Collateral Values and Corporate Employment*

by

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Abstract

We examine the impact of real estate collateral values on corporate employment. Our empirical strategy exploits regional variation in local real estate price growth, firm-level data on real estate holdings, as well as establishment-level data on employment and the location of firms' operations from the U.S. Census Bureau. Over the period from 1993 until 2006, we show that a typical U.S. publicly-traded firm increases employment expenditures by $0.10 per $1 increase in collateral. We show this additional hiring is funded through debt issues and the effects are stronger for firms likely to be financially constrained. These firms increase employment at establishments outside of their core industry focus and away from the location of real estate holdings, leading to regional spillover effects. We document how shocks to collateral values influence labor allocation within firms and how these effects show up in the aggregate.

Keyword*:* Financial Constraints; Collateral Lending Channel; Employment

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1 Introduction

A central topic in macroeconomics and finance is precisely how firm-level credit constraints come about, how they interact with economic conditions, and whether they can have real effects. In an environment with incomplete or unenforceable contracts, firms have limited debt capacity and collateral is pledged to secure loans (Eisfeldt and Rampini, 2009; Hart and Moore, 1994; Rampini and Viswanathan, 2013; Stiglitz and Weiss, 1981). In principle, collateral-based credit constraints can provide a link between asset values and factor input use by firms that can translate economic shocks into business cycle fluctuations (Bernanke and Gertler, 1989; Kiyotaki and Moore, 1997; Liu et al., 2013). In the wake of the recent collapse of U.S. real estate prices, this collateral lending channel has featured in economic discussions, as well as empirical research attempting to quantify its importance.[1]

While prior empirical research on financial constraints has focused almost exclusively on corporate investment, little evidence exists on the impact on employment.[2] This is surprising given the observational link between financial crises, economic recessions, and job destruction, as well as theoretical work on the relation between corporate finance frictions and employment (e.g., Berk et al., 2010; Jaggia and Thakor, 1994; Titman, 1984). This motivates an important empirical question: Are external financing frictions and corporate employment decisions related and, if so, how? In this paper, we examine this question in the context of the collateral lending channel and the effect of real estate asset values on corporate hiring.[3]

[1] However, existing empirical analyses of the slump in business investment and employment in the Great Recession mostly emphasize the employment effects of household balance sheets (e.g., Mian and Sufi, 2011, 2014) or bank balance sheets (e.g., Chodorow-Reich, 2014; Duygan-Bump et al., 2015).

[2] Exceptions include Benmelech et al. (2011), Chodorow-Reich (2014), Giroud and Mueller (2015a), and Giroud and Mueller (2015b), although these papers do not examine the collateral lending channel.

[3] Berger and Udell (1990) show that 70% of all commercial and industrial long-term debt and 30-40% of short-term loans in the United States are secured by collateral assets. In Section 2.2 we show that, in 1993, 64.1% of U.S. publicly-traded firms report real estate ownership on their balance sheet, constituting a sizable 85% of tangible assets (see also, Chaney et al., 2012; Cvijanović, 2014).

From a theoretical perspective, collateral-based financing constraints could impact corporate employment for at least two reasons. First, if collateral value appreciation permits external funding of investment, this could increase both capital and employment if they are complementary inputs in the production function. Second, even if there are no complementarities (or capital) in the production process, employment might still depend on external finance and thus directly on a changes in collateral values. For example, employment costs may include an upfront, fixed component associated with hiring or training activities (e.g., Oi, 1962). Alternatively, if the cash flow cycle is mismatched with the timing of operating costs then the firm may need to pay employees from working capital (Benmelech et al., 2011).

Based on such reasoning, we estimate the effect of real estate collateral values on corporate employment. We conduct our analysis using establishment-level data from the U.S. Census Bureau merged with balance sheet data from Compustat covering publicly-traded corporations from 1993 until 2006. These sources provide administrative data on employment, as well as firm locations and real estate holdings. We use an instrumental variables (IV) strategy to identify exogenous variation in local real estate prices and thus collateral value associated with the real estate holdings of local firms. Following Mian and Sufi (2011) and Chaney et al. (2012) among others, we instrument for local real estate prices with the interaction of the land supply elasticity at the Metropolitan Statistical Area (MSA) level with a measure of nationwide mortgage interest rates. Our approach overcomes a key identification challenge, namely, unobserved local economic shocks that may jointly impact real estate prices and the growth opportunities of real estate owning firms.[4,5]

We show that firms significantly increase employment when the market value of their real estate collateral appreciates. On average, firms increase employment expenditures by

[4]This approach has recently become standard in the empirical finance literature. See Adelino et al. (2015), Cvijanović (2014), Giroud and Mueller (2015b), Lin (2015), Schmalz et al. (2015) for other applications.

[5]A second identification concern is that firms that choosing to purchase real estate may be more responsive to local economic conditions. We describe this issue and how we tackle it in Section 2.3.

about \$0.10 per \$1 increase in the value of its collateral, or about a 15.6% increase of the standard deviation of employment. This sizable response results from changes in the number of employees, as opposed to adjustments in the average wage. Consistent with prior empirical research (e.g., Cvijanović, 2014; Lin, 2015), we show this additional hiring is funded through debt issues and the effects are stronger for firms likely to be financially constrained. Crucially, our findings hold when we focus our attention on industries least likely to be influenced by local demand shocks, including manufacturers and firms in tradable industries.

We explore the unique features of the establishment-level data to understand precisely how firms choose to expand employment across their portfolio of assets. Our within-firm analysis shows that firms increase hiring at existing and new establishments, as well as establishments in non-core industries and geographically distant locations. By considering firms as portfolios of locations, we further explore these within-firm spillover effects across geographic regions. We find evidence that financially constrained firms transmit real estate collateral shocks across borders in a way that is quantitatively important at the macro-level. Thus, our evidence lends empirical support to theoretical models identifying financial constraints and their interaction with collateral values providing a channel to spread and potentially amplify economic shocks (e.g., Jermann and Quadrini, 2012; Kiyotaki and Moore, 1997). Overall, our micro-evidence highlights the empirical importance of collateral lending channel as a key determinant of corporate employment decisions.

Our findings relate to at least two strands of the literature. First, we contribute to the literature on the real effects of financing frictions (e.g., Whited, 1992). Until recently, this literature has focused on investment, however an emerging literature examines the impact of financial market frictions on corporate labor demand. Benmelech et al. (2011) identify the effects on labor—both at the firm- and county-level in the U.S.—using three different quasi-experiments. Adelino et al. (2015) and Schmalz et al. (2015) document the importance of financial constraints for small business and self-employment, respectively. Other papers focus

on the recent financial crisis and Great Recession. Duygan-Bump et al. (2015) document relatively large employment cuts for small firms from industries with higher financing needs. Relatedly, Chodorow-Reich (2014) shows there were significant firm-level employment effects for corporations reliant on credit lines from impaired banks during the 2007 to 2009 U.S. financial crisis (see also Greenstone et al., 2014).[6] Our results complement this literature by examining the impact of financial constraints, specifically, through collateral restrictions, on corporate employment. We show firms use increased availability of pledgeable assets to externally fund additional employment. We also provide new evidence on how firms restructure and allocate resources across their portfolio of assets after debt capacity increases.

Second, we contribute to a literature on the real effects of collateral-based lending constraints. From a theoretical perspective, Kiyotaki and Moore (1997) model the relation between firm collateral shocks and investment. Jermann and Quadrini (2012) show collateral constraints can matter in the aggregate, whereas Liu et al. (2013) stress this importance of land prices and real estate collateral dynamics. On the empirical front, we complement recent work linking exogenous variation in real estate collateral to corporate investment, notably Chaney et al. (2012) who also studies the U.S. real estate market from 1993 until 2006. Gan (2007a) investigates the relation between real estate collateral and corporate investment in a quasi-experimental setting. Peek and Rosengren (2000) and Gan (2007b) examine the firm-level investment-effects of a bank credit supply shock resulting from real estate loan exposure. These last three papers all consider a severe negative shock: the 1990s Japanese land market collapse. We instead characterize the effects of firm-level real estate collateral value on corporate employment over a relatively normal business cycle, and provide direct evidence of a link between the commercial real estate sector and the real economy.

[6]There is also a literature on the relation between firm capital structure and employment, including Hanka (1998), Davis et al. (2014), and Agrawal and Tambe (2014). Giroud and Mueller (2015b) examine the impact of firm leverage on unemployment during the Great Recession using establishment-level data from the U.S. Census Bureau.

The remainder of this paper is organized as follows. Section 2 presents the data and empirical methodology. Section 3 provides our empirical results on relation between collateral and employment. Section 4 concludes.

2 Data and Empirical Methodology

Our data construction and empirical methodology builds on the Chaney et al. (2012) framework. The novel step in our analysis is to incorporate establishment-level data from the U.S. Census Bureau on employment and the internal organization of firms. In this section, we describe these steps in detail.

2.1 Data Sources

We use firm-level data from Compustat. We start with the sample of firms active in 1993.[7] We then apply the following initial filters. We drop firms with missing total assets. We keep firms headquartered in the U.S. and exclude those operating in the following industries: finance, insurance, real estate (SIC 60-67), construction (SIC 15-17), and mining (SIC 10-14). Finally, we keep only firms with the required data for at least three consecutive years.

The establishment-level data comes from the U.S. Census Bureau. The primary data source is the Longitudinal Business Database (LBD), an annual register of all U.S. private sector places of employment ("establishments") with at least one paid employee. The LBD contains longitudinal establishment identifiers as well as data on employment and payroll, industry codes, location, and corporate ownership (used to assign establishments to firms). Consistent with the standard U.S. statistical agency definition, annual employment is equal to the total number of employees on payroll as of March 12th each year. We retain

[7]This is the last year that the accumulated depreciation of buildings in reported in Compustat. As described below in Section 2.2, this item is required to measure the value of real estate assets.

establishment-year observations with nonmissing and nonzero employment and payroll data, and establishments with at least two consecutive years of data.

Data on manufacturing plants are obtained from the Census of Manufacturers (CMF) and the Annual Survey of Manufacturers (ASM). The CMF covers all U.S. manufacturing establishments ("plants") with at least one paid employee and is conducted every five years in Census years (years ending with either 2 or 7). The ASM covers a subset of CMF plants in non-Census years. This includes plants with greater than 250 employees and a randomly selected subset of smaller plants. The CMF and ASM provide plant-level data on corporate ownership, industry codes, location, capital expenditures, employment, and the value of shipments. The longitudinal establishment identifiers in the LBD are be used to merge the CMF and ASM at the plant-level. We merge Compustat firms to establishments in the LBD via the Compustat-SSEL bridge maintained by the U.S. Census Bureau where possible. When this is not possible (e.g., the bridge ends in 2005), we match via the employer identification number (EIN) along with employer name and address.

We obtain data on real estate prices at the MSA-level from the Office of Federal Housing Enterprise Oversight (OFHEO). The OFHEO provides price indices of single-family homes in the U.S. at the state- and MSA-level after 1987.[8] We use these real estate price indices to update the value of firms real estate assets beyond 1993, using information on the location of headquarters from Compustat and establishments from the LBD (see Section 2.2). We match the MSA-level price data to headquarter locations in Compustat using a mapping from Federal Information Processing Standards (FIPS) codes to MSA identifiers provided by the OFHEO.

[8]OFHEO residential real estate prices proxy adequately for commercial real estate prices and have the advantage of being available for a greater number of MSAs.

2.2 Variable Construction and Summary Statistics

Our main dependent variable is the annual change in employment expenditures normalized by lagged plants, property, and equipment (PPE). Employment expenditures are measured using payroll data from the LBD, aggregated to the firm level. We also use three alternative measures of the employment decision using employment data from the LBD. First, the annual change in the number of employees scaled by lagged PPE. Second, the annual change in number of employees divided by one half of the sum of current and lagged employment. This latter measure is the symmetric employment growth rate, which can accommodate both entry and exit as well as being less sensitive to outliers (Chodorow-Reich, 2014; Davis et al., 1998). Finally, the average wage growth, which is defined as the annual change in payroll divided by the number of employees. We use these different employment measures to elicit the channel through which firms adjust employment (i.e., more employees or wages per employee)

We proxy for collateral value using the market value of real estate assets of each firm. To construct this variable we proceed in two steps. We first measure each firm's value of real estate assets as of 1993 using data from Compustat. Then we use time series and geographical variation in real estate prices to isolate changes in these real estate asset values.

To measure the market value of real estate assets of each firm in 1993, we first define real estate assets as buildings, land and improvement, and construction in progress. These assets are reported at historical cost, so their market value as of 1993 must be estimated. This requires two steps. First, we estimate the (average) year that the assets were purchased. To this end, we first divide the accumulated depreciation of buildings by the historical cost of buildings to measure the percent of the historical asset value claimed as depreciation. Then, assuming assets have a depreciable life of 40 years, we can estimate the year in which the assets were purchased. In the second step, we use historical prices to inflate the reported historical cost to a current market value of real estate assets of each firm. In particular,

the 1993 value is computed by inflating their historical cost using MSA-level residential real estate prices after 1975 and CPI inflation beforehand. Once we have the 1993 market value, we use a MSA-level residential price index to obtain a market value of real estate assets for each firm-year in our sample from 1993 until 2006.

An important caveat is that our measurement of real estate asset values relies on information on the geographic location (i.e., MSA) of assets owned by each firm. However, Compustat does not provide this data and instead reports firms' headquarter locations at the ZIP code level. We therefore proxy for the location of real estate using the headquarter MSA.[9] For this to be a valid approximation, we rely on the following two assumptions. First, the location of headquarters and owned real estate assets is the same MSA. Second, firms headquarters are a large fraction of the value of real estate assets. We empirically assess these assumptions two ways in Section 3. In particular, we use establishment-level data from the LBD on the "true" locations of firms' operations to form alternative measures of exposure to real estate shocks. We also use data hand-collected from SEC 10-K filings—made available online by Chaney et al. (2012)—identifying firms that report owning their headquarters. In each case our results are similar, indicating that our method for calculating the value of real estate assets provides a good quality approximation.

We use standard firm-level variables commonly used in the financial constraints literature to supplement our main analysis. These variables are described here and precisely defined in Appendix A. To account for observable differences among firms in our regressions, we consider the following firm-level characteristics: return on assets, total assets, Tobin's Q, cash flow, age, 2-digit SIC industry and MSA of headquarters location fixed effects. We also include several measures of debt issuance and repayment constructed using Compustat data: long-term debt issues, long-term debt repayment, and annual changes in current debt and long-term debt (net), all scaled by total assets. These variables are used as dependent

[9]ZIP codes are matched to MSA identifiers using a correspondence provided by the U.S. Census Bureau.

variables to corroborate our hypothesis that collateral value appreciation leads to hiring funded by additional debt issues. All ratios are winsorized at the 1% level to ensure that results are robust to outliers.

With these data requirements in place, particularly the Compustat-SSEL link, we are able to construct a final sample containing 13,000 firm-year observations. Summary statistics are presented in Table I.[10] Importantly, as of 1993, 64.1% of firms reported real estate ownership in Compustat data. For the average firm, the market value of real estate assets represents 85% of (lagged) PPE. These numbers are in line with previous estimates from the literature, notably Chaney et al. (2012). Thus, we find real estate holdings represent a significant portion of the tangible assets held on the balance sheet of these corporations. Other firm- and establishment-level variables appear broadly consistent with the empirical corporate finance literature (e.g., Giroud and Mueller, 2015a). This indicates that the match to the Census data does not lead to any sample selection issues. This is unsurprising given the data is administrative and should cover the universe of Compustat firms.

Finally, as we shall discuss in detail below, we instrument local real estate price growth using the interaction of local land supply elasticity and long-term interest rates. Local land supply elasticities are collected from Saiz (2010). These elasticities attempt to measure the availability of developable land in each MSA based on satellite-generated data. They vary from 0 to 4 with an elasticity of 4 corresponding to an MSA with land supply that is relatively easy to expand. We measure long-term interest rates using the interest rate on 30-year, fixed rate conventional residential mortgage loan. These data are provided by the Federal Reserve.

[10] In accordance with the Census Bureau's disclosure requirements, the numbers of observations in tables are rounded off and we do not report any quantile values.

2.3 Identification and Empirical Model

Changes in the market value of real estate holdings may impact the amount of assets a firm has available to pledge in collateralized borrowing. To examine the implications for corporate employment, we start by estimating a version of a standard reduced-form investment equation with employment given by:

$$\text{Employment}_{it} = \alpha_i + \alpha_t + \beta \text{ RE Value}_{it} + \gamma \text{ RE Price Index}_{mt} + \theta' \mathbf{X}_{imt} + \epsilon_{it}, \quad (1)$$

where i indexes firms, m indexes headquarters locations (i.e., MSAs), t indexes years, Employment_{it} is the annual change in the dollar value of employment expenditures scaled by lagged PPE, and RE Value is the market value of real estate assets scaled by lagged PPE. We incorporate firm-fixed effects (α_i) and year-fixed effects (α_t), where the latter controls for economy-wide shocks in growth opportunities. A vector of control variables, $\mathbf{X}$, includes the ratio of cash flow to PPE, the one-year lagged Tobin's Q, and other initial firm characteristics (as described below). We include the MSA-level real estate price index to control for the direct effect of local real estate prices on employment, independent of firms' real estate holdings. The error terms, ϵ_{it}, are clustered at the MSA-year level, which is conservative given the main independent variable, RE Value, is measured at the firm level (Bertrand et al., 2004).

The main coefficient of interest, β, measures how a firm's employment responds to an extra dollar of real estate holdings. If some firms face financial constraints, the coefficient β will be strictly positive. On the other hand, if financial constraints are not binding (or additional real estate collateral cannot be pledged) then β will be zero.

Estimation of Equation (1) exploits two sources of variation. First, differences in hiring by firms with real estate holdings across MSAs with different real estate price appreciation. Second, within-MSA differences in the response of corporate hiring to real estate valuations

between firms owning and leasing real estate. There are several identification concerns with this approach. We now state these concerns and detail how we attempt to address them.

The key concern is that real estate prices could proxy for an omitted variable such as the state of the local economy. For example, a positive demand shock could lead to increased production and hence demand for all factors of production including labor, as well as greater demand for housing. Alternatively, higher real estate prices could increase demand for goods and prompt growth in corporate hiring, say because households feel wealthier or withdraw home equity (Mian and Sufi, 2014). Either way, if firms with *greater* real estate holdings are *more sensitive* to local demand shocks then could lead to a spurious positive estimate of β.

To address this issue, we adopt an instrumental variables (IV) approach that has now become standard in the literature (e.g., Mian and Sufi, 2011).[11] We instrument for real estate prices using the interaction of land supply elasticities with shifts in the nationwide mortgage interest rate. The intuition for this approach is as follows: for a given increase in real estate demand—proxied by a decrease in mortgage interest rates—the extent to which local real estate prices rise is determined by the slope of the local land supply curve. If the local land supply curve is flat (elastic), then greater demand will result in additional land development as opposed to higher land prices. On the other hand, if land supply is inelastic then greater demand will result in higher prices.[12] We therefore expect in MSAs with more inelastic local land supply elasticities, falls in mortgage interest rates should result in greater real estate price appreciation. To illustrate this logic, Figure 1 plots the real estate price index from 2000 until 2006 separately for MSAs with high and low land supply elasticities. Evidently, low elasticity MSAs experience a more pronounced boom in the real estate market than high elasticity MSAs.

[11] Other papers using this approach include Adelino et al. (2015), Chaney et al. (2012), Cvijanović (2014), Giroud and Mueller (2015b), Lin (2015), and Schmalz et al. (2015).

[12] This intuition is consistent with empirical evidence from the house price booms of the 1980s (Glaeser et al., 2008), as well as the most recent episode (Mian and Sufi, 2011).

Accordingly, the first-stage of our IV approach predicts real estate prices by:

$$\text{RE Price Index}_{mt} = \alpha_m + \alpha_t + \psi \text{ Elasticity}_m \times \text{Mortgage Rate}_t + \nu_{mt}, \quad (2)$$

where m indexes MSAs, t indexes years, α_m are MSA-fixed effects, and α_t year fixed effects. Elasticity_m is the MSA-level local land supply elasticity and Mortgage Rate_t is the nationwide rate at which banks finance 30-year, fixed rate conventional residential mortgage loans. The error terms, ν_{it}, are clustered at the MSA-level. The results of this first-stage estimation are in line with expectations—the coefficient, ψ, is economically large and statistically significant, and the F-test indicates the instrument is not weak—and deferred to the Internet Appendix.

The second-stage of the IV regression modifies (1), with employment now given by:

$$\text{Employment}_{it} = \alpha_i + \alpha_t + \beta \widehat{\text{RE Value}}_{it} + \gamma \widehat{\text{RE Price Index}}_{mt} + \theta' \mathbf{X}_{imt} + \epsilon_{it}, \quad (3)$$

where we now instrument for the MSA-level real estate price index. Importantly, the market value of real estate holdings as of 1993 is now inflated by the instrumented MSA-level price index from 1993 to year t, giving $\widehat{\text{RE Value}}_{it}$. We will refer to this as our baseline specification throughout the remainder of the paper.

We consider two additional specifications to provide reassurance that we adequately control for local demand shocks. The first replaces year-fixed effects (α_t) with industry $\times$ year $\times$ MSA-fixed effects in Equation (3). This powerful set of controls captures industry-level, aggregate, and local variation in demand shocks impacting firms both with and without real estate assets. Intuitively, this amounts to comparing how firms with different real estate holdings located in the same MSA and 2-digit SIC industry at the same point in time respond to an identical real estate shock.

We also consider a specification that exploits establishment-level data from the LBD. We examine how employment adjusts at the establishment level in response to changes in the

market value of real estate assets measured at the firm level under the maintained assumption that owned assets are located in the same MSA as the firm's headquarters. We estimate the following model where establishment-level employment is given by:

$$\text{Employment}_{ijt} = \alpha_j + \alpha_t + \beta\ \widehat{\text{RE Value}}_{it} + \gamma\ \text{RE}\ \widehat{\text{Price Index}}_{mt} + \theta' \mathbf{X}_{ijmt} + \epsilon_{ijt}. \qquad (4)$$

The unit of observation is an establishment-year. Here, j indexes the establishments of firm i, m indexes the MSA in which the firm is headquartered, and α_j denotes establishment-fixed effects. Since establishment and headquarters locations need not be the same we have another source of variation to identify β. In particular, we can tighten identification by examining how establishments located in the same MSA—each with different headquarters locations—respond to contemporaneous local shocks. Notice that in order to include establishment-fixed effects in this model we must have its ownership (i.e., by firm i) remain unchanged from year t to $t+1$. Thus, our establishment-level analysis considers the intensive margin of employment and not hiring through acquisitions or establishment openings.

Estimation of Equation (3) is also subject to reverse causality, whereby firms increasing hiring might have a positive impact on the local economy and thus boost real estate prices. We investigate this concern by simply re-estimating the model on a subsample of small firms located in large MSAs. Since these firms are unlikely to push up local real estate prices, it allows us to address the reverse causality issue directly. We discuss this test in detail in Section 3.1.

The final identification concern with this estimation is the real estate ownership decision and how it may relate to different firm-types. In particular, if firms choosing to purchase real estate are also more responsive to local economic conditions, our estimate of β could be biased. We approach this issue following the literature (Chaney et al., 2012; Cvijanović, 2014): we control for the interaction of observable firm characteristics that determine real

estate ownership with the local real estate price index. If the underlying characteristics of real estate owners make them more sensitive to fluctuations in real estate prices then controlling for this interaction allows us to identify the collateral lending channel. Note that heterogeneity in the ownership decision should partly be controlled for through the inclusion of firm-fixed effects, but controlling for the observable determinants of real estate holdings will improve identification.

We focus on the real estate ownership decision as of 1993 and the following determinants: five quintiles of return on assets, total assets, and age, and industry- and MSA-fixed effects. Consistent with the literature, we find firms with higher return on assets, larger firms, and older firms are more likely to purchase real estate in our sample.[13] These firm-level characteristics, measured as of 1993 and interacted with the contemporaneous local real estate price index, are thus included in the vector of controls, $\mathbf{X}$, in every employment regression model. Thus, our final identifying assumption is that the ownership decision is orthogonal to the sensitivity of employment to local real estate prices, once we control for these observable determinants and how they interact with prices.

3 Empirical Results

This section provides estimates of the impact of real estate collateral values on the employment decisions on the firm. In Section 3.1, we conduct the baseline firm-level analysis, as well as robustness tests. In Sections 3.1.3 and 3.2, we examine how the relation between collateral and employment varies in the cross-section of firms. Sections 3.3 and 3.4 document within-firm adjustments in employment using the establishment-level information. Section 3.5 investigates whether collateral has an impact on employment at the macro level.

[13]The results of estimating a cross-sectional regression of the firm-level market value of real estate and an ownership indicator—a variable equal to one if the firm reports real estate assets in Compustat—on firm characteristics (as of 1993) are deferred to the Internet Appendix.

3.1 Real Estate Collateral Values and Corporate Employment

We begin by estimating several models of the relation between employment and collateral based on Equations (1) and (3). Table II provides the results.

Column [1] shows the results from the estimation of (1) without any time-varying firm controls. The coefficient on RE Value is equal to 0.102 and significant at the 1% confidence level. The direction of this estimate is consistent with our expectation that firms with greater real estate holdings increase their employment more when real estate prices rise. In terms of economic magnitudes, the estimate implies that increasing the market value of real estate holdings by one standard deviation (this is, roughly a 1.121 increase) leads to a 0.114 increase in employment, which constitutes about 15.6% of its standard deviation (0.733). In dollar terms, an extra dollar of real estate collateral increases employment expenditures by about \$0.102. These micro-estimates suggest the collateral lending channel has a strong impact on employment.[14]

Column [2] shows the results of the OLS estimation of Equation (1), but now we add controls for investment opportunities: cash flow and Tobin's Q. We find both Cash Flow and Q have a significant, positive impact on employment which is in line with our expectations. The coefficient on RE Value is now 0.097 and still statistically significant at the 1% level. The economic magnitude of this coefficient is on the same order as the baseline estimate.

Column [3] saturates this specification with industry $\times$ year $\times$ MSA-fixed effects. Note that the coefficient on RE Price index is no longer identified once we include these fixed effects. In this specification, β is identified off firms operating in the same MSA and industry in the same year that are exposed to the same real estate price shock, but have different real estate holdings. Despite the inclusion of this extensive set of controls, the resulting

[14]In the Internet Appendix, we examine changes in debt financing decisions and find evidence consistent with the collateral lending channel theory (e.g., Almeida and Campello, 2007). We show a positive impact of real estate collateral values on long-term debt issuance and repayment consistent with utilization of greater debt capacity. For more detailed evidence on how these firms adjust leverage and debt contracting, see Cvijanović (2014) and Lin (2015).

coefficient is now 0.098 and remains significant at the 1% confidence level.

Columns [4] to [6] conducts the IV estimation of Equation (3) with real estate prices instrumented using the interaction of the local land supply elasticity and nationwide mortgage rate. Section 2.3 provides details of the IV strategy and first-stage results, so here we focus on the second-stage equation. These columns show the IV estimation yields coefficients between 0.098 and 0.103, depending on the set of controls included in the regression, and always significant at the 1% level. Thus, the IV and OLS estimates are similar both in terms of magnitude and significance.

3.1.1 Robustness Checks

To examine the robustness of the baseline firm-level estimates in Table II, we conduct a number of additional tests. The results of these tests are presented in Tables III.

As described earlier, our approach isolates exogenous variation in real estate collateral values, which addresses the concern that real estate assets may proxy for growth opportunities. However, our measurement of the market value of real estate assets relies on several assumptions that may introduce measurement error into the regression analysis. Columns [1] to [4] of Table III attempt to address this issue directly.

We first investigate our assumption that the location of all real estate assets is the same MSA as headquarters. This assumption may be problematic if the majority of real estate holdings are located elsewhere. In this case, the baseline estimates reported in Table II might be subject to measurement error and biased either downwards or upwards (Cvijanović, 2014). On the one hand, if the measurement error is independent of the true market value of real estate assets then the estimate of β may be biased towards zero. On the other hand, if the measurement error is positively correlated with the true value of real estate—say, if firms with the largest real estate holdings also have the lowest fraction of their holdings in the headquarters MSA—then β may be upwards biased.

We gauge the importance our location assumption using establishment-level data on the location of firms' operations from the LBD of the U.S. Census Bureau. While the LBD does not provide information on the ownership of establishments, it does provide establishment-level employment data that can be used to construct weights that indicate how exposed each firm is to each MSA-level real estate market.[15] We consider two such weighting schemes. First, for each firm, we weight according to the fraction of the firm's total employment located in each MSA ("Employment-Weighted"). Second, we assign a 100% weight to the MSA with the greatest fraction of the firm's employment ("Employment-Maximum"). These weights are then interacted with appropriate MSA-level real estate price indices and aggregated to the firm-year level to give a quasi-real estate price index. This firm-year level price index can then be used to inflate the market value of real estate assets as of 1993, as described in Section 2.2, and provide a more refined measure of collateral value.

Columns [1] and [2] show the results of the IV estimation of Equation (3) using these two alternative weighting schemes. In both cases, we see the coefficient on RE Value is positive and statistically significant at the 1% confidence level. The point estimates—0.093 and 0.088 for employment-weighted and employment-maximum, respectively—are consistent with Table II, although slightly smaller in magnitude. This suggests the location assumption may introduce measurement error in our baseline regression leading to (slightly) inflated estimates of the impact of collateral on employment. One explanation mentioned above is that firms with the largest real estate ownership may also have more dispersed holdings.

To further investigate the location assumption, we use headquarters ownership data hand-collected from SEC 10-K filings by Chaney et al. (2012). In particular, we restrict the sample to firms where we know with certainty whether the firm did or did not own their headquarters in 1997, the first year when filings were available in electronic format. This

[15]This is only relevant for ("multi-unit") firms with more than one establishment. Such firms comprise more than 84% of the observations in our sample. The Internet Appendix provides detailed summary statistics for both single- and multi-unit firms.

reduces the sample size to 8,632 firm-years observations. We calculate the market value of real estate assets following the usual procedure and perform IV estimation of Equation (3) on this subsample. Column [3] shows the results of this test. The coefficient of interest is now 0.109 and remains significant at the 1% confidence level, which conforms well with the baseline IV estimates.

Next, we take a simpler approach and replace RE Value with RE Owner—an indicator variable equal to one if the firm reports any real estate holdings in 1993—as the main independent variable in Equation (3). This indicator variable is interacted with the (instrumented) MSA-level real estate price index corresponding to each firm's headquarters location. If collateral values matter for employment then we would expect that the coefficient on RE Owner $\times$ RE Price Index should be positive. This approach complements the baseline regression analysis by using a simpler method to calculate real estate exposure. It also allows us to investigate whether previous estimates are driven by a small number of large real estate holders. Column [4] shows the result, which is consistent with our expectation. The coefficient estimate is positive (0.433) and significant at the 5% level. The economic magnitude implied by this specification is in line with prior estimates: a one standard deviation increase in the interaction term (0.334) leads to a 19.7% increase of employment's standard deviation.

One remaining concern is our estimates may be affected by reverse causality in real estate holding decisions: hiring by large firms might impact local real estate prices by increasing local demand for housing. To address this issue, as discussed previously, we repeat our baseline IV estimation on a subsample of small firms located in large MSAs. We define small firms as those belonging to the bottom three quartiles of the size distribution and large MSAs are restricted to the top 20 (ranked on population). The estimated coefficient reported in Column [5], is 0.125 and is statistically significant at the 1% confidence level, thus alleviating the reverse causality concern. In fact, the point estimate for the small firms

is quite a bit larger than the baseline estimate, a fact we will revisit when we discuss the role of ex ante financial constraints in Section 3.2.

3.1.2 Alternative Measures of Employment

We now consider several alternative measures of employment. The results serve as both robustness checks and also shed light on the channel through which firms expand employment (i.e., more employees or wages per employee). These results are shown in Tables III and IV.

First, we re-estimate Equation (3) using industry-adjusted employment expenditures as a dependent variable. More precisely, each firm's employment expenditures is demeaned by the expenditures of the other firms in the same two-digit SIC industry and year. This adjustment mitigates the concern that employment growth might occur in industries concentrated in areas experiencing greater real estate price appreciation, and firms in these industries have greater real estate holdings. Column [6] of Table III shows the coefficient of interest remains unchanged (0.100 versus 0.098 in the corresponding baseline estimation) and remains significant at the 1% confidence level.

We explore three alternative definitions of the dependent variable in our baseline estimation. We calculate each of these measures using employment data from the LBD. Table IV reports the results. Columns [1] and [2] use the annual change in the number of employees scaled by lagged PPE as the dependent variable. Columns [3] and [4] use the annual change in number of employees divided by one half of the sum of current and lagged employment, i.e., the symmetric employment growth rate. In each of these four columns the coefficient on RE Value is positive and statistically significant at the 1% level, consistent with the increase in collateral value leading to hiring of new employees. Columns [5] and [6] use the average wage growth (payroll divided by the number of employees) and show the coefficient of interest is essentially zero and insignificant. Thus, we find the change in real estate collateral value results in incremental hiring, but not higher wages for existing or new employees.

3.1.3 Comparing Tradable and Non-Tradable Industries

In this section, we perform sample splits at the industry level to further address the possibility that local demand shocks give rise to a spurious correlation between real estate prices, real estate holdings, and corporate employment. While a local demand shock associated with real estate price appreciation should affect all firms similarly, the collateral lending channel is only relevant firms with real estate holdings. However, it is still possible that real estate holding firms respond more to local demand shocks. To examine this possibility, we separate out industries most likely to benefit from local demand shocks ("non-tradable" industries, such as construction and restaurants) from all others ("tradable" industries, such as heavy manufacturing). Naturally, firms from tradable industries are less likely to make employment decisions in response to local demand shocks.

We partition industries on the basis of tradability three ways and rerun our main specification separately on each subsample. The results of this analysis are reported in Table V. First, we use the classification provided by Mian and Sufi (2014).[16] These authors define a four-digit NAICS industry as tradable if it has imports plus exports above $10,000 per employee, or if total exports plus imports for the NAICS four-digit industry exceeds $500M. Retail industries and restaurants are classified as non-tradable. Columns [1] and [2] show the results of the IV estimation. For both columns, we see that the coefficient of interest is positive and significant at the 1% level. Most importantly, the coefficient for the "Tradable" subsample is positive (0.088) and highly significant, indicating that the collateral effect is still strong once we remove firms most likely to be sensitive to local demand shocks from the sample.

Second, we split industries based on the average distance of shipments following Adelino et al. (2015), who use shipment distance data from the 2007 Census Commodity Flow Survey

[16]Mian and Sufi provide a classification of all 4-digit NAICS industries into tradable and non-tradable groups in an online appendix.

for their classification. In particular, we classify three-digit NAICS industry-state pairs as tradable if the median reported shipment distance is above 600 miles. Columns [3] and [4] report the results of the estimation. Once again, the coefficient in the tradable group is positive (0.081) and significant at the 1% confidence level.

Finally, we repeat our tests simply classifying manufacturing firms as belonging to tradable industries and all other firms as non-tradable. The same pattern emerges: employment expenditures of firms from tradable industries, here manufacturers, show a strong dependence on real estate collateral values. Thus, the relationship we uncovered in our baseline sample is not driven by the inclusion of non-manufacturers.

The main implication of Table V is that the magnitude and significance of the effect of collateral on employment are essentially the same if we focus on tradable industries. If, instead of a collateral lending channel, we were measuring the effects of a local demand shock then we would expect to see the coefficient of interest attenuate markedly once firms most sensitive to local demand are removed from the sample. Thus, the interpretation that our real estate collateral effect is proxying for a greater sensitivity to local demand shocks among real estate holding firms does not appear validated by the data.

3.2 Impact of Financial Constraints

In this section, we analyze whether the effect of real estate collateral values on corporate employment varies with the extent of financial constraints. Our tests allow us to evaluate whether real estate price appreciation, by increasing available collateral and thus debt capacity, helps alleviate potential inefficiencies resulting from imperfect capital markets (Almeida and Campello, 2007).

We follow the standard approach in the empirical corporate finance literature (e.g., Giroud and Mueller, 2015a), which uses (lagged) measures of financial constraints to sort

firms into either "Constrained" or "Unconstrained" groups.[17] We focus on three different measures of financial constraints following the definitions given by Chaney et al. (2012). Our first measure of constraints is firm size. For each year in the sample, we label firms as financially constrained if they are in the bottom three deciles of the asset size distribution and unconstrained if they are in the top three deciles. All other firm-years are excluded from the analysis. Second, we use payout policy to classify firms. In particular, for each year we calculate the payout ratio of each firm: total payouts (dividends plus stock repurchases) divided by operating income. Each year, firms in the lowest three deciles of the distribution of payouts are labeled as financially constrained, firms in the highest three deciles of the distribution are considered unconstrained, and all other firms are discarded. Finally, we use long-term bond rating from Compustat (assigned by Standard and Poor's), among those firms with outstanding long-term debt, we label unrated (rated) firms as financially constrained (unconstrained). Then we estimate Equation (3) on the subsamples of firms and compare the coefficient of interest across constrained and unconstrained groups.

Table VI reports the results. The point estimates indicate that there are substantial differences in the responsiveness of firm-level employment to variation in real estate collateral values between the groups. In particular, the size of the coefficient of interest, β, is estimated to be about twice as large for the constrained group in all three cases. The point estimate for the constrained group is always significant at the 1% level. Thus, we find evidence that increased collateral values leads to additional hiring particularly for the set of financially constrained firms.

[17]The use of lagged values alleviates concerns that the classification might be contaminated by contemporaneous real estate price appreciation.

3.3 Intensive and Extensive Margins of Expansion

There is little existing empirical evidence on how firms allocate resources and restructure following increases in debt capacity. As collateral values appreciate and debt capacity increases, the firm faces decisions on how to expand employment. The firm can increase employment organically at existing establishments or at new establishments through acquisitions or openings. In this section, we analyze adjustments in employment at existing establishments or newly acquired or opened establishments, i.e., along the intensive or extensive margins.

Our results so far have been based on a measure of employment expenditures calculated across all establishments belonging to a given firm. This measure therefore combines the intensive and extensive change in employment into one estimate. To capture the intensive margin of employment growth, we measure the change in employment at existing establishments only. We now simply require that a given firm owns each establishment in year t when aggregating employment over establishments in year $t+1$. We then re-estimate our baseline regression for firm-level employment along the intensive margin as a function of real estate collateral.

Table VII shows the results. Columns [1] and [2] present the average effect across all firms using OLS and IV estimation, respectively, with the full set of control variables and fixed effects. The coefficient on RE Value remains positive (0.052) and significant at the 1% level. The direction of the estimate indicates that firms with greater real estate holdings increase employment at existing establishments when real estate prices rise. Comparing this point estimate with the corresponding baseline coefficient from column [5] of Table II (0.098), we see that roughly half of the increase in employment is allocated between existing and new establishments. Thus, the increase in collateral values has a meaningful effect in funding the expansion of operations. In the next section, we dig deeper and conduct an establishment-level analysis to further understand where this expansion in operations takes

place.

The remaining columns of Table VII examine the change in employment along the intensive margin for financially constrained and unconstrained firms. We use the three measures of constraints defined in the previous section. First, notice that the point estimates for the constrained firms are all positive and significant at the 1% level. Also, these estimates are larger than the average effect from Column [2], which is consistent with these firms experiencing a relaxation of a constraint and expanding employment accordingly. Moreover, comparing the magnitude of the coefficient of interest with the corresponding estimates reported in Table VI, we see that the constrained firms allocate about half of their expansion in employment along the intensive margin.

For financially unconstrained firms we find, for each classification, the coefficient on RE Value is small in magnitude and insignificant for the intensive margin of employment. However, recall the corresponding estimates in Table VI are all positive and statistically significant at conventional levels. Thus, financially unconstrained firms appear to use the additional debt capacity primarily to fund employment at new establishments, i.e., expand along the extensive margin.

3.4 Establishment-Level Analysis: Within-Firm Expansion

In this section, we estimate establishment-level regressions using data from the LBD. We measure how employment adjusts among a firm's establishments in response to changes in the market value of its collateral. This analysis serves two purposes. First, we corroborate our main results using more granular data that allows us to include powerful controls such as establishment-fixed effects. Second, we document how firms experiencing a relaxation of financial constraints—here, a boost in pledgeable assets—choose to expand their operations among their portfolio of existing assets.

Table VIII shows the results of estimating Equation (4), which quantifies the effect of

real estate collateral values on corporate employment for individual establishments. The regressions now include establishment-fixed effects in addition to the usual set of controls and year-fixed effects. We maintain our assumption that owned real estate is located in the same MSA as the firm's headquarters and calculate the firm-level collateral value accordingly. Columns [1] and [2] show the results for OLS and IV estimation, respectively. In both cases, the coefficient of interest is positive, although marginally significant for OLS and insignificant once we correct for endogeneity of real estate prices using our IV.

Columns [3] to [8] show the estimates separately for the establishments of financially constrained and unconstrained firms. We find the effect of real estate collateral on establishment-level employment is now positive and highly statistically significant, but only for the establishments of financially constrained firms. In the case of financially unconstrained firms, establishment-level hiring does not appear to respond to additional collateral. This is true whether we sort firms on the basis of size, payout policy, or credit rating, and corroborates our findings from Tables II, VI, and VII.[18] Finally, notice for each measure of financial constraints, the number of establishments of constrained firms is considerably smaller that those of the unconstrained firms, which likely explains the lack of statistical significance in Column [2].

We next focus exclusively on the set of constrained firms—since they are the only firms to adjust—and examine how they choose to increase employment across different types of establishments within their portfolio. The key idea we wish to test is whether firms use the additional debt capacity to fund employment at core or relatively marginal, potentially risky, assets. For instance, non-core or peripheral business lines—establishments not in the industry sector associated with the bulk of the firm's business—may be less well developed or management may lack experience relative to core business lines and therefore an expansion

[18]Note that the insensitivity of financially unconstrained firms' establishments is consistent with the intensive margin response from Table VII. This follows from our inclusion of establishment-fixed effects here, which forces the estimation in Table VIII to be along the intensive margin.

of these operations may present a greater risk of failure.

To implement our tests, we interact RE Value with several establishment characteristics following Giroud and Mueller (2015a); in particular, whether an establishment operates in a location in close proximity to headquarters, a core or peripheral industry sector, or whether it is relatively productive (for the subsample of manufacturing plants). We classify establishments along these dimensions at the beginning of each year. We then estimate a modified version of Equation (4):

$$\begin{aligned}\text{Employment}_{ijt} &= \alpha_j + \alpha_t + \beta_1 \widehat{\text{RE Value}}_{it} \times \text{Yes}_{jt} + \beta_2 \widehat{\text{RE Value}}_{it} \times \text{No}_{jt} \\ &\quad + \gamma \widehat{\text{RE Price Index}}_{mt} + \theta' \mathbf{X}_{ijmt} + \epsilon_{ijt}, \end{aligned} \tag{5}$$

where Yes_{jt} (No_{jt}) is an indicator variable equal to one (zero) if the establishment satisfies (does not satisfy) the criteria in question at the beginning of year t. The coefficients of interest here are β_1 and β_2 which capture the sensitivity of the different establishment types to changes in real estate values.

Table IX shows the results. The first characteristic we examine is the proximity of the establishment to headquarters. We classify an establishment as in close proximity if they are located in the same MSA as headquarters. As is shown in Columns [1] to [3], the coefficients of interest are positive and (nearly) always significant at at least the 10% level for establishments both near to and far from headquarters. The coefficient of interest for the distant establishments, β_2, is smaller in magnitude than the corresponding coefficient for the close-to-headquarters establishments. This indicates that constrained firms increase employment uniformly as a function of distance. Moreover, these results suggest firms transmit real estate collateral shocks across their locations of operation resulting in geographical spillovers of collateral shocks to other regions of the economy. We explore the potential for these effects to show up in the aggregate in the next section.

The second characteristic is whether an establishment operates in a core or peripheral industry sector of the firm. Following Maksimovic and Phillips (2002), we assign a 3-digit SIC industry to a firm's core business if it accounts for at least 25% of firm's employment and label it peripheral otherwise. Columns [4] to [6] show the effect of real estate price appreciation on employment is present in both core and peripheral establishments. The effect is stronger—about 50% larger—for establishments in peripheral industries and significant at at least the 5% confidence level across all measures of financial constraints. This suggests that firms channel the additional funds into peripheral industries and expand the scope of operations.

The third characteristic is establishment productivity. Since the LBD does not provide the necessary data to estimate a measure of productivity, we instead focus on the subsample of manufacturing establishments (plants) for which the CMF and ASM provide rich data on factor inputs and outputs. We estimate total factor productivity (TFP) at the plant-level following Foster et al. (2014). We classify a plant as productive if its TFP lies above the median TFP of the firms plants in a given year and unproductive otherwise. Columns [7] to [9] shows coefficients of interest are positive and significant at at least the 5% confidence level. This indicates that increased collateral among the financially constrained manufacturing firms causes employment to expand in both (ex ante) productive and unproductive plants, at least in the case of manufacturing firms.

3.5 Regional Spillover Effect at Macro-Level

In this section, we investigate whether the corporate balance sheets and the collateral lending channel play a role in transmitting real estate shocks between regions. We build on the establishment-level results and examine whether the internal capital markets of constrained firms lead to geographic spillover effects that can impact macro-level employment.

To investigate this hypothesis we focus on MSA-level employment outcomes (for a similar

approach, see Giroud and Mueller, 2015b).[19] Our independent variable is designed to capture the potential exposure of a given MSA to out-of-MSA real estate collateral value shocks. For each MSA we define a variable, RE Value$_{-m}$, as the employment-weighted average of the firm-level real estate market value for establishments located in a MSA. To capture a transmission effect from headquarters real estate collateral value, we exclude establishments whose parent firm is headquartered in the MSA. In line with previous literature, we estimate the following log-log specification:

$$\begin{aligned}\text{Log}(\text{Employment}_{mt}) &= \alpha_m + \alpha_t + \beta\ \text{Log}(\widehat{\text{RE Value}}_{(-m)t}) + \gamma\ \text{Log}(\text{RE } \widehat{\text{Price Index}}_{mt}) \\ &\quad + \theta' \mathbf{X}_{mt} + \epsilon_{mt}, \end{aligned} \tag{6}$$

where m indexes MSAs, t indexes years, Employment$_{mt}$ is the number of employees, and α_m) and α_t are MSA- and year-fixed effects, respectively. A vector of MSA control variables, $\mathbf{X}$, includes the employment rate and population. Employment is measured by aggregating across all establishments in the MSA using data from the LBD. The regression includes the MSA-level real estate price index to control for the direct effect of local real estate prices on employment. The coefficient of interest, β, captures the effect of out-of-MSA real estate price appreciation on local employment through geographic spillover effects associated with the internal capital markets of constrained firms.

In additional tests, we attempt to further identify the role of constrained firms transmitting real estate shocks. We classify MSAs as financially constrained and unconstrained depending on the fraction of MSA employment that comes from the establishments of constrained firms. If an MSA has an above-median proportion of employment across all MSAs coming from constrained establishments then we call the MSA financially constrained. The remaining MSAs are considered financially unconstrained. We continue to use our three

[19] Giroud and Mueller examine the impact of firm leverage on macro-level employment outcomes during the years from 2007 until 2009. We adapt their macro-level empirical approach to our setting.

measures of financial constraints—firm size, payout policy, and bond rating—to carry out this classification procedure. We then re-estimate Equation (6) separately on the subsamples of constrained and unconstrained MSAs.

Table X reports the results. Columns [1] and [2] show the estimation by OLS and IV, respectively. The coefficient of interest is positive and significant at conventional levels. This indicates the within-firm geographical spillover effects documented in Section 3.4 aggregate to the MSA-level and have a positive impact on employment. In Columns [3] to [8], once we partition MSAs according to the presence of constrained establishments we find further supportive evidence. For each measure of financial constraints, the coefficient is positive and significant. Indeed, we observe an increase in MSA-level employment in response to out-of-MSA real estate shocks only among the financially constrained MSAs. For the unconstrained MSAs, we observe no sensitivity to out-of-MSA real estate shocks and all of the estimated coefficients are insignificant.

Overall, we find that MSAs with a larger proportion of establishments belonging to financially constrained firms exhibit a significant response in employment following changes in non-local real estate collateral values. Thus, the collateral lending channel appears to play an important role for employment at the macro-level.

4 Conclusion

Using establishment-level data from the U.S. Census Bureau, we measure the sensitivity of firm employment to changes in debt capacity induced by fluctuations in real estate prices over the period from 1993 until 2006. We provide evidence that firms significantly increase employment when the value of real estate collateral appreciates. On average, a publicly-traded U.S. corporation increases employment expenditures by about \$0.10 per \$1 increase in the value of its collateral, or about or 15.6% of the standard deviation of employment. In

line with previous research, we show this additional hiring is funded through debt issues and the effects are stronger for firms likely to be financially constrained. Crucially, our findings hold when we focus our attention on the industries least likely to respond to local demand shocks, including manufacturers and firms in tradable industries.

We explore the unique features of the establishment-level data to understand how firms choose to expand employment across their portfolio of assets. Our within-firm analysis shows that firms increase hiring at existing and new establishments, as well as establishments in non-core industries and geographically distant locations. By considering firms as portfolios of locations, we further explore these within-firm spillover effects across geographic regions. We find evidence that financially constrained firms can transmit real estate collateral shocks across regions and that this can matter at the macro-level.

Overall, the micro-evidence we present highlights the empirical importance of collateral lending channel as a key determinant of corporate employment decisions. Our evidence is consistent with financial constraints and their interaction with real estate collateral values providing a channel to spread economic shocks, as articulated theoretically in Kiyotaki and Moore (1997), Jermann and Quadrini (2012), and Liu et al. (2013).

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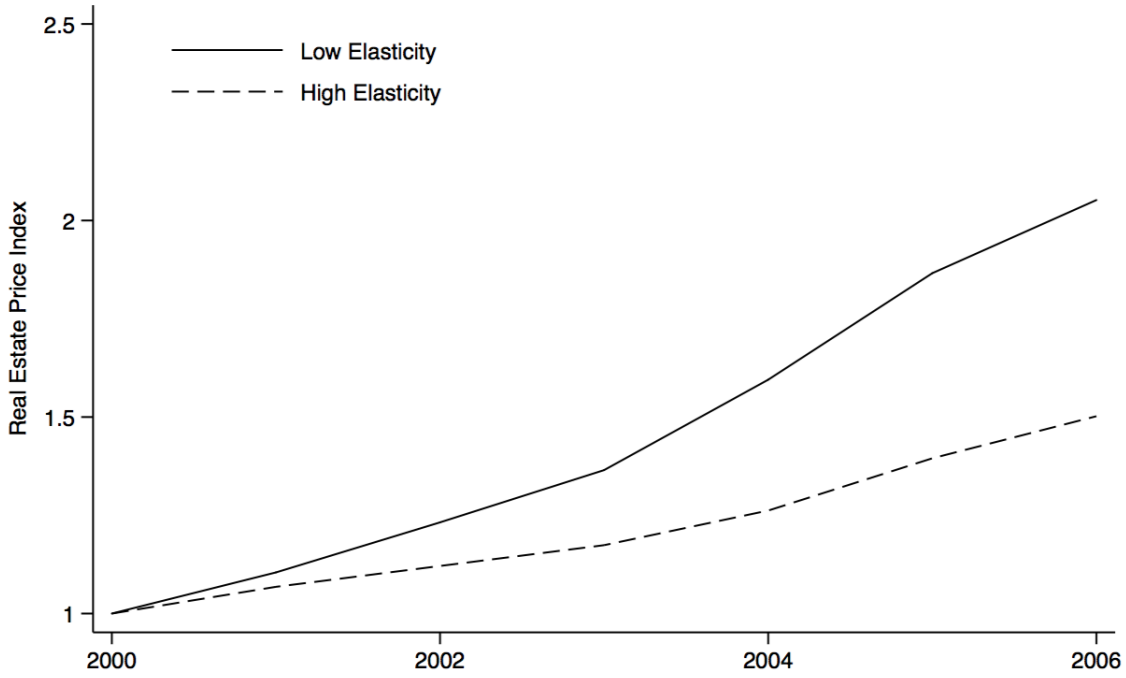

Figure 1: Relative Evolution of U.S. Real Estate Prices. This figure plots the time series average of annual MSA-level real estate prices (residential, single-family home). The price index is normalized to one in 2000. The sample period is from 2000 until 2006. The series is plotted separately for MSAs with high (top quartile) and low (bottom quartile) elasticity of land supply.

Table I
Summary Statistics

This table provides sample summary statistics. Panel A provides firm-level statistics. Panel B provides establishment-level statistics. Panel C summarizes MSA-level statistics. The unit of observation in Panel A, B, and C, respectively, is a firm-year, establishment-year, and MSA-year. All variables are defined in Appendix A.

	N	Mean	Std.
	[1]	[2]	[3]
Panel A: Firm-Level			
Employment Expenditures	13,000	0.193	0.733
Employment Expenditures (IM)	13,000	0.123	0.569
Number of Employees	13,000	2.594	15.795
Number of Employees (Alt.)	13,000	0.011	0.323
Average Wage	13,000	0.002	0.008
RE Value	13,000	0.852	1.121
RE Value (Employment-Weighted)	13,000	0.890	1.215
RE Value (Employment-Maximum)	13,000	0.881	1.207
RE Value (HQ Owner)	9,000	0.781	1.134
RE Owner	13,000	0.641	0.480
Return on Assets	13,000	0.007	0.236
Cash Flow	13,000	-0.265	2.668
Q	13,000	2.087	1.554
Total Assets	13,000	1,511.688	5,910.535
Age	13,000	20.108	14.067
Panel B: Establishment-Level			
Employment Expenditures	912,000	0.097	0.695
Number of Employees	912,000	0.000	0.031
Age	912,000	10.374	8.219
Panel C: MSA-Level			
Number of Employees	1,230	853,971.2	966,523.7
RE Price Index	1,230	0.676	0.192
RE Value$_{-l}$	1,230	7.292	0.830
Elasticity	1,230	1.632	0.860
Employment Rate	1,230	0.948	0.021
Population	1,230	1,720,035	1,866,270

Table II
Real Estate Collateral and Corporate Employment: Firm-Level Analysis

This table presents estimates of the firm-level impact of real estate collateral value on corporate employment. The unit of observation in each regression is a firm-year pair. The dependent variable is the annual change in employment expenditures divided by the lagged value of plants, property, and equipment. The market value of real estate assets is calculated assuming assets are located in the same MSA as firms' headquarters. Columns [1]–[3] show the results of the OLS estimation and [4]–[6] for the IV estimation, where MSA-level real estate prices are instrumented using the interaction of the local land supply elasticity and the real mortgage rate. Where indicated, regressions control for initial firm characteristics (five quintiles of Return on Assets, Total Assets, Age, and MSA and two-digit SIC industry dummies) interacted with MSA-level real estate prices and year- and firm-fixed effects. All variables are defined in Appendix A. Standard errors (in parentheses) are clustered at the MSA-year level. ***, **, * denotes 1%, 5%, and 10% statistical significance.

Dependent Variable: Employment Expenditures						
	(OLS)	(OLS)	(OLS)	(IV)	(IV)	(IV)
	[1]	[2]	[3]	[4]	[5]	[6]
RE Value	0.102***	0.097***	0.098***	0.103***	0.098***	0.100***
	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)
RE Price Index	0.401	0.615		0.375	0.578	
	(0.774)	(0.771)		(0.848)	(0.840)	
Cash Flow		0.023***	0.022***		0.023***	0.022***
		(0.007)	(0.007)		(0.007)	(0.007)
Q		0.038***	0.037***		0.039***	0.038***
		(0.009)	(0.009)		(0.009)	(0.009)
RE Price Index × Init. Controls	Y	Y	Y	Y	Y	Y
Year Fixed Effects	Y	Y	Y	Y	Y	Y
Firm Fixed Effects	Y	Y	Y	Y	Y	Y
Industry × Year × MSA Fixed Effects	N	N	Y	N	N	Y
Observations	13,000	13,000	13,000	13,000	13,000	13,000
R^2	0.29	0.30	0.31	0.29	0.30	0.31

Table III
Real Estate Collateral and Corporate Employment: Robustness Checks

This table presents robustness checks of the baseline estimates of the firm-level impact of real estate collateral value on corporate employment. The unit of observation in each regression is a firm-year pair. The dependent variable is the annual change in employment expenditures divided by the lagged value of plants, property, and equipment. The market value of real estate assets is calculated assuming assets are located in the same MSA as firms' headquarters. Column [1] instead assumes that real estate assets are geographically distributed in proportion to establishment-level employment. Column [2] assumes that real estate assets are located in the MSA with the greatest firm-level employment. Column [3] uses the market value of real estate assets for firms that own their headquarters. Column [3] replaces the market value of real estate assets with an indicator variable equal to one if the firm had positive real estate holdings in 1993. Column [5] restricts the sample to firms in the bottom three quartiles in the distribution of total assets and in the largest 20 MSAs by population. Column [6] demeans the dependent variable using the mean of all other firms in the same two-digit SIC grouping. All columns use IV estimation, where MSA-level real estate prices are instrumented using the interaction of the local land supply elasticity and the real mortgage rate. Each regression controls for initial firm characteristics (five quintiles of Return on Assets, Total Assets, Age, and MSA and two-digit SIC industry dummies) interacted with MSA-level real estate prices and year- and firm-fixed effects. All variables are defined in Appendix A. Standard errors (in parentheses) are clustered at the MSA-year level. ***, **, * denotes 1%, 5%, and 10% statistical significance.

Dependent Variable: Employment Expenditures						
	E-Weighted RE Prices	E-Maximum RE Prices	HQ RE Value	RE Owner Indicator	Large MSA, Small Firm	Ind.-Adj. Employment
	(IV)	(IV)	(IV)	(IV)	(IV)	(IV)
	[1]	[2]	[3]	[4]	[5]	[6]
RE Value	0.093***	0.088***	0.109***		0.125***	0.100***
	(0.013)	(0.013)	(0.018)		(0.024)	(0.015)
RE Owner × RE Price Index				0.433**		
				(0.174)		
RE Price Index	1.015	0.600	-0.293	-0.412	3.080*	-0.317
	(0.858)	(0.709)	(1.004)	(0.832)	(1.683)	(0.744)
Cash Flow	0.023***	0.023***	0.020***	0.023***	0.018*	0.021***
	(0.007)	(0.007)	(0.008)	(0.007)	(0.009)	(0.007)
Q	0.039***	0.039***	0.042***	0.043***	0.043***	0.039***
	(0.009)	(0.009)	(0.011)	(0.009)	(0.014)	(0.009)
RE Price Index × Init. Controls	Y	Y	Y	Y	Y	Y
Year Fixed Effects	Y	Y	Y	Y	Y	Y
Firm Fixed Effects	Y	Y	Y	Y	Y	Y
Observations	13,000	13,000	9,000	13,000	5,000	13,000
R^2	0.30	0.30	0.27	0.29	0.29	0.26

Table IV
Real Estate Collateral and Corporate Employment: Alternative Measurement

This table presents estimates of the firm-level impact of real estate collateral value on alternative measures of corporate employment. The unit of observation in each regression is a firm-year pair. The dependent variable changes across specifications. Columns [1]–[2] use the annual change in number of employees divided by the lagged value of plants, property, and equipment. Columns [3]–[4] use twice the annual change in number of employees divided by the sum of current and lagged employment (i.e., the symmetric growth rate). Columns [5]–[6] use the change in the average wage (payroll divided by number of employees). The market value of real estate assets is calculated assuming assets are located in the same MSA as firms' headquarters. Where indicated, columns use OLS estimation or IV estimation, where MSA-level real estate prices are instrumented using the interaction of the local land supply elasticity and the real mortgage rate. Each regression controls for initial firm characteristics (five quintiles of Return on Assets, Total Assets, Age, and MSA and two-digit SIC industry dummies) interacted with MSA-level real estate prices and year- and firm-fixed effects. All variables are defined in Appendix A. Standard errors (in parentheses) are clustered at the MSA-year level. ***, **, * denotes 1%, 5%, and 10% statistical significance.

Dependent Variable:	Number of Employees		Number of Employees (Alt.)		Average Wage	
	(OLS)	(IV)	(OLS)	(IV)	(OLS)	(IV)
	[1]	[2]	[3]	[4]	[5]	[6]
RE Value	1.991***	2.065***	0.054***	0.058***	0.000	0.000
	(0.333)	(0.336)	(0.009)	(0.009)	(0.000)	(0.000)
RE Price Index	-1.654	3.536	-4.256*	-3.836*	0.045	0.031
	(24.139)	(24.152)	(2.445)	(2.046)	(0.044)	(0.038)
Cash Flow	0.404***	0.409***	0.005**	0.005**	0.000	0.000
	(0.141)	(0.142)	(0.002)	(0.002)	(0.000)	(0.000)
Q	1.834***	1.854***	0.036***	0.037***	-0.001***	-0.001***
	(0.172)	(0.171)	(0.003)	(0.003)	(0.000)	(0.000)
RE Price Index × Init. Controls	Y	Y	Y	Y	Y	Y
Year Fixed Effects	Y	Y	Y	Y	Y	Y
Firm Fixed Effects	Y	Y	Y	Y	Y	Y
Observations	13,000	13,000	13,000	13,000	13,000	13,000
R^2	0.26	0.26	0.20	0.20	0.12	0.12

Table V
Real Estate Collateral and Corporate Employment: Tradable versus Non-Tradable Industries

This table presents estimates of the firm-level impact of real estate collateral value on corporate employment across three definitions of tradable and non-tradable industries. The unit of observation in each regression is a firm-year pair. The dependent variable is the annual change in employment expenditures divided by the lagged value of plants, property, and equipment. The market value of real estate assets is calculated assuming assets are located in the same MSA as firms' headquarters. Columns [1]–[2], following Mian and Sufi (forth.), defines a 4-digit NAICS industry as tradable if it has imports plus exports above $10,000 per employee, or if total exports plus imports for the NAICS 4-digit industry exceeds $500M. We define remaining industries as non-tradable and firms are grouped accordingly. Columns [3]–[4], following Adelino et al. (forth.), classifies 3-digit NAICS industry-state pairs as tradable based on the median of the shipment distance distribution (above 600 miles). Columns [5]–[6] defines manufacturing firms as tradable and other firms non-tradable. All columns use IV estimation, where MSA-level real estate prices are instrumented using the interaction of the local land supply elasticity and the real mortgage rate. Each regression controls for Cash Flow and Q as well as initial firm characteristics (five quintiles of Return on Assets, Total Assets, Age, and MSA and two-digit SIC industry dummies) interacted with MSA-level real estate prices and year- and firm-fixed effects. All variables are defined in Appendix A. Standard errors (in parentheses) are clustered at the MSA-year level. ***, **, * denotes 1%, 5%, and 10% statistical significance.

Dependent Variable: Employment Expenditures						
	Retail and World Trade		Shipping Distance		Manufacturing Industry	
	Tradable	Non-Tradable	Tradable	Non-Tradable	Tradable	Non-Tradable
	(IV)	(IV)	(IV)	(IV)	(IV)	(IV)
	[1]	[2]	[3]	[4]	[5]	[6]
RE Value	0.088***	0.105***	0.081***	0.086***	0.083***	0.120***
	(0.023)	(0.020)	(0.021)	(0.018)	(0.015)	(0.036)
RE Price Index	-0.473	-7.433*	1.079	-0.282	-0.307	-9.404**
	(1.373)	(3.979)	(0.974)	(1.458)	(0.706)	(4.388)
Firm Controls	Y	Y	Y	Y	Y	Y
RE Price Index × Init. Controls	Y	Y	Y	Y	Y	Y
Year Fixed Effects	Y	Y	Y	Y	Y	Y
Firm Fixed Effects	Y	Y	Y	Y	Y	Y
Observations	6,000	7,000	5,000	2,000	8,000	5,000
R^2	0.28	0.33	0.27	0.32	0.27	0.33

Table VI
Real Estate Collateral and Corporate Employment: Impact of Financial Constraints

This table presents estimates of the firm-level impact of real estate collateral value on corporate employment across ex ante financially constrained and unconstrained firms. The unit of observation in each regression is a firm-year pair. The dependent variable is the annual change in employment expenditures divided by the lagged value of plants, property, and equipment. The market value of real estate assets is calculated assuming assets are located in the same MSA as firms' headquarters. Columns [1]–[2] classify firms in the bottom three deciles of the size distribution (lagged total assets) as constrained and firms in the top three deciles as unconstrained. Columns [3]–[4] classify firms in the bottom three deciles of the payout ratio distribution (dividends plus repurchases over operating income) as constrained and firms in the top three deciles as unconstrained. Columns [5]–[6] classify firms with long-term debt outstanding and no bond rating as constrained and firms with a bond rating unconstrained. All columns use IV estimation, where MSA-level real estate prices are instrumented using the interaction of the local land supply elasticity and the real mortgage rate. Each regression controls for Cash Flow and Q as well as initial firm characteristics (five quintiles of Return on Assets, Total Assets, Age, and MSA and two-digit SIC industry dummies) interacted with MSA-level real estate prices and year- and firm-fixed effects. All variables are defined in Appendix A. Standard errors (in parentheses) are clustered at the MSA-year level. ***, **, * denotes 1%, 5%, and 10% statistical significance.

Dependent Variable: Employment Expenditures						
	Firm Size		Payout Policy		Bond Rating	
	Constrained	Unconstrained	Constrained	Unconstrained	Constrained	Unconstrained
	(IV)	(IV)	(IV)	(IV)	(IV)	(IV)
	[1]	[2]	[3]	[4]	[5]	[6]
RE Value	0.165***	0.073***	0.124***	0.055*	0.121***	0.069***
	(0.047)	(0.021)	(0.028)	(0.030)	(0.020)	(0.027)
RE Price Index	-1.194	-2.370	-3.186	1.494	-0.428	4.890
	(1.693)	(1.653)	(2.450)	(1.595)	(1.001)	(7.320)
Firm Controls	Y	Y	Y	Y	Y	Y
RE Price Index × Init. Controls	Y	Y	Y	Y	Y	Y
Year Fixed Effects	Y	Y	Y	Y	Y	Y
Firm Fixed Effects	Y	Y	Y	Y	Y	Y
Observations	4,000	4,000	7,000	4,000	8,000	3,000
R^2	0.34	0.36	0.33	0.53	0.34	0.40

Table VII
Real Estate Collateral and Corporate Employment: Intensive versus Extensive Margin

This table presents estimates of the firm-level impact of real estate collateral value on corporate employment at existing establishments only. The unit of observation in each regression is a firm-year pair. The dependent variable is the annual change in employment expenditures at establishments owned at the beginning of the year divided by the lagged value of plants, property, and equipment. The market value of real estate assets is calculated assuming assets are located in the same MSA as firms' headquarters. Columns [1]–[2] show the results of OLS and IV estimation. Columns [3]–[8] classify firms as financially constrained or unconstrained according to the definitions in Table VI and repeat the estimation on these subsamples. All columns (except [1]) use IV estimation, where MSA-level real estate prices are instrumented using the interaction of the local land supply elasticity and the real mortgage rate. Each regression controls for Cash Flow and Q as well as initial firm characteristics (five quintiles of Return on Assets, Total Assets, Age, and MSA and two-digit SIC industry dummies) interacted with MSA-level real estate prices and year- and firm-fixed effects. All variables are defined in Appendix A. Standard errors (in parentheses) are clustered at the MSA-year level. ***, **, * denotes 1%, 5%, and 10% statistical significance.

Dependent Variable: Employment Expenditures (IM)								
			Financial Constraints					
			Firm Size		Payout Policy		Bond Rating	
			Constr.	Unconstr.	Constr.	Unconstr.	Constr.	Unconstr.
	(OLS)	(IV)	(IV)	(IV)	(IV)	(IV)	(IV)	(IV)
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
RE Value	0.054***	0.052***	0.109***	0.014	0.079***	-0.004	0.068***	0.011
	(0.011)	(0.011)	(0.035)	(0.012)	(0.022)	(0.020)	(0.016)	(0.012)
RE Price Index	-0.250	0.158	-0.471	-2.292	-3.581	0.433	-0.370	1.121
	(0.723)	(0.749)	(1.368)	(1.063)	(2.408)	(1.116)	(0.864)	(4.045)
Firm Controls	Y	Y	Y	Y	Y	Y	Y	Y
RE Price Index × Init. Controls	Y	Y	Y	Y	Y	Y	Y	Y
Year Fixed Effects	Y	Y	Y	Y	Y	Y	Y	Y
Firm Fixed Effects	Y	Y	Y	Y	Y	Y	Y	Y
Observations	13,000	13,000	4,000	4,000	7,000	4,000	8,000	3,000
R^2	0.26	0.26	0.31	0.28	0.30	0.50	0.31	0.37

Table VIII
Real Estate Collateral and Corporate Employment: Establishment-Level Analysis

This table presents estimates of the establishment-level impact of real estate collateral value on corporate employment. The unit of observation in each regression is an establishment-year pair. The dependent variable is the annual establishment-level change in employment expenditures divided by the lagged firm-level value of plants, property, and equipment. The market value of real estate assets is calculated assuming assets are located in the same MSA as firms' headquarters. Columns [1]–[2] show the results of OLS and IV estimation. Columns [3]–[8] classify firms as financially constrained or unconstrained according to the definitions in Table VI and repeat the estimation on these subsamples. All columns (except [1]) use IV estimation, where MSA-level real estate prices are instrumented using the interaction of the local land supply elasticity and the real mortgage rate. Each regression controls for Cash Flow and Q as well as initial firm characteristics (five quintiles of Return on Assets, Total Assets, Age) and establishment characteristics (MSA and two-digit SIC industry dummies) interacted with MSA-level real estate prices and year- and establishment-fixed effects. Coefficients are scaled up by 1,000 for readability. All variables are defined in Appendix A. Standard errors (in parentheses) are clustered at the firm level. ***, **, * denotes 1%, 5%, and 10% statistical significance.

Dependent Variable: Employment Expenditures								
			Financial Constraints					
			Firm Size		Payout Policy		Bond Rating	
			Constr.	Unconstr.	Constr.	Unconstr.	Constr.	Unconstr.
	(OLS)	(IV)	(IV)	(IV)	(IV)	(IV)	(IV)	(IV)
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
RE Value	0.055*	0.039	0.242***	0.036	0.119**	0.073	0.205***	0.039
	(0.029)	(0.032)	(0.068)	(0.035)	(0.055)	(0.048)	(0.047)	(0.040)
RE Price Index	1.503	1.341	2.701	-1.235	-0.513	-4.687	1.535	2.585
	(1.700)	(2.416)	(5.631)	(11.607)	(3.381)	(7.995)	(2.675)	(3.001)
Firm Controls	Y	Y	Y	Y	Y	Y	Y	Y
RE. Prices × Init. Controls	Y	Y	Y	Y	Y	Y	Y	Y
Year Fixed Effects	Y	Y	Y	Y	Y	Y	Y	Y
Establishment Fixed Effects	Y	Y	Y	Y	Y	Y	Y	Y
Observations	912,000	912,000	62,000	850,000	210,000	600,000	200,000	600,000
R^2	0.26	0.26	0.34	0.27	0.41	0.28	0.34	0.26

Table IX
Real Estate Collateral and Corporate Employment: Within-Firm Expansion Among Constrained Firms

This table shows the impact of real estate collateral value on the within-firm adjustment in employment among financially constrained firms. The unit of observation in each regression is an establishment-year pair. The dependent variable is the annual establishment-level change in employment expenditures divided by the lagged firm-level value of plants, property, and equipment. The market value of real estate assets is calculated assuming assets are located in the same MSA as firms' headquarters. Financial constraints are defined in Table VI. Columns [1]–[3] classify establishments as in close proximity to headquarters if they are located in the same MSA as headquarters. Columns [4]–[6] classify establishments as in the core industry if they operate in the same 3-digit SIC code as more than 25% of total firm-level employment. Columns [7]–[9] classify (manufacturing) establishments as productive if they have above-median (lagged) total factor productivity. All columns use IV estimation, where MSA-level real estate prices are instrumented using the interaction of the local land supply elasticity and the real mortgage rate. Each regression controls for Cash Flow and Q as well as initial firm characteristics (five quintiles of Return on Assets, Total Assets, Age, and MSA and two-digit SIC industry dummies) interacted with MSA-level real estate prices and year- and establishment-fixed effects. Coefficients are scaled up by 1,000 for readability. All variables are defined in Appendix A. Standard errors (in parentheses) are clustered at the firm level. ***, **, * denotes 1%, 5%, and 10% statistical significance.

Dependent Variable: Employment Expenditures									
	Close to HQ?			Core Industry?			Productive Plant?		
	Firm Size	Payout Policy	Bond Rating	Firm Size	Payout Policy	Bond Rating	Firm Size	Payout Policy	Bond Rating
	(IV)	(IV)	(IV)	(IV)	(IV)	(IV)	(IV)	(IV)	(IV)
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
RE Value × Yes	0.257**	0.163	0.294***	0.219***	0.090	0.171**	5.232**	2.861**	3.268**
	(0.103)	(0.102)	(0.081)	(0.068)	(0.066)	(0.050)	(2.399)	(1.286)	(1.420)
RE Value × No	0.230***	0.094*	0.130***	0.310***	0.155**	0.249***	4.155**	3.274***	2.624**
	(0.069)	(0.052)	(0.043)	(0.081)	(0.071)	(0.058)	(2.006)	(1.233)	(1.130)
RE Price Index	2.709	-0.643	1.735	3.044	-0.309	1.778	444***	-168***	51.394
	(5.635)	(3.355)	(2.723)	(5.676)	(3.439)	(2.733)	(104)	(67)	(85.155)
Firm Controls	Y	Y	Y	Y	Y	Y	Y	Y	Y
RE Price Index × Init. Controls	Y	Y	Y	Y	Y	Y	Y	Y	Y
Year Fixed Effects	Y	Y	Y	Y	Y	Y	Y	Y	Y
Establishment Fixed Effects	Y	Y	Y	Y	Y	Y	Y	Y	Y
Observations	62,000	200,000	200,000	62,000	200,000	200,000	3,000	6,000	7,000
R^2	0.34	0.41	0.34	0.34	0.41	0.34	0.36	0.49	0.41

Table X
Real Estate Collateral and Corporate Employment: Regional Spillover Effect at Macro-Level

This table presents estimates of the cross-border spillover of real estate collateral value on MSA-level corporate employment. In particular, assuming that firms real estate value lies with their headquarters, the estimates show the transmission from headquarters collateral value to non-headquarters (out-of-MSA) employment. The unit of observation in each regression is an MSA-year pair. The dependent variable is the natural logarithm of total number of employees at the MSA-level. In all regressions, we use the employment-weighted average of out-of-MSA real estate market value for firms that have establishments in the MSA but are not headquarters. Columns [1] and [2] shows the average effect using OLS and IV estimation. Columns [3]–[8] classify MSAs as financially constrained if an above-median fraction of MSA-level employment comes from establishments belonging to financially constrained firms, and unconstrained otherwise. Where indicated columns use IV estimation, where MSA-level real estate prices are instrumented using the interaction of the local land supply elasticity and the real mortgage rate. Each regression controls for MSA-level characteristics (Employment Rate and Population), MSA, and year-fixed effects. All variables are defined in Appendix A. Robust standard errors are shown in parentheses. ***, **, * denotes 1%, 5%, and 10% statistical significance.

Dependent Variable: Log(Number of Employees)								
			Financial Constraints					
			Firm Size		Payout Policy		Bond Rating	
			Constr.	Unconstr.	Constr.	Unconstr.	Constr.	Unconstr.
	(OLS)	(IV)	(IV)	(IV)	(IV)	(IV)	(IV)	(IV)
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
Log(RE Value$_{-m}$)	0.016**	0.011*	0.021**	-0.010	0.018**	0.007	0.018**	0.013
	(0.007)	(0.006)	(0.009)	(0.009)	(0.009)	(0.009)	(0.008)	(0.009)
Log(RE Price Index)	-0.165**	-0.223**	-0.251**	-0.245**	-0.333**	-0.259**	-0.231**	-0.265***
	(0.073)	(0.077)	(0.181)	(0.099)	(0.137)	(0.088)	(0.091)	(0.090)
MSA Controls	Y	Y	Y	Y	Y	Y	Y	Y
Year Fixed Effects	Y	Y	Y	Y	Y	Y	Y	Y
MSA Fixed Effects	Y	Y	Y	Y	Y	Y	Y	Y
Observations	1,230	1,230	615	615	615	615	615	615
R^2	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99

Appendix A: Variable Definitions

This appendix presents the definitions for the variables used throughout the paper.

Variable	Definition	Source
Panel A: Firm-Level Variables		
Employment Expenditures	Change in payroll summed across establishments over lagged PPE	LBD, Compustat
Employment Expenditures (IM)	Change in payroll summed across current establishments over lagged PPE	LBD, Compustat
Number of Employees	Change in employees summed across establishments over lagged PPE	LBD, Compustat
Number of Employees (Alt.)	Two times the change in employees summed across establishments over sum of current and lagged employment (i.e., symmetric growth rate)	LBD, Compustat
Average Wage	Total payroll divided by total number of employees	LBD
RE Value	Market value of real estate assets assuming located in same MSA as HQ	OFHEO, Compustat
RE Value (Employment-Weighted)	Market value of real estate assets assuming located in proportion to establishment-level employment	OFHEO, Compustat, LBD
RE Value (Employment-Maximum)	Market value of real estate assets assuming located in MSA with greatest firm-level employment	OFHEO, Compustat, LBD
RE Owner	Equal to one if the book value of real estate holdings is greater than zero	Compustat
HQ RE Value	Market value of real estate assets for firms that own their HQ	Chaney et al. (2012)
Return on Assets	Net operating income divided by total assets	Compustat
Cash Flow	Ratio of cash flow (EBITDA) to lagged PPE	Compustat
Q	Ratio of market to book value of assets	Compustat
Total Assets	Book value of assets	Compustat
Age	Number of years since IPO	Compustat
Panel B: Establishment-Level Variables		
Employment Expenditures	Change in establishment-level payroll over lagged firm-level PPE	LBD
Number of Employees	Change in establishment-level employees over lagged firm-level PPE	LBD
Age	Number of years the establishment appears in the LBD	LBD
Panel C: MSA-Level Variables		
Number of Employees	Log number of employees summed across all establishments in a given MSA	LBD
RE Price Index	Residential (single-family home) real estate price index	OFHEO
Elasticity	Local elasticity of land supply	Saiz (2010)
RE Value$_{-m}$	Market value of real estate multiplied by the fraction of employees in a given MSA, summed across all firms whose headquarter are not in that MSA	OFHEO, Compustat, LBD
Employment Rate	Ratio of number of employed to labor force	Bureau of Labor Statistics
Population	Log number of residents in an MSA	Census

Internet Appendix for "Collateral Values and Corporate Employment"

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September 25, 2015

Appendix IA.I: First-Stage for IV Estimation

This table presents estimates of the impact of land supply elasticity on real estate prices. The unit of observation in each regression is an MSA-year pair. The dependent variable is the real estate price index (single-family home, residential) defined at the MSA-year level. The MSA-level land supply elasticity—taken from Saiz (2010)—is interacted with the interest rate on a 30-year, fixed rate conventional home mortgage. Column [1] uses the land supply elasticity directly. Column [2] uses the quartiles of the land supply elasticity. Each regression controls for year- and MSA-fixed effects. All variables are defined in Appendix A. Standard errors (in parentheses) are clustered at the MSA level. ***, **, * denotes 1%, 5%, and 10% statistical significance.

Dependent Variable: RE Price Index		
	(OLS)	(OLS)
	[1]	[2]
Elasticity × Mortgage Rate	0.035***	
	(0.004)	
Elasticity (First Quartile) × Mortgage Rate		-0.064***
		(0.007)
Elasticity (Second Quartile) × Mortgage Rate		-0.046***
		(0.008)
Elasticity (Third Quartile) × Mortgage Rate		-0.014**
		(0.007)
Year Fixed Effects	Y	Y
MSA Fixed Effects	Y	Y
Observations	1,358	1,358
R^2	0.95	0.95

Appendix IA.II: Determinants of Real Estate Ownership Decision

This table presents estimates of the firm-level determinants of the real estate ownership decision in 1993. The unit of observation in each regression is a firm. Column [1] uses Real Estate Owner as the dependent variable, which is an indicator variable equal to one if the firm reports any real estate holdings on its balance sheet in 1993. Column [2] uses the market value of real estate assets in 1993 as the dependent variable. Each regression includes for firm characteristics (five quintiles of Return on Assets, Total Assets, Age) and industry- and MSA-fixed effects. All variables are defined in Appendix A. Robust standard errors are shown in parentheses. ***, **, * denotes 1%, 5%, and 10% statistical significance.

Dependent Variable:	RE Owner	RE Value
	(OLS)	(OLS)
	[1]	[2]
Return on Assets (Second Quintile)	0.128***	0.252**
	(0.026)	(0.067)
Return on Assets (Third Quintile)	0.151***	0.219***
	(0.027)	(0.070)
Return on Assets (Fourth Quintile)	0.138***	0.189***
	(0.027)	(0.069)
Return on Assets (Fifth Quintile)	0.120***	0.206***
	(0.026)	(0.067)
Total Assets (Second Quintile)	0.173***	0.156***
	(0.026)	(0.066)
Total Assets (Third Quintile)	0.308***	0.203**
	(0.026)	(0.068)
Total Assets (Fourth Quintile)	0.484***	0.381***
	(0.028)	(0.073)
Total Assets (Fifth Quintile)	0.517***	0.235***
	(0.031)	(0.081)
Age (Second Quintile)	0.057**	0.054
	(0.026)	(0.068)
Age (Third Quintile)	0.12***	0.120*
	(0.02)	(0.066)
Age (Fourth Quintile)	0.227***	0.386***
	(0.025)	(0.064)
Age (Fifth Quintile)	0.285***	0.848***
	(0.027)	(0.071)
Industry Fixed Effects	Y	Y
MSA Fixed Effects	Y	Y
Observations	2,474	2,474
R^2	0.58	0.37

Appendix IA.III: Real Estate Collateral and Debt Financing

This table presents estimates of the firm-level impact of real estate collateral value on corporate debt. The dependent variables in columns [1] to [5] are Debt Issues, Debt Repayment, Net Debt Issues, Changes in Long-Term Debt, and Changes in Current Debt, respectively. The market value of real estate assets is calculated assuming assets are located in the same MSA as firms' headquarters. All columns use IV estimation, where MSA-level real estate prices are instrumented using the interaction of the local land supply elasticity and the real mortgage rate . Each regression controls for initial firm characteristics (five quintiles of Return on Assets, Total Assets, Age, and MSA and two-digit SIC industry dummies) interacted with MSA-level real estate prices and year- and firm-fixed effects. All variables are defined in Appendix A. Standard errors (in parentheses) are clustered at the MSA-year level. ***, **, * denotes 1%, 5%, and 10% statistical significance.

Dependent Variable:	Debt Issues	Debt Repayment	Net Debt Issues	Changes in LT Debt	Changes in Current Debt
	(IV)	(IV)	(IV)	(IV)	(IV)
	[1]	[2]	[3]	[4]	[5]
RE Value	0.084***	0.059***	0.019	0.074***	0.007**
	(0.021)	(0.013)	(0.013)	(0.015)	(0.003)
RE Price Index	0.835	-0.860	1.164	0.718	0.039
	(1.349)	(0.793)	(0.815)	(0.972)	(0.159)
Cash Flow	-0.033***	-0.005	-0.017***	-0.018***	-0.003***
	(0.008)	(0.004)	(0.004)	(0.005)	(0.001)
Q	0.056***	-0.004	0.036***	0.043***	0.003**
	(0.011)	(0.005)	(0.006)	(0.006)	(0.001)
RE Price Index × Init. Controls	Y	Y	Y	Y	Y
Year Fixed Effects	Y	Y	Y	Y	Y
Firm Fixed Effects	Y	Y	Y	Y	Y
Observations	12,350	12,654	12,087	12,896	12,931
R^2	0.44	0.49	0.24	0.16	0.12

Appendix IA.IV: Further Summary Statistics

This table provides sample summary statistics for the LBD universe versus the Compustat-LBD matched sample and for single- and multi-unit firms within the matched sample. Panel A provides firm-level statistics. Panel B provides establishment-level statistics. The unit of observation in Panel A and B, respectively, is a firm-year and establishment-year. All variables are defined in Appendix A.

	Compustat-LBD			Single-Unit			Multi-Unit		
	N	Mean	Std.	N	Mean	Std.	N	Mean	Std.
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
Panel A: Firm-Level									
Employment Expenditures	13,000	0.193	0.733	2,000	0.326	1.001	11,000	0.168	0.668
Number of Employees	13,000	2.594	15.795	2,000	3.420	19.126	11,000	2.439	15.087
Number of Employees (Alt.)	13,000	0.011	0.323	2,000	0.013	0.370	11,000	0.010	0.313
Average Wage	13,000	0.002	0.008	2,000	0.002	0.012	11,000	0.002	0.007
RE Value	13,000	0.852	1.121	2,000	0.211	0.748	11,000	0.971	1.139
RE Value (Employment-Weighted)	13,000	0.890	1.215	2,000	0.214	0.759	11,000	1.016	1.242
RE Value (Employment-Maximum)	13,000	0.881	1.207	2,000	0.214	0.759	11,000	1.006	1.234
RE Value (HQ Owner)	9,000	0.781	1.134	2,000	0.174	0.707	7,000	0.923	1.167
RE Owner	13,000	0.641	0.480	2,000	0.127	0.333	11,000	0.737	0.440
Return on Assets	13,000	0.007	0.236	2,000	-0.240	0.373	11,000	0.053	0.163
Cash Flow	13,000	-0.265	2.668	2,000	-2.534	4.803	11,000	0.159	1.730
Q	13,000	2.087	1.554	2,000	3.115	2.196	11,000	1.895	1.316
Total Assets	13,000	1,512	5,911	2,000	46.562	141.493	11,000	1,786	6,402
Age	13,000	20.108	14.067	2,000	10.714	6.451	11,000	21.866	14.406
Panel B: Establishment-Level									
Employment Expenditures	912,000	0.097	0.695	2,000	0.834	1.841	912,000	0.095	0.689
Number of Employees	912,000	0.000	0.031	2,000	0.008	0.078	912,000	0.000	0.030
Age	912,000	10.374	8.219	2,000	12.658	6.365	912,000	10.368	8.223