1.780)
30-Year Mortgage Rate, Bank's State(s)		45.06***	29.45***
		(9.928)	(8.771)
			Coefficients for $1987-1998$
Land Unavailability, Bank's State(s)	32.99***	88.62***	40.15***
	(11.05)	(22.19)	(12.65)
Land Unavailability × Mortgage Rate		-59.69***	-10.64
		(17.42)	(7.122)
			Coefficients for $1999-2005$
Land Unavailability, Bank's State(s)			157.9***
			(34.65)
Land Unavailability × Mortgage Rate			-134.7***
			(38.50)
Bank Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
Observations	82232	82232	82232
Banks	8246	8246	8246
Adjusted R^2	0.899	0.910	0.919

Standard errors in parentheses. * p<0.10, ** p<0.05, *** p<0.01

Table IV: Investment Regression

Columns (1) through (6) are panel fixed effect regressions. *Investment* is the firm's capital expenditures divided by lagged net PP&E and scaled by 100. Columns (2), (4), and (6) use the unavailable land measure, the state-level 30-year mortgage rate, and their interaction as instruments. All continuous independent variables are scaled by their respective standard deviations. The first-stage for Columns (2), (4), and (6) are provided in Table A2. Standard errors are clustered by firm, bank, and year.

	Investment					
	(OLS)	(IV)	(OLS)	(IV)	(OLS)	(IV)
	(1)	(2)	(3)	(4)	(5)	(6)
Housing Price Index, Bank's State(s)	-1.340	-3.106**	-3.882**	-9.079***	-4.207**	-9.615***
	(1.283)	(1.458)	(1.956)	(2.003)	(1.912)	(2.658)
National Banks × HPI, Bank's State(s)			2.880***	4.699***	3.133***	7.019***
			(1.096)	(1.629)	(1.093)	(2.052)
Lagged Market to Book	9.123***	9.032***	9.116***	9.175***	9.022***	9.130***
	(0.608)	(0.498)	(0.600)	(0.559)	(0.661)	(0.628)
Cash Flow	8.682***	9.221***	8.678***	9.022***	8.633***	9.185***
	(1.153)	(1.084)	(1.156)	(1.128)	(1.161)	(1.025)
Lagged Firm Size	-19.12***	-18.07***	-19.07***	-18.05***	-19.04***	-18.46***
	(2.769)	(2.685)	(2.765)	(2.584)	(2.875)	(2.748)
Bank's Size	-2.713	-2.904*	-2.883*	-2.664*	-2.489	-2.278
	(1.724)	(1.662)	(1.585)	(1.458)	(1.631)	(1.511)
Bank's Equity Ratio	-0.369	-0.365	-0.339	-0.318	-0.415	-0.295
	(0.392)	(0.374)	(0.375)	(0.366)	(0.405)	(0.387)
Bank's Net Income	0.330	0.257	0.344	0.428	0.395	0.367
	(0.295)	(0.266)	(0.299)	(0.301)	(0.319)	(0.304)
Bank's Cost of Deposits	0.0244	-0.147	0.0857	-0.234	0.0826	-0.0357
	(0.799)	(0.766)	(0.702)	(0.659)	(0.554)	(0.529)
Change in Unemp. Rate, Firm's State	-0.900***	-0.849***	-0.869***	-0.692***		
	(0.279)	(0.260)	(0.281)	(0.241)		
Change in Unemp. Rate, Bank's State(s)	1.107*	0.860*	1.268**	1.309**	0.964	1.069*
	(0.572)	(0.517)	(0.567)	(0.537)	(0.634)	(0.606)
Firm-Bank Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	No	No
Firm's State-Year Fixed Effects	No	No	No	No	Yes	Yes
Observations	38600	38600	38600	38600	38553	38553
Firms	4812	4812	4812	4812	4808	4808
Banks	436	436	436	436	435	435
Adjusted R^2	0.465	0.465	0.466	0.465	0.466	0.466

Standard errors in parentheses. * p<.10, ** p<.05, *** p<.01

Table V: Investment Regression for Constrained and Unconstrained Banks

Columns (1) through (8) are panel fixed effect regressions. *Investment* is the firm's capital expenditures divided by lagged net PP&E and scaled by 100. All columns use the unavailable land measure, the state-level 30-year mortgage rate, and their interactions as instruments. Banks in the largest quintile by deposits are designated as unconstrained and banks outside the largest quintile are designated as constrained. Banks in the bottom two quintiles of equity to assets are designated as constrained and all other banks are designated as unconstrained. Banks without securitization activity are designated as constrained and banks with securitization activity are designated as unconstrained. Banks in the bottom two quintiles of employee growth are designated as constrained, and all other banks are designated as unconstrained. The bank-specific employee growth measure is calculated excluding the state where the firm operates and is at a one year lag. All continuous independent variables are scaled by their sample standard deviations. Standard errors are clustered by firm, bank, and year. The *Wald Test* provides the χ^2 statistic on whether the *Housing Price Index, Bank's State(s)* coefficient is statistically different across the constrained and unconstrained samples.

	Investment							
	Bank Size		Bank Leverage		Securitization Activity		Employee Growth	
	(Constrained)	(Unconstrained)	(Constrained)	(Unconstrained)	(Constrained)	(Unconstrained)	(Constrained)	(Unconstrained)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Housing Price Index, Bank's State(s)	-25.68***	-6.559***	-38.42**	-4.815*	-11.93**	-5.597***	-28.73***	-4.851
	(9.457)	(2.303)	(16.32)	(2.473)	(5.275)	(2.167)	(8.444)	(3.671)
Lagged Market to Book	8.323***	8.938***	5.949	8.888***	7.805***	10.68***	9.250***	10.12***
	(1.610)	(0.715)	(4.092)	(0.760)	(1.565)	(0.846)	(2.011)	(0.655)
Cash Flow	8.888***	7.712***	14.06***	7.462***	8.397***	7.372***	8.431***	6.309***
	(1.660)	(1.282)	(3.683)	(1.098)	(1.428)	(1.566)	(1.792)	(1.296)
Lagged Firm Size	-22.03***	-15.64***	-28.26***	-18.79***	-20.18***	-17.65***	-15.39***	-21.89***
	(4.507)	(3.431)	(8.275)	(3.214)	(5.078)	(4.113)	(5.398)	(5.249)
Bank's Size	-7.388**	0.813	-1.007	-1.807	-4.041	-2.235	-0.562	-5.127
	(3.447)	(2.135)	(5.403)	(2.199)	(3.317)	(2.319)	(2.281)	(6.736)
Bank's Equity Ratio	-1.445	-0.488	5.003	-0.417	-0.228	-0.105	1.516	-1.780
	(1.295)	(0.554)	(3.240)	(0.501)	(0.915)	(0.680)	(1.198)	(2.515)
Bank's Net Income	-0.716	0.815	0.511	0.696**	0.832	0.919	1.615*	-1.280
	(0.447)	(0.529)	(0.533)	(0.340)	(0.523)	(0.622)	(0.834)	(2.857)
Bank's Cost of Deposits	-12.07	-1.784	-0.887	-0.848	0.0882	-2.773**	-4.913***	-37.67
	(7.549)	(1.102)	(2.664)	(0.812)	(0.591)	(1.388)	(1.003)	(51.73)
Change in Unemp. Rate, Bank's State(s)	-0.790	0.803	0.120	0.677	1.523	0.300	2.094	0.831
	(0.822)	(0.708)	(1.641)	(0.702)	(1.092)	(0.972)	(1.969)	(1.562)
Wald Test:								
(Constrained Banks = Unconstrained Banks)	3.86**		4.14**		1.23		6.73***	
Firm-Bank Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm's State-Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	8999	29064	4865	31766	10741	23992	10575	18061
Firms	1880	3867	1302	4365	2292	3616	2521	3408
Banks	243	282	156	403	226	294	269	328
Adjusted R^2	0.492	0.485	0.581	0.491	0.518	0.489	0.609	0.466

Standard errors in parentheses. * p<0.10, ** p<0.05, *** p<0.01

Table VI: Investment Regression for Constrained and Unconstrained Firms

Columns (1) through (6) are panel fixed effect regressions. *Investment* is the firm's capital expenditures divided by lagged net PP&E and scaled by 100. All columns use the unavailable land measure, the state-level 30-year mortgage rate, and their interactions as instruments. Splitting the sample into terciles by firm size, constrained firms are the bottom tercile and unconstrained firms are the top tercile (Columns (1) and (2)). In Columns (3) and (4), firms with any public bond rating are designated as unconstrained and firms without any rating are designated as constrained. Firm-bank observations that contain a credit line are designated as unconstrained and firm-bank observations without a credit line are designated as constrained (Columns (5) and (6)). All continuous independent variables are scaled by their sample standard deviations. Standard errors are clustered by firm, bank, and year. The *Wald Test* provides the χ^2 statistic on whether the *Housing Price Index, Bank's State(s)* coefficient is statistically different across the constrained and unconstrained samples.

	Investment					
	Firm Size		Bond Ratings		Credit Line	
	(Constrained)	(Unconstrained)	(Constrained)	(Unconstrained)	(Constrained)	(Unconstrained)
	(1)	(2)	(3)	(4)	(5)	(6)
Housing Price Index, Bank's State(s)	-19.12***	1.014	-11.74***	-3.728	-37.37**	-7.425***
	(5.062)	(2.734)	(3.723)	(3.606)	(15.48)	(1.904)
National Banks × HPI, Bank's State(s)	5.240	1.501	4.118	1.962	15.43*	3.815***
	(5.424)	(1.433)	(2.568)	(1.573)	(7.943)	(1.197)
Lagged Market to Book	8.359***	4.628***	9.398***	6.191***	4.956***	9.372***
	(1.351)	(1.535)	(0.690)	(1.555)	(1.322)	(0.715)
Cash Flow	6.494***	8.853***	8.360***	7.284***	8.570***	8.576***
	(1.276)	(1.779)	(1.370)	(1.381)	(3.104)	(1.101)
Lagged Firm Size	-27.55***	-11.46***	-20.64***	-19.78***	-5.250	-19.81***
	(5.408)	(2.181)	(3.749)	(4.435)	(6.060)	(2.977)
Bank's Size	-3.524	-0.548	-3.069	-1.397	29.51	0.0347
	(3.169)	(2.120)	(2.312)	(2.057)	(26.09)	(1.382)
Bank's Equity Ratio	-0.440	-0.401	-0.579	-0.0246	-2.237	-0.112
	(0.866)	(0.418)	(0.589)	(0.470)	(1.541)	(0.495)
Bank's Net Income	0.204	-0.222	0.393	0.0561	3.529***	0.272
	(0.744)	(0.232)	(0.465)	(0.260)	(1.364)	(0.372)
Bank's Cost of Deposits	0.142	-0.126	0.353	-0.116	-2.951	-0.0155
	(0.855)	(0.581)	(0.585)	(0.675)	(1.877)	(0.580)
Change in Unemp. Rate, Bank's State(s)	0.942	1.271	1.370	0.768	4.938**	0.865
	(1.339)	(0.874)	(0.924)	(0.772)	(1.925)	(0.637)
Wald Test:						
(Constrained Firms = Unconstrained Firms)	12.25***		2.39		3.69*	
Firm-Bank Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Firm's State-Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	13513	11117	21354	16543	4150	34456
Firms	2552	1181	3492	1822	851	4564
Banks	364	155	401	241	227	388
Adjusted R^2	0.450	0.731	0.457	0.539	0.423	0.479

Standard errors in parentheses. * p<0.10, ** p<0.05, *** p<0.01

Table VII: Investment Regression: Robustness Checks

Columns (1) through (8) are panel fixed effect regressions. *Investment* is the firm's capital expenditures divided by lagged net PP&E and scaled by 100. Columns (2), (4), (6), and (8) use the unavailable land measure, the state-level 30-year mortgage rate, and their interaction as instruments. Columns (1) and (2) include the housing price index of the firm's state as an additional control. Columns (3) and (4) include fixed effects at the firm's county-year level. Columns (5) and (6) exclude firm-bank-year observations where the firm's state matches one of the bank's five largest deposit states. Columns (7) and (8) exclude firm-bank-year observations in the top tercile by land intensity. All continuous independent variables are scaled by their respective standard deviations. Standard errors are clustered by firm, bank, and year.

	Investment							
	Include Firm's State HPI		County-Level Fixed Effects		Exclude Overlapping States		Exclude Land Intensive Industries	
	(OLS)	(IV)	(OLS)	(IV)	(OLS)	(IV)	(OLS)	(IV)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Housing Price Index, Bank's State(s)	-3.816**	-6.079***	-4.524***	-9.527***	-3.154	-7.983***	-2.979	-5.176**
	(1.889)	(2.307)	(1.667)	(1.295)	(2.514)	(2.454)	(1.959)	(2.081)
National Banks × HPI, Bank's State(s)	2.873***	3.450**	3.269***	4.310**	2.326*	7.329***	2.562**	2.885**
	(1.083)	(1.463)	(0.986)	(1.762)	(1.387)	(1.773)	(1.124)	(1.398)
Housing Price Index, Firm's State	-0.483	-0.332						
	(1.054)	(1.034)						
Lagged Market to Book	9.111***	9.107***	8.927***	9.280***	8.944***	9.130***	7.453***	7.459***
	(0.595)	(0.592)	(0.941)	(0.873)	(1.349)	(1.194)	(0.838)	(0.743)
Cash Flow	8.678***	8.679***	8.493***	8.413***	6.888***	6.994***	7.084***	7.460***
	(1.156)	(1.156)	(1.214)	(1.068)	(1.359)	(1.296)	(1.124)	(1.003)
Lagged Firm Size	-19.07***	-18.99***	-19.69***	-18.60***	-21.96***	-22.17***	-14.29***	-12.81***
	(2.766)	(2.759)	(2.936)	(2.401)	(4.688)	(4.562)	(2.928)	(2.634)
Bank's Size	-2.874*	-2.890*	-0.365	0.495	-3.080	-3.317**	-0.511	-1.701
	(1.580)	(1.593)	(1.488)	(1.234)	(2.244)	(1.602)	(1.709)	(1.573)
Bank's Equity Ratio	-0.346	-0.332	-0.708	-0.541	-0.908	-0.865	0.0751	0.482
	(0.375)	(0.377)	(0.460)	(0.442)	(0.683)	(0.600)	(0.489)	(0.441)
Bank's Net Income	0.349	0.408	0.367	0.484**	0.291	0.306	0.395	0.163
	(0.300)	(0.311)	(0.306)	(0.244)	(0.333)	(0.325)	(0.344)	(0.270)
Bank's Cost of Deposits	0.0923	0.0482	-0.555	-0.612	1.331*	1.234*	0.104	0.427
	(0.696)	(0.694)	(0.587)	(0.500)	(0.775)	(0.721)	(0.764)	(0.667)
Change in Unemp. Rate, Firm's State	-0.854***	-0.838***						
	(0.282)	(0.282)						
Change in Unemp. Rate, Bank's State(s)	1.272**	1.382**	0.791	1.188**	1.158	1.324**	1.164*	1.162*
	(0.568)	(0.556)	(0.546)	(0.515)	(0.705)	(0.622)	(0.671)	(0.598)
Firm-Bank Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	No	No	No	No	No	No
Firm's State-Year Fixed Effects	No	No	No	No	Yes	Yes	Yes	Yes
Firm's County-Year Fixed Effects	No	No	Yes	Yes	No	No	No	No
Observations	38600	38600	35868	35868	20660	20660	25328	25328
Firms	4812	4812	4510	4510	2917	2917	3258	3258
Banks	436	436	423	423	318	318	357	357
Adjusted R^2	0.466	0.465	0.498	0.497	0.479	0.478	0.498	0.497

Standard errors in parentheses. * p<0.10, ** p<0.05, *** p<0.01

Table VIII: Interest Rate Regression

Columns (1) through (6) are panel fixed effect regressions. The *All In Drawn Spread* is the spread paid over LIBOR for each dollar of loan drawn, in basis points. All columns use the unavailable land measure, the state-level 30-year mortgage rate, and their interactions as instruments. Splitting the sample into terciles by firm size, constrained firms are the bottom tercile and unconstrained firms are the top tercile. Firms with any public bond rating are designated as unconstrained and firms without any rating are designated as constrained. Firm-bank observations that contain a credit line are designated as unconstrained and firm-bank observations without a credit line are designated as constrained. All continuous independent variables are scaled by their sample standard deviations. Standard errors are clustered by firm, bank, and year. The *Wald Test* provides the χ^2 statistic on whether the *Housing Price Index, Bank's State(s)* coefficient is statistically different across the constrained and unconstrained samples.

	All In Drawn Spread					
	Firm Size		Bond Ratings		Credit Line	
	(Constrained)	(Unconstrained)	(Constrained)	(Unconstrained)	(Constrained)	(Unconstrained)
	(1)	(2)	(3)	(4)	(5)	(6)
Housing Price Index, Bank's State(s)	59.99***	2.477	20.21**	9.689	42.44	5.337
	(17.90)	(6.559)	(8.777)	(9.465)	(30.35)	(7.029)
National Banks × HPI, Bank's State(s)	6.094	-2.408	-1.267	-5.310	4.021	-2.935
	(9.913)	(5.281)	(8.438)	(5.892)	(17.75)	(7.744)
Lagged Book Leverage	19.24***	20.79***	23.56***	20.12***	10.58*	25.05***
	(2.870)	(2.472)	(2.203)	(3.112)	(5.980)	(2.187)
Lagged Market to Book	-11.41***	-10.50**	-11.35***	-18.25***	-9.930*	-12.57***
	(1.210)	(4.374)	(1.846)	(5.086)	(5.659)	(1.949)
Lagged Altman's Z-Score	-7.179**	-26.80***	-11.38***	-22.18***	-2.943	-14.61***
	(3.032)	(3.949)	(2.668)	(4.249)	(8.676)	(2.443)
Lagged Firm Size	-60.39***	-40.44***	-65.81***	-66.43***	-56.16***	-67.83***
	(7.880)	(3.936)	(3.495)	(3.345)	(7.458)	(1.876)
Loan Amount to Lagged PPE	-0.374	18.28***	1.998	7.409***	-3.399	3.364**
	(2.110)	(3.527)	(1.798)	(2.393)	(4.099)	(1.467)
Log(Maturity)	-23.51***	6.734*	-22.25***	-0.0925	-22.85***	-10.47***
	(2.491)	(3.892)	(2.624)	(4.305)	(4.547)	(3.712)
Takeover Loan	29.11***	28.13***	36.37***	32.61***	21.33	31.87***
	(4.069)	(5.524)	(4.276)	(5.080)	(18.34)	(3.973)
Revolving Credit Line	23.49**	-32.17***	19.95**	-30.58***		
	(9.265)	(8.166)	(8.808)	(10.25)		
Bank's Size	-34.11**	8.301	-3.867	-12.53	-111.1***	-3.845
	(15.30)	(11.53)	(12.62)	(14.32)	(40.27)	(12.06)
Bank's Equity Ratio	1.930	5.554	0.561	1.952	-2.922	1.043
	(4.157)	(3.695)	(4.185)	(3.560)	(9.268)	(3.228)
Bank's Net Income	0.272	-0.760	0.127	1.267	0.202	1.402
	(2.819)	(2.891)	(2.427)	(2.125)	(6.811)	(1.634)
Bank's Cost of Deposits	-5.032	-1.480	-2.805	6.104**	1.073	-0.378
	(5.893)	(6.971)	(3.024)	(2.814)	(24.36)	(3.484)
Change in Unemp. Rate, Bank's State(s)	-4.021	10.90**	-3.929	4.678	4.836	-0.889
	(5.959)	(4.386)	(3.956)	(5.003)	(10.16)	(3.006)
Wald Test:						
(Constrained Firms = Unconstrained Firms)	9.10***		0.66		1.42	
Bank Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Firm's State-Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3974	3538	6989	5114	1196	10881
Firms	2358	1050	3517	1643	889	4409
Banks	320	117	369	200	203	351
Adjusted R^2	0.283	0.351	0.381	0.424	0.359	0.462

Standard errors in parentheses. * p<0.10, ** p<0.05, *** p<0.01

Table IX: Loan Amount Regression: Firms with Multiple Lenders

Columns (1) and (2) are panel fixed effect regressions. *Loan Amount* is the dollar amount of the loan package divided by the firm's lagged net PP&E and scaled by 100. Column (2) uses the unavailable land measure, the state-level 30-year mortgage rate, and their interaction as instruments. *High Housing Prices, Bank's State(s)* is an indicator if the bank holding company's housing price index is above the median in a given year. All continuous independent variables are scaled by their respective standard deviations. Standard errors are clustered by firm, bank holding company, and year.

	Loan Amount	
	(OLS)	(IV)
	(1)	(2)
High Housing Prices, Bank's State(s)	-101.3*	-149.1**
	(59.07)	(67.49)
Takeover Loan	66.80**	53.56**
	(28.11)	(22.81)
Revolving Credit Line	65.72***	69.43***
	(24.14)	(23.98)
Bank's Size	-183.7*	-118.5*
	(94.44)	(62.53)
Bank's Equity Ratio	9.526	36.74
	(39.13)	(30.57)
Bank's Net Income	-7.305	-14.78
	(16.91)	(14.68)
Bank's Cost of Deposits	-19.59	-29.65
	(35.98)	(33.67)
Change in Unemp. Rate, Bank's State(s)	2.137	0.143
	(38.50)	(27.07)
Bank Fixed Effects	Yes	Yes
Firm-Year Fixed Effects	Yes	Yes
Observations	2606	2606
Firms	945	945
Banks	59	59
Adjusted R^2	0.953	0.953

Standard errors in parentheses. * p<0.10, ** p<0.05, *** p<0.01

Table X: Bank Asset Regression

Columns (1) through (14) are panel fixed effect regressions. The loan variables (*Real Estate Loans*, *MBS*, *Commercial Mortgages*, *C&I Loans*, *Consumer Loans*) are log transformations of their dollar amounts. Columns (1) through (10) use the entire sample of bank holding companies from the *all banks panel*. Columns (11) through (14) use a subsample of constrained banks, defined as banks below the median as ranked by total deposits. Columns (2), (4), and (6) use the unavailable land measure as an instrument. Columns (8), (10), (12), and (14) use the unavailable land measure, the state-level 30-year mortgage rate, and their interaction as instruments. All independent variables are scaled by their respective standard deviations. Standard errors are clustered by bank holding company and year.

	Log(Loans)													
	All Banks										Constrained Banks			
	Real Estate Loans		MBS		Commercial Mortgages		C&I Loans		Consumer Loans		C&I Loans		Consumer Loans	
	(OLS)	(IV)	(OLS)	(IV)	(OLS)	(IV)	(OLS)	(IV)	(OLS)	(IV)	(OLS)	(IV)	(OLS)	(IV)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Housing Price Index, Bank's State(s)	0.0812***	0.544**	0.0564	0.626	0.0604***	0.436**	0.0259*	-0.0821*	-0.0391**	-0.336***	-0.0176	-0.174**	-0.0486*	-0.361***
	(0.0177)	(0.223)	(0.0369)	(0.401)	(0.0213)	(0.218)	(0.0146)	(0.0483)	(0.0175)	(0.106)	(0.0340)	(0.0728)	(0.0286)	(0.0808)
Bank's Size (excl. loans)	0.508***	0.445***	0.491***	0.415***	0.604***	0.553***	0.543***	0.558***	0.422***	0.463***	0.289***	0.287***	0.217***	0.222***
	(0.0332)	(0.0368)	(0.0709)	(0.0847)	(0.0371)	(0.0408)	(0.0314)	(0.0338)	(0.0286)	(0.0325)	(0.0370)	(0.0360)	(0.0257)	(0.0257)
Bank's Equity Ratio	-0.0911***	-0.0960***	-0.108***	-0.113***	-0.108***	-0.112***	-0.0765***	-0.0754***	-0.0798***	-0.0760***	-0.0926***	-0.0958***	-0.0817***	-0.0862***
	(0.00863)	(0.00879)	(0.0214)	(0.0213)	(0.0118)	(0.0116)	(0.0102)	(0.0103)	(0.00863)	(0.00920)	(0.0108)	(0.0109)	(0.00821)	(0.00838)
Bank's Net Income	0.0540***	0.0428***	0.00328	-0.00979	0.0230***	0.0137	0.0371***	0.0398***	0.0443***	0.0513***	0.0276***	0.0308***	0.0375***	0.0445***
	(0.00706)	(0.00827)	(0.0135)	(0.0160)	(0.00697)	(0.00868)	(0.00539)	(0.00566)	(0.00545)	(0.00545)	(0.00613)	(0.00639)	(0.00541)	(0.00490)
Bank's Cost of Deposits	0.0685**	0.0494*	0.0327	0.0109	0.0807**	0.0639*	0.0114	0.0158	-0.0153	-0.00197	0.0354*	0.0364*	0.0170	0.0166
	(0.0319)	(0.0286)	(0.0338)	(0.0361)	(0.0360)	(0.0338)	(0.0133)	(0.0144)	(0.0106)	(0.0132)	(0.0196)	(0.0194)	(0.0158)	(0.0163)
Change in Unemp. Rate, Bank's State(s)	0.0123*	0.00364	-0.0281	-0.0370	0.0197*	0.0128	0.0129	0.0149	-0.00696	-0.00133	0.0183	0.0261*	-0.00289	0.00787
	(0.00711)	(0.0119)	(0.0180)	(0.0255)	(0.0113)	(0.0122)	(0.00913)	(0.0106)	(0.00521)	(0.00916)	(0.0148)	(0.0141)	(0.00395)	(0.00777)
Bank Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	82040	82040	66005	66005	80957	80957	81886	81886	81949	81949	40559	40559	40608	40608
Banks	8231	8231	7187	7187	8166	8166	8214	8214	8217	8217	4977	4977	4973	4973
Adjusted R^2	0.952	0.943	0.771	0.765	0.923	0.920	0.930	0.930	0.928	0.924	0.819	0.819	0.852	0.848

Standard errors in parentheses. * p<0.10, ** p<0.05, *** p<0.01

Table XI: C&I Loan Profitability Regression

Columns (1) through (4) are panel fixed effect regressions. *C&I Loan Profitability* is defined as interest and fee income on C&I loans divided by the amount of C&I loans, scaled as a percent. Columns (3) and (4) use the unavailable land measure, the state-level 30-year mortgage rate, and their interaction as instruments. *Constrained Banks* is defined as banks below the median as ranked by total deposits. All continuous independent variables are scaled by their sample standard deviations. Standard errors are clustered by bank holding company and year.

	C&I Loan Profitability			
	(OLS)	(OLS)	(IV)	(IV)
	(1)	(2)	(3)	(4)
Constrained Banks	0.574***	0.599***	0.658***	0.00598
	(0.0926)	(0.0864)	(0.0798)	(0.356)
Housing Price Index, Bank's State(s)		0.0593**	0.201***	0.166***
		(0.0251)	(0.0420)	(0.0455)
Constrained Banks × HPI, Bank's State(s)				0.223**
				(0.112)
Bank's Equity Ratio	-0.00281	-0.00199	-0.0000448	0.000779
	(0.0282)	(0.0285)	(0.0297)	(0.0299)
Bank's Net Income	0.0777**	0.0836**	0.0977***	0.0997***
	(0.0353)	(0.0338)	(0.0332)	(0.0339)
Bank's Cost of Deposits	0.0495	0.0741	0.133	0.127
	(0.0927)	(0.0922)	(0.0971)	(0.0947)
Change in Unemp. Rate, Bank's State(s)	-0.000262	0.00240	0.00875	0.00360
	(0.0378)	(0.0338)	(0.0363)	(0.0396)
Year Fixed Effects	Yes	Yes	Yes	Yes
Observations	34748	34748	34748	34748
Banks	6134	6134	6134	6134
Adjusted R^2	0.154	0.155	0.151	0.150

Standard errors in parentheses. * p<0.10, ** p<0.05, *** p<0.01

Appendices

A Data Appendix

A.1 Panel Construction: Additional Details

Our main analysis utilizes three panels: the *relationship panel*, the *loan panel*, and the *all banks panel* (discussed in Section II). Because we utilize several different data sources, we have different samples of firms and banks. Specifically, we use both Compustat and DealScan for firm-related information, and DealScan and Call Report for bank-related information. In the *relationship panel* and the *loan panel*, we focus on firms that are matched across both Compustat and DealScan, which is discussed in more detail in Appendix A.2. The *all banks panel* does not require firm specific data.

On the bank side, we have two different "units" for a bank: the consolidated bank holding company (BHC) and the individual financial lender that undertakes the loan in the DealScan data. Which unit we use to denote a "bank" depends on the panel in question: in the *relationship panel* we use the DealScan lender identifier as the bank unit whereas in the *loan panel* and the *all banks panel* we use the Call Report BHC level identifier as the bank unit. Here we are weighing the following trade-offs: using DealScan lender as a unit allows for finer application of fixed effects, (e.g. controlling for persistent differences in lending behavior across subsidiaries in the same holding company) but loses potential observations and data as any fixed effects require multiple observations (e.g. a given BHC will have more loan observations collectively than the individual DealScan lenders that are its subsidiaries).

A.2 Matching and Variable Construction: Additional Details

DealScan contains both sole-lender loans and syndicated loans. In the case of syndicated loans with multiple lenders, we consider the relationship bank to be the one which serves as lead agent on the loan. In determining the lead agent on a loan, we follow a procedure very similar to Bharath, Dahiya, Saunders, and Srinivasan (2011). There are two variables in DealScan that are useful in determining the lead agent, a text variable that defines the lender role and a yes/no lead arranger credit variable. After carefully investigating the use of these variables in the data, we developed the following ranking hierarchy: 1) lender is denoted as "Admin Agent", 2) lender is denoted as "Lead bank", 3) lender is denoted as "Lead arranger", 4) lender is denoted as "Mandated lead arranger", 5) lender is denoted as "Mandated arranger", 6) lender is denoted as either "Arranger" or "Agent" and has a "yes" for the lead arranger credit, 7) lender is denoted as either "Arranger" or "Agent" and has a "no" for the lead arranger credit, 8) lender has a "yes" for the lead arranger credit but has a role other than those previously listed ("Participant" and "Secondary investor" are also excluded), 9) lender has a "no" for the lead arranger credit but has a role other than those previously listed ("Participant" and "Secondary investor" are also excluded), and 10) lender is denoted as a "Participant" or "Secondary investor". For a given loan package, the lender with

the highest title (following our ten-part hierarchy) is considered the lead agent. About 90% of the matched loan packages in our sample have a bank that falls under the one of the first six categories. Any loan where a single lead agent cannot be determined is excluded from the sample, which accounts for about 20% of loan packages.

The specific relationship length between a lender and borrower is determined in part by the stated maturity dates of loan packages. For those observations without sufficient maturity data to determine the relationship length, we assume the median sample relationship length of five years. 1,014 of 14,363 firm-bank pairs do not have sufficient data to determine the relationship length. We can also set the missing relationship lengths to the median loan maturity of three years (as opposed to general relationship length of five years), one year (assuming the relationship exists only in the year of origination), or exclude these firm-bank pairs entirely. Our main results are robust to these different assumptions.

As DealScan focuses on providing detailed information about the terms of the loan packages, it provides only limited data on the borrowing firms and lending banks. Following Chava and Roberts (2008), we link the DealScan borrowers to Compustat for firm-specific information using their link table. For the lending banks, we create our own link table which matches DealScan lenders to their bank holding companies in the Call Report data. As the DealScan lending data is for individual bank or financial companies, there can be multiple DealScan lenders to each BHC. We choose to match to the BHC as it provides the most complete picture of the bank's finances—this choice assumes that the BHC influences its subsidiary banks' policies for lending, which we believe to be reasonable. We are able to match 753 DealScan lenders to 120 BHCs in the Call Report data.[45] These matches are determined by hand using the FDIC's Summary of Deposits data and other available data on historical BHC structures. We present the statistics on the number of relationships between borrowers, DealScan lenders, and BHCs in Panel A of Table I. The median bank holding company in our sample has 15 DealScan lenders associated with it. The median borrower in our sample has relationships with two DealScan lenders. The median DealScan lender has 181 different Compustat-matched borrowers in our sample, whereas the median BHC has 466 borrowers.

There is a significant amount of consolidation in the U.S. banking sector during our sample period. As such, we update the current holding company for lenders over time. The Summary of Deposits data is helpful for this task, as are historical press releases about different mergers between banks. We assume that the relationship between borrower and lender continues under the new BHC for the length of the loan, and any subsequent loans under that same DealScan lender. The main difference is that the bank characteristics that we use as controls change with mergers to reflect the new BHC.

For our analysis we use Call Report data from the fourth quarter of each year, aggregated to the BHC level using the RSSD9348 variable. In our analysis, a bank's real estate exposure

[45] Of these 753 lenders, 654 lenders (and 106 BHCs) have borrowers that can be matched to Compustat and are included in our main sample.

is measured by two key variables: mortgage-backed securities (RCFD8639) and loans secured by real estate (RCFD1410).[46,47] The mortgage-backed securities (MBS) include two major types: (1) traditional pass-through securities and (2) other security types, including collateralized mortgage obligations (CMOs), real estate mortgage investment conduits (REMICs), and stripped MBS. The banks also denote whether these securities are composed of agency-backed mortgages (GNMA, FNMA, FHLMC) or non-agency mortgages. Loans secured by real estate include all loans, regardless of purpose, that are secured primarily by real estate. Types of security include mortgages, deeds of trust, land contracts, and other instruments. Loans secured by real estate can be first or junior liens (including equity loans and second mortgages on real estate) and stand in contrast to MBS holdings as they are not securitized pools. For our analysis, we separate commercial mortgages (RCON1480) from the remaining real estate loans.

Using state-level data on credit intermediation employment levels from the Bureau of Labor Statistics, we construct a BHC measure of employee growth as follows: we divide the number of reported employees in a given state among active BHCs in that state depending on their share of the state's total deposits.[48] We then aggregate the employment levels across all the states where a BHC reports deposits to obtain a BHC-specific employment level. Finally, we calculate yearly BHC-level employee growth rates using these BHC-specific employment levels. This variable assumes that the bank holding companies account for all credit intermediation employment reported by the BLS and that this employment is proportional to the amount of deposits at given banks. Although these assumptions are not strictly true, we believe this variable broadly captures differences in employment growth at different banks.

All firm and bank variables that are ratios are winsorized at the 1 and 99 percentiles, with the exception of the cash flow variable. The cash flow variable is winsorized at the 2.5 and 97.5 percentiles because of more extreme outliers. The housing price results are robust to winsorizing the cash flow variable at the 1 and 99 percentiles.

A.3 Construction and Assumptions of Housing Variable

We use the Federal Housing Finance Agency (FHFA) House Price Index (HPI) data as the basis for our bank housing exposure variable. The HPI is a weighted, repeat-sales index, which measures average price changes in repeat sales or refinancings. The homes included in the HPI are individual single-family residential properties on which at least two mortgages were originated and subsequently purchased by Fannie Mae or Freddie Mac. The state-level housing price indices are

[46] RCFD8639 only becomes available in 1994. We measure MBS before 1994 as the sum of two variables: (1) all holdings of private (non-agency) certificates of participation in pools of residential mortgages—book value (RCFD0408) and (2) all holdings of U.S. government issued or guaranteed certificates of participation in pools of residential mortgages—book value (RCFD0602).

[47] Additional real estate exposure for banks is captured by two additional variables: (1) premises and other fixed assets (RCFD2145) and (2) other real estate owned (RCFD2150), which includes properties held from foreclosure and direct and indirect investments in real estate ventures. Including these variables does not materially affect our results.

[48] The FDIC Summary of Deposits data is discussed in more detail in Section II.D.

normalized to 100 in the first quarter of 1980. One issue that arises is comparability across state price indices. Because all the state-level FHFA indices are set to 100 in 1980, the index value of 100 corresponds to different dollar amounts in each state.[49] If unadjusted, the price level of banks located in high-price states will be understated compared to banks located in lower-price states. As the geography of deposit bases for each bank holding company are varying annually, this mismeasurement will not be fixed by BHC-level fixed effects. To address this issue, we adjust each state's HPI so that its index level corresponds to the same dollar amount. Specifically, we use the estimated median house price in the fourth quarter of 2000 divided by the state HPI from the fourth quarter of 2000 to find the state's index value in dollars.[50] We then scale each state's index so that an index value of 100 corresponds to $50,000 in every state.[51]

We should note that the use of a deposit-weighted housing price index variable to capture exposure of banks to real estate requires an assumption. We assume that banks make at least some portion of their real estate loans in the geographical region of their branches. We believe this is a reasonable assumption because real estate loans are somewhat complex consumer-level transactions, so they are most likely to be originated in places where banks have branches and a general physical presence. A larger physical presence should also lead to a larger amount of deposits in those areas.

A concern may be that the rise of mortgage-backed securities has allowed banks to diversify exposure away from any single geographical location.[52] However, such a concern does not seem warranted in our sample. Our assumption that banks have some exposure to local real estate is supported by an inspection of our data set, which shows that traditional real estate loans remain the dominant real estate asset on bank balance sheets. In our sample, banks have an average of 28.97% of assets in real estate loans (residential and commercial), compared to 8.59% for mortgage-backed securities. Even focusing on the later part of our sample (1999–2006), when MBS gained popularity, on average 12.3% of assets are MBS compared to 32.7% for traditional real estate loans.

[49] This problem is even more apparent in the MSA data, where the indices are set to 100 in 1995. If unadjusted, all banks, regardless of geographical deposit variation, would have a value of 100 in that year.

[50] Estimated median house price data is available for select years on the FHFA website (`http:\www.fhfa.gov`).

[51] We perform the same correction for the MSA-level housing price indices such that 100 again corresponds to $50,000.

[52] The development of mortgage-backed securities, which allows banks that originate mortgages to unload the capital requirements and risk of these loans by organizing them into pools and selling shares of these assets, mitigates the concentration of real estate lending in the states where the banks have a physical presence. However, even when these loans are sold, banks are likely to remain as servicers of the mortgage and maintain exposure to the local market. Further, MBS contracts are structured such that banks are often liable to take back mortgages that are deemed unfit for a given mortgage pool. When banks sponsor (create) the mortgage-backed security, as opposed to simply selling the mortgages to another unrelated sponsor, they often maintain a certain share of the security as a signal of its quality. (See Demiroglu and James (2012) for more details.) When the securities are tranche-structured, as with a CMO, the sponsoring bank typically holds a share of the junior or equity tranche. These practices maintain some of the bank's local exposure to real estate, even if much of the risk is diversified. See Section I.A.2 for additional discussion.

A.4 Investment Regression First-Stage Results

Table A2 presents the first-stage regressions associated with Table IV in Section III.A. Column 1 is the first-stage regression associated with Column 2 in Table IV. Here we split the land unavailability measure into two parts to better capture the differential effect of the housing boom in the second half of our sample. We choose to leave the mortgage rate as a single variable across our sample. Although allowing a differential effect generates similar results, we use the more parsimonious instrument set for our main results. As the land unavailability measure is split into two parts, its interaction with the mortgage rate is split as well. For this specification, we find results similar to Table III. Here we do not scale the instrumental variables to be marginal effects.

Columns 2 and 3 in Table A2 are associated with Column 4 in Table IV. In this instance we have two endogenous variables, *Housing Price Index, Bank's State(s)* and *National Banks* $\times$ *HPI, Bank's State(s)*, hence the two columns. Because of the additional endogenous variable, the interaction of the national bank indicator with *Land Unavailability, Bank's State(s)* and *Land Unavailability* $\times$ *Mortgage Rate* are included as additional instruments. We do not interact the mortgage rate variable explicitly with the national bank indicator, although doing so generates similar results.

Columns 4 and 5 in Table A2 are associated with Column 6 in Table IV. These first-stage specifications are very similar to Columns 2 and 3 except use firm's state by year fixed effects. For each IV specification, we calculate the Kleibergen-Paap Wald F-statistic (Kleibergen and Paap, 2006) as a weak-instrument statistic, which accounts for our clustered standard errors. For all the specifications, the F-statistics are sufficiently large that weak instruments are not a problem in our setting.

Table A1: Variable Definitions

Variable Definitions		
	Definition	Data sources
Firm Variables		
Investment	Capital expenditures divided by lagged net PPE	Compustat
Market to Book	Book assets plus closing stock price times shares outstanding minus common equity minus deferred taxes, all divided by book assets	Compustat
Cash Flow	Income before extraordinary items plus depreciation and amortization divided by lagged net PPE	Compustat
Firm Size	Log of book assets	Compustat
Book Leverage	Total debt divided by book assets	Compustat
Altman's Z-Score	Sum of 3.3 times pre-tax income, sales, 1.4 times retained earnings, 1.2 times the difference between current assets and current liabilities, all divided by book assets	Compustat
Market Value of Buildings	Buildings at historical cost (as of 1993) times change in HPI in firm's state divided by lagged net PPE. Change in housing price index is the inflation in state-level housing prices since the year the buildings are built, as estimated by the building age as of 1993. Building age as of 1993 is determined by accumulated depreciation for buildings in 1993 divided by buildings at historical cost in 1993 times 40. 1993-specific data replaced with current year for pre-1993 observations.	Compustat and FHFA; See Chaney, Sraer, and Thesmar (2012)
Industry Land Intensity	Percentage share of industry capital income attributable to land.	Bureau of Labor Statistics
Loan Characteristics		
All In Drawn Spread (bps)	Basis point spread paid over LIBOR for each dollar of loan drawn. For loan packages with multiple facilities, a dollar-weighted average is used.	DealScan
Loan Amount	Total amount available in a loan package divided by the borrowing firm's lagged net PPE	DealScan and Compustat
Maturity (months)	Loan package maturity (in months) at origination. Dollar-weighted average for packages with multiple facilities.	DealScan
Takeover Loan	Indicator that loan purpose is an acquisition line, LBO, MBO, or takeover.	DealScan
Revolving Credit Line	Indicator that at least one facility is a revolving credit line in loan package.	DealScan

Table A1—*Continued*

Variable Definitions—*Continued*		
	Definition	Data sources
Bank Variables		
MBS	Mortgage-backed securities (RCFD8639) divided by total assets (RCFD2170). RCFD8639 is unavailable before 1994, so we use the sum of RCFD0408 and RCFD0602 instead.	Call Report
Real Estate Loans	Loans secured by real estate (RCFD1410) minus real estate loans secured by nonfarm nonresidential properties (RCON1480) divided by total assets (RCFD2170)	Call Report
Commercial Mortgages	Real estate loans secured by nonfarm nonresidential properties (RCON1480) divided by total assets (RCFD2170)	Call Report
C&I Loans	Commercial and industrial loans (RCFD1766) divided by total assets (RCFD2170)	Call Report
Consumer Loans	Consumer loans (RCFD1975) divided by total assets (RCFD2170)	Call Report
C&I Loan Profitability	Interest and fee income on commercial and industrial loans (RIAD4012) divided by commercial and industrial loans (RCFD1766)	Call Report
Bank's Size	Log of total assets (RCFD2170)	Call Report
Bank's Equity Ratio	Total equity capital (RCFD3210) divided by total assets (RCFD2170)	Call Report
Bank's Net Income	Net income (RIAD4340) divided by total assets (RCFD2170)	Call Report
Bank's Cost of Deposits	Interest on deposits (RIAD4170) divided by total deposits (RCFD2200)	Call Report
Securitization Activity	Indicator that bank actively securitizes. From 2001–2006, determined by whether BHC has non-zero net securitization income (RIADB493). For 1991–2000, use presence of reported securitized loans (RCFD2741, RCFD2742, RCFD2743).	Call Report
Employee Growth	Percent growth rate for employees in credit intermediation, measured at the state level. Bank-specific weighting determined by prior year's summary of deposits.	Summary of Deposits and Bureau of Labor Statistics
Housing Variables		
Housing Price Index, Bank's State(s)	State-level housing price index, adjusted by state median housing prices in 2000. Bank-specific weighting determined by prior year's summary of deposits.	Summary of Deposits and FHFA
Return on Housing, Bank's State(s)	Annual change in *Housing Price Index, Bank's State(s)*	Summary of Deposits and FHFA
Land Unavailability, Bank's State(s)	Percent of land unavailable for development in specific MSAs, averaged to state-level using population for weights. Bank-specific weighting determined by prior year's summary of deposits.	Summary of Deposits, Census (2000), and Saiz (2010)
Office Price Index, Firm's State	Index for office prices, averaged to state-level using population for weights.	Census (2000) and Chaney, Sraer, and Thesmar (2012)
Macroeconomic Variables		
Change in Unemp. Rate, Firm's State	Annual change in unemployment rate firm's headquarters state	Compustat and FRED
Change in Unemp. Rate, Bank's State(s)	Annual change in unemployment rate where bank has deposits, weighted by prior year's deposit amounts.	Summary of Deposits and FRED
30-Year Mortgage Rate, Bank's State(s)	Average 30-year fixed mortgage rate in states where bank has deposits, weighted by prior year's deposit amounts.	Summary of Deposits and HSH Associates

Table A2: Investment Regression: First Stage

First stage regressions that correspond to the IV specifications in Table IV. Column (1) is the first-stage for Column (2) of Table IV, Columns (2) and (3) are the first-stage for Column (4) of Table IV, and Columns (4) and (5) are the first-stage for Column (6) of Table IV. *Housing Price Index, Bank's State(s)* is scaled by its standard deviation. *30-Year Mortgage Rate, Bank's State(s)*, and *Land Unavailability, Bank's State(s)* are demeaned by their sample averages and scaled by their respective standard deviations. Variables under *Coefficients for* $1987-1998$ take on a zero value for all years outside of $1987-1998$, and variables under *Coefficients for* $1999-2005$ take on a zero value for all years outside $1999-2005$. All other control variables are included as in Table IV. The Kleibergen-Paap Wald F-stat test for weak instruments is provided below their respective specifications. Standard errors are clustered by firm, bank, and year.

	Table IV Col. (2)	Table IV Col. (4)		Table IV Col. (6)	
	Housing Price Index, Bank's State(s)	Housing Price Index, Bank's State(s)	National Banks × HPI, Bank's State(s)	Housing Price Index, Bank's State(s)	National Banks × HPI, Bank's State(s)
	(1)	(2)	(3)	(4)	(5)
30-Year Mortgage Rate, Bank's State(s)	0.403***	0.391***	0.236**	0.379***	0.238**
	(0.147)	(0.138)	(0.107)	(0.140)	(0.111)
Coefficients for $1987-1998$					
Land Unavailability, Bank's State(s)	3.702***	2.166***	-2.183	2.348***	-1.790
	(0.578)	(0.730)	(1.638)	(0.690)	(1.294)
Land Unavailability × Mortgage Rate	-0.00682	0.0153	0.165	0.00535	0.123
	(0.0701)	(0.0658)	(0.136)	(0.0660)	(0.0986)
National Banks × Land Unavailability		4.301***	15.81***	4.300***	16.16***
		(1.175)	(3.287)	(1.154)	(3.333)
National Banks × Land Unavailability × Mortgage Rate		-0.195**	-1.183***	-0.204**	-1.222***
		(0.0946)	(0.354)	(0.0964)	(0.354)
Coefficients for $1999-2005$					
Land Unavailability, Bank's State(s)	18.50***	15.86***	8.081	15.87***	7.870
	(4.406)	(3.948)	(5.963)	(3.908)	(5.541)
Land Unavailability × Mortgage Rate	-1.855***	-1.700***	-1.304	-1.680***	-1.266
	(0.616)	(0.578)	(0.915)	(0.567)	(0.845)
National Banks × Land Unavailability		4.621***	14.35***	4.751***	14.61***
		(1.790)	(3.680)	(1.770)	(3.668)
National Banks × Land Unavailability × Mortgage Rate		-0.222*	-0.923**	-0.238**	-0.968**
		(0.116)	(0.382)	(0.117)	(0.382)
Firm and Bank Controls	Yes	Yes	Yes	Yes	Yes
Firm-Bank Fixed Effects	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	No	No
Firm's State-Year Fixed Effects	No	No	No	Yes	Yes
Kleibergen-Paap Wald F-stat	58.515		74.700		49.169
Observations	38600	38600	38600	38553	38553
Firms	4812	4812	4812	4808	4808
Banks	436	436	436	435	435
Adjusted R^2	0.974	0.975	0.982	0.978	0.983

Standard errors in parentheses. * p<.10, ** p<.05, *** p<.01

B Additional Results

B.1 Firm Demand, Commercial Real Estate Prices, and Land Intensity

As discussed in Section III.C, while we do not believe our main results are driven by alternative firm demand explanations, we next attempt to measure the effect of local real estate prices on firm investment directly. As additional controls, we include (i) the cost of commercial real estate in the firm's state and (ii) the importance of land to the firm's capital income which is captured by our land intensity measure. Table B1 reports the results. Commercial real estate, an office price index, is not significant across all specifications.

In Columns 3 and 4, we interact the office price index with the firm's land intensity.[53] We find that for one standard deviation increases in office prices and the firm's land intensity, firm investment decreases by 0.751 percentage points, and is significant at the 5% level. This result is very similar across both non-instrumented and instrumented specifications, and the presence of year or firm's state by year fixed effects. Firms for which land is a more important source of capital income decrease investment in response to increased commercial real estate prices.

At the same time, the economic magnitude of this effect is smaller than that of the lending channel. Because all coefficients are presented in terms of marginal effects, we can easily contrast relative importance. The effect of changes housing prices for the regional banks is almost factor of five larger than the land intensity effect for the non-instrumented results (Columns 3 and 5), and about a factor of ten larger for the instrumented results (Columns 4 and 6). Also, the magnitudes of our main results are virtually unchanged by the inclusion of the commercial real estate prices and land intensity—it appears that this additional effect, while present, is orthogonal to that of the lending channel.

B.2 Alternative Housing Variable and IV Specifications

In Section II.E, we discuss potential endogeneity issues and our instrumental variables approach in detail. In Table B2, we present a few alternative specifications to demonstrate the robustness of our main results to different variable specifications. Columns 1 through 3 of Table B2 maintain our use of lagged deposit weights for variable construction and use alternate instrument specifications. Columns 4 and 5 use different assumptions about bank deposits to construct our main variables and instruments.

Column 1 of Table B2 shows our results using only the unavailable land measure as an instrument.[54] We find results that are similar to our instrumental variable specifications in Section III.A. To address the possibility that the state-level mortgage rate may be influenced by specific bank holding company actions, in Column 2 we replace it with a national 30-year fixed rate mortgage measure. Although the mortgage variable itself is absorbed by the firm-state by year fixed effects,

[53] Land intensity is fixed for an industry over our sample, so the separate variable is absorbed by the firm-bank fixed effects in our specifications.

[54] As in our main results, we split the measure into two parts depending on the time period.

the interaction between land unavailability and the mortgage rate remains. The results are similar to those of our main specifications. This mitigates the concern that our instrument is driven by banks with significant market power lowering mortgage rates to spur additional mortgage lending.[55]

Alternatively, in Column 3 we include the state-level mortgage rate in the bank's states as an additional control variable, rather than as an instrument. The remaining instrumental variables are the unavailable land measure and the interaction between the land measure and the mortgage rate variable. Again, we find that state-level mortgage rates in the bank's region do not have a significant effect on firm investment, and that our remaining instruments still identify a strong effect of housing prices on firm investment.

Instead of using the prior year's deposit weights to construct our housing price and instrumental variables, Columns 4 and 5 instead use the deposit weights from the year in which the bank holding company first appears in our sample and keeps this fixed. Of the 93 bank holding companies in Table IV, 77 of them exist in the beginning of the sample in 1987.[56] The remaining 16 bank holding companies enter the sample between 1988 and 2004. While this construction introduces some measurement error, it eliminates the possibility that economic changes in the geographical location of banks' branches are driving our results through changing lagged deposit weights. We find statistically and economically similar results to our main regressions in both non-instrumented (Column 4) and instrumented (Column 5) specifications. Taken together, our main results appear robust to alternative instrumental variable and housing variable specifications.

B.3 Loan Amounts for All Borrowers

Another dimension of the crowding out of commercial borrowing and investment is the size of loans being given to firms. Section IV.B looks specifically at firms that receive multiple loans in the same year, where we are best able to rule out differences in loan amounts coming from differences in borrower characteristics and demand. To investigate credit rationing further, we consider the larger sample of all originated loans and look at the relative size of new loans made to borrowers.

Using the same panel as in the interest rate analysis in Section IV.A (*loan panel*), we estimate the following equation:

$$\begin{aligned}\text{Loan Amount}_{ijt} = \alpha_j + \gamma_t + \theta_1 \text{Housing Prices}_{jt-1} + \theta_2 \text{Firm Variables}_{it-1} \\ + \theta_3 \text{Bank Variables}_{jt-1} + \theta_4 \text{Macro Variables}_{ijt-1} + \varepsilon_{jt}. \qquad (6)\end{aligned}$$

The results are presented in Table B3. Our dependent variable, *Loan Amount*, is scaled by lagged net PP&E and multiplied by 100 to aid in comparison with our investment results in Section III.A. To control for other macroeconomic effects that may affect our estimates, Column 1 uses year fixed

[55] Calculating a Herfindal-Hirschman Index (HHI) for BHC deposit share at the state-year level, we also find that most markets have fairly low HHI values. The median HHI index value is 791, the 75 percentile value is 1168, and the 95 percentile value is 2429.

[56] Although we match 106 BHCs, only 93 have all the required variables and enough observations for the various fixed effects used.

effects (γ_t) and Columns 2 through 6 use firm-state by year fixed effects. For the sample selection reasons discussed in Appendix A.1, we choose to use BHC level rather than DealScan lender level fixed effects for banks (α_j) in the specifications.

To measure the impact of housing prices on the largest sample of firms, Columns 1 through 3 of Table B3 include bank-level fixed effects. Across these specifications, we are not able to precisely estimate an effect of housing prices on loan amounts. Columns 4 through 6 instead use firm-bank fixed effects. Although this change eliminates the observations in which the firm only borrows once from a given bank holding company, the effect of housing prices for the remaining observations is better estimated.

In Column 4, which does not include instruments, a one standard deviation increase in housing prices decreases the loan amount by 22.97 percentage points, as scaled by lagged net PP&E. This estimate is significant at the 5% level. Column 5, which uses instruments, finds an even larger effect of -55.8 percentage points, which corresponds to about 7.3% of a sample standard deviation for loan amounts. Column 6 adds the separate interaction term for the largest bank holding companies, but it is not significantly different than the estimate for the regional banks.

These results compare to an effect of -9.62 percentage points for firm investment (Table IV, Column 6), as both dependent variables are scaled by lagged net PP&E. The magnitude of the lending and investment effects are therefore comparable but larger for lending. This difference in magnitudes is expected if firms are able to substitute different sources of capital for investment or if investment reductions are spread out over several years rather than concentrated entirely in the year that the loan is taken.

B.4 Firm Collateral

Chaney, Sraer, and Thesmar (2012) find that increased real estate values for companies are related to increases in firm borrowing and investment. They calculate the market value of a firm's buildings for their sample of Compustat firms as of 1993 and use housing price changes in the state where the firm is headquartered to get an estimate of the market value of these buildings from 1993–2007.[57] They find a one standard deviation increase in the market value of a firm's buildings is associated with a 10.5 percentage point increase in firm investment.[58] They argue that this result is evidence of a positive collateral channel associated with the housing boom. When firms have more valuable collateral, they are able to borrow and invest more. In this period, the general real estate boom increased the value of firms' collateral and so benefited the economy with increases in real investment.

In Table B4, we include the Chaney, Sraer, and Thesmar (2012) collateral variable, *Market Value of Buildings*, in our main investment regression specifications. As with our other specifications, we scale all independent variables by their sample standard deviations to aid in comparison of economic

[57] The necessary variables are only available until 1993.

[58] This amount is derived using the sample standard deviations available in Table 1 of the paper combined with the first specification in Table 4.

significance. Because of the limited availability of this new variable, our sample size shrinks from 38,600 observations of 4,812 firms to only 13,688 observations of 1,415 firms. Because of the age requirement to construct this market value of buildings variable (the firm must be present in 1993), this sample will be on average larger and less constrained than our full sample, so we do not expect as strong results. Nevertheless, we are able to find our result at a smaller magnitude, but with sufficient statistical precision. In the instrumented specification (Column 2), we find a one standard deviation increase in housing prices where the more regional banks operate corresponds to a 4.29 percentage point decrease in investment. This result is significant at the 5% level.

In the same specification, we find the marginal effect of a one standard deviation increase in the value of the firm's buildings to increase investment by 4.75 percentage points. Even though we run a somewhat different specification on a different sample of firms, we find a statistically significant result for firm collateral only somewhat smaller in terms of economic magnitude to the result found in Chaney, Sraer, and Thesmar (2012).

Both the negative lending channel and positive collateral channel are at work during the housing boom. For firms with sufficient real estate in areas with high price appreciation and that borrowed from the largest banks, the positive collateral channel probably offsets the negative effects of the housing boom we document. However, for many firms, especially those that borrowed from more regional banks and do not have significant real estate collateral, the negative bank lending channel appears dominant. This finding is consistent with our finding that banks increased commercial mortgage lending in response to increasing housing prices. Given that we expect efficient lending to depend on project quality and not on real estate collateral available, these results point toward suboptimal allocation among firms.

Table B1: Investment Regression: Commercial Real Estate Prices

Columns (1) through (6) are panel fixed effect regressions. *Investment* is the firm's capital expenditures divided by lagged net PP&E and scaled by 100. Columns (2), (4), and (6) use the unavailable land measure, the state-level 30-year mortgage rate, and their interaction as instruments. All continuous independent variables are scaled by their respective standard deviations. Standard errors are clustered by firm, bank, and year.

	Investment					
	(OLS)	(IV)	(OLS)	(IV)	(OLS)	(IV)
	(1)	(2)	(3)	(4)	(5)	(6)
Housing Price Index, Bank's State(s)	-3.740**	-6.963***	-3.716**	-6.948***	-4.087**	-8.203***
	(1.862)	(2.549)	(1.875)	(2.539)	(1.840)	(2.732)
National Banks × HPI, Bank's State(s)	2.543**	3.491**	2.562**	3.509**	2.724***	3.800***
	(1.018)	(1.433)	(1.022)	(1.430)	(1.028)	(1.323)
Office Price Index, Firm's State	0.162	0.231	0.764	0.821		
	(0.691)	(0.682)	(0.733)	(0.720)		
Industry Land Intensity × Office Prices, Firm's State			-0.751**	-0.736*	-0.799**	-0.783**
			(0.380)	(0.381)	(0.383)	(0.385)
Lagged Market to Book	8.673***	8.654***	8.672***	8.653***	8.570***	8.552***
	(0.854)	(0.853)	(0.854)	(0.853)	(0.873)	(0.872)
Cash Flow	8.820***	8.820***	8.826***	8.826***	8.806***	8.803***
	(0.977)	(0.978)	(0.975)	(0.976)	(0.974)	(0.973)
Lagged Firm Size	-17.46***	-17.37***	-17.42***	-17.32***	-17.51***	-17.43***
	(2.799)	(2.794)	(2.801)	(2.796)	(2.874)	(2.870)
Bank's Size	-2.025	-2.074	-2.010	-2.059	-1.542	-1.607
	(1.351)	(1.333)	(1.351)	(1.333)	(1.336)	(1.306)
Bank's Equity Ratio	-0.254	-0.241	-0.253	-0.240	-0.240	-0.231
	(0.422)	(0.424)	(0.423)	(0.424)	(0.429)	(0.429)
Bank's Net Income	0.256	0.337	0.257	0.338	0.384	0.481
	(0.298)	(0.314)	(0.298)	(0.315)	(0.313)	(0.333)
Bank's Cost of Deposits	-0.348	-0.395	-0.316	-0.364	-0.469	-0.546
	(0.755)	(0.756)	(0.745)	(0.747)	(0.649)	(0.656)
Change in Unemp. Rate, Firm's State	-0.900***	-0.870***	-0.892***	-0.861***		
	(0.291)	(0.289)	(0.288)	(0.286)		
Change in Unemp. Rate, Bank's State(s)	1.051*	1.228**	1.055*	1.231**	0.746	0.952
	(0.547)	(0.532)	(0.546)	(0.531)	(0.639)	(0.637)
Firm-Bank Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	No	No
Firm's State-Year Fixed Effects	No	No	No	No	Yes	Yes
Observations	34772	34772	34772	34772	34768	34768
Firms	4413	4413	4413	4413	4412	4412
Banks	417	417	417	417	417	417
Adjusted R^2	0.479	0.479	0.479	0.479	0.482	0.482

Standard errors in parentheses. * p<0.10, ** p<0.05, *** p<0.01

Table B2: Investment Regression: Alternative Instrument Specifications

Columns (1) through (5) are panel fixed effect regressions. *Investment* is the firm's capital expenditures divided by lagged net PP&E and scaled by 100. Column (1) uses just the unavailable land measure as an instrument. Column (2) uses the unavailable land measure and the interaction between the land measure and the national mortgage rate as instruments. Column (3) uses the unavailable land measure and the interaction between the land measure and state-level mortgage rates as instruments. Columns (4) and (5) use bank deposit weights from the year the bank holding company enters the sample to construct the housing price and instrumental variables. All continuous independent variables are scaled by their respective standard deviations. Standard errors are clustered by firm, bank, and year.

	Investment				
	Lagged Deposit Weights			Fixed Deposit Weights	
	(IV)	(IV)	(IV)	(OLS)	(IV)
	(1)	(2)	(3)	(4)	(5)
Housing Price Index, Bank's State(s)	-8.087***	-8.574***	-10.02***	-2.242**	-6.804***
	(2.470)	(2.291)	(2.772)	(0.955)	(2.437)
National Banks × HPI, Bank's State(s)	4.269***	4.785***	4.779***	2.164**	5.594
	(1.464)	(1.204)	(1.229)	(0.848)	(3.588)
30-Year Mortgage Rate, Bank's State(s)			2.063		
			(2.355)		
Lagged Market to Book	8.670***	8.693***	9.085***	9.057***	8.842***
	(0.595)	(0.558)	(0.626)	(0.669)	(0.630)
Cash Flow	9.444***	9.293***	9.134***	8.540***	8.749***
	(1.108)	(1.052)	(1.098)	(1.144)	(1.097)
Lagged Firm Size	-17.35***	-17.07***	-17.87***	-19.13***	-19.11***
	(2.772)	(2.359)	(2.584)	(2.888)	(2.354)
Bank's Size	-1.658	-1.778	-1.551	-2.720	-4.517**
	(1.561)	(1.384)	(1.544)	(1.756)	(1.975)
Bank's Equity Ratio	-0.266	-0.294	-0.254	-0.371	0.333
	(0.395)	(0.383)	(0.394)	(0.407)	(0.421)
Bank's Net Income	0.245	0.361	0.324	0.266	0.0631
	(0.320)	(0.317)	(0.330)	(0.284)	(0.279)
Bank's Cost of Deposits	0.0673	0.394	-0.0827	0.131	0.328
	(0.540)	(0.425)	(0.545)	(0.578)	(0.617)
Change in Unemp. Rate, Bank's State(s)	1.187**	1.273**	1.112*	0.672	0.580
	(0.605)	(0.583)	(0.577)	(0.527)	(0.471)
Instrument Set:					
Land Unavailability	Yes	Yes	Yes	No	Yes
Land Unaval. × National Mortgage Rate	No	Yes	No	No	No
State-Level Mortgage Rate	No	No	No	No	Yes
Land Unaval. × State-Level Mortgage Rate	No	No	Yes	No	Yes
Firm-Bank Fixed Effects	Yes	Yes	Yes	Yes	Yes
Firm's State-Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
Observations	38553	38553	38553	38588	38588
Firms	4808	4808	4808	4810	4810
Banks	435	435	435	437	437
Adjusted R^2	0.466	0.466	0.466	0.464	0.463

Standard errors in parentheses. * p<.10, ** p<.05, *** p<.01

Table B3: Loan Amount Regression

Columns (1) through (6) are panel fixed effect regressions. *Loan Amount* is the dollar amount of the loan package divided by the firm's lagged net PP&E and scaled by 100. Columns (3), (5), and (6) use the unavailable land measure, the state-level 30-year mortgage rate, and their interaction as instruments. All continuous independent variables are scaled by their respective standard deviations. Standard errors are clustered by firm, bank holding company, and year.

	Loan Amount					
	(OLS)	(OLS)	(IV)	(OLS)	(IV)	(IV)
	(1)	(2)	(3)	(4)	(5)	(6)
Housing Price Index, Bank's State(s)	3.914	-17.53	-8.164	-22.97**	-55.84**	-50.37**
	(25.85)	(23.27)	(32.76)	(11.54)	(23.39)	(24.32)
National Banks × HPI, Bank's State(s)						-7.685
						(14.41)
Lagged Book Leverage	0.879	4.699	4.707	-16.63	-16.74	-16.54
	(7.368)	(7.062)	(7.061)	(16.41)	(16.33)	(16.10)
Lagged Market to Book	52.44***	46.90***	46.89***	30.66**	30.56**	30.78**
	(7.017)	(8.729)	(8.727)	(12.28)	(12.17)	(12.17)
Lagged Altman's Z-Score	-9.784	-12.54	-12.53	31.58	30.92	31.05
	(16.57)	(16.19)	(16.20)	(26.81)	(26.82)	(26.63)
Lagged Firm Size	-198.8***	-196.8***	-196.8***	-299.7***	-299.1***	-300.0***
	(15.05)	(13.65)	(13.65)	(53.25)	(52.99)	(54.16)
Log(Maturity)	26.26**	26.04***	25.99***	30.94***	31.02***	30.99***
	(10.71)	(9.966)	(10.02)	(3.933)	(3.923)	(3.891)
Takeover Loan	204.6***	206.7***	206.6***	109.1***	109.9***	110.0***
	(23.06)	(22.56)	(22.45)	(17.17)	(17.43)	(17.47)
Revolving Credit Line	80.34***	92.47***	92.40***	93.60***	94.20***	93.93***
	(16.15)	(20.49)	(20.48)	(16.24)	(16.29)	(16.59)
Bank's Size	56.20	63.89	62.03	38.59	42.79	51.62
	(48.40)	(40.55)	(41.18)	(31.65)	(34.91)	(39.36)
Bank's Equity Ratio	-14.27	-11.42	-11.71	-2.396	-1.849	-1.234
	(14.38)	(11.67)	(11.68)	(8.462)	(9.059)	(8.789)
Bank's Net Income	0.947	-6.744	-7.100	-1.826	-2.632	-2.207
	(7.883)	(9.039)	(8.802)	(6.211)	(6.383)	(6.513)
Bank's Cost of Deposits	-21.11	-27.60	-27.45	-11.65	-13.81	-13.50
	(17.69)	(22.25)	(22.16)	(16.07)	(16.21)	(15.94)
Change in Unemp. Rate, Firm's State	-4.569					
	(10.75)					
Change in Unemp. Rate, Bank's State(s)	-0.459	-4.821	-5.378	-32.60**	-31.50**	-32.05**
	(19.54)	(23.73)	(24.06)	(15.97)	(15.38)	(15.68)
Bank Fixed Effects	Yes	Yes	Yes	No	No	No
Firm-Bank Fixed Effects	No	No	No	Yes	Yes	Yes
Year Fixed Effects	Yes	No	No	No	No	No
Firm's State-Year Fixed Effects	No	Yes	Yes	Yes	Yes	Yes
Observations	12293	12203	12203	7925	7925	7925
Firms	4691	4664	4664	2186	2186	2186
Banks	83	83	83	74	74	74
Adjusted R^2	0.114	0.122	0.122	0.863	0.863	0.863

Standard errors in parentheses. * p<0.10, ** p<0.05, *** p<0.01

Table B4: Firm Collateral

Columns (1) and (2) are panel fixed effect regressions. *Investment* is the firm's capital expenditures divided by lagged net PP&E and scaled by 100. Column (2) uses the unavailable land measure, the state-level 30-year mortgage rate, and their interaction as instruments. All continuous independent variables are scaled by their sample standard deviations. Standard errors are clustered by firm, bank, and year.

	Investment	
	(OLS)	(IV)
	(1)	(2)
Housing Price Index, Bank's State(s)	-2.913***	-4.291**
	(0.999)	(1.950)
National Banks × HPI, Bank's State(s)	2.385***	2.631**
	(0.634)	(1.052)
Market Value of Buildings	4.755***	4.752***
	(1.454)	(1.450)
Lagged Market to Book	7.781***	7.761***
	(1.557)	(1.551)
Cash Flow	10.97***	10.97***
	(2.065)	(2.062)
Lagged Firm Size	-7.955***	-7.912***
	(2.762)	(2.744)
Bank's Size	-0.895	-0.883
	(1.198)	(1.216)
Bank's Equity Ratio	0.407	0.413
	(0.417)	(0.411)
Bank's Net Income	0.000940	0.0355
	(0.281)	(0.292)
Bank's Cost of Deposits	-0.209	-0.239
	(0.486)	(0.517)
Change in Unemp. Rate, Bank's State(s)	0.0674	0.123
	(0.520)	(0.532)
Firm-Bank Fixed Effects	Yes	Yes
Firm's State-Year Fixed Effects	Yes	Yes
Observations	13688	13688
Firms	1415	1415
Banks	273	273
Adjusted R^2	0.575	0.575

Standard errors in parentheses. * p<0.10, ** p<0.05, *** p<0.01