House Money and Entrepreneurship*

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Abstract: We exploit legal variation in the pledgeability of housing collateral, together with micro data from the US Census Bureau, to study the importance of the collateral channel in entrepreneurship. We find that increases in the ability to borrow against one’s home leads to more entrepreneurship, but the overall magnitude is small. For example, a mortgage reform unlocking housing collateral in Texas led to just 0.6% higher employment in start-ups for every 10% increase in house prices. We trace this limited response to most entrepreneurs not relying on home equity to finance their businesses. Moreover, among those who do use home equity to finance their business, most homeowners already have sufficient collateral to pledge for loans even in the absence of house price increases. We estimate an overall link of house price gains and entrepreneurship that is five or ten times larger than the collateral effect, but trace much of this relationship to intra-city aggregate demand and individual-level covariates. Our results provide a more nuanced picture of housing collateral in driving entrepreneurship: while housing collateral is clearly important for some entrepreneurs to access bank credit, it plays a small part in the overall way in which house price increases connect to entrepreneurship.

JEL Classification: E44, G21, L26, M13, R12, R31, R32.

Key Words: house prices, mortgages, collateral channel, entrepreneurship, entry.
1 Introduction

The role of the housing sector in driving aggregate outcomes in the economy has received renewed interest following the rapid increase of home prices during the early 2000s and their subsequent decline after the 2008 financial crisis. Several papers document the link between the value of housing assets and the impact through household balance sheets on aggregate consumption (Leth-Petersen, 2010; Mian and Sufi, 2011; Mian, Rao and Sufi, 2013), employment (Mian and Sufi, 2014) and household investment (Mian, Sufi and Trebbi, 2015). To what extent do house prices impact the ability of individuals to engage in entrepreneurship by impacting their ability to borrow against housing equity? Related, what role can housing collateral play in alleviating these financial constraints for potential business owners?

The potential role of the collateral channel in entrepreneurship is intuitive. Debt financing is important for small and young businesses (e.g., Berger and Udell, 1998; Robb and Robinson, 2014), but the challenges associated with asymmetric information in small business lending are difficult for banks to overcome (e.g., Stiglitz and Weiss, 1981). Pledging personal collateral against business loans aids the lending process, and thus an increase in the value of a potential or current entrepreneur’s home raises the value of the collateral they can pledge to the bank and may therefore boost the willingness of banks to lend to their business (e.g., Chaney, Sraer and Thesmar, 2012). The degree to which the collateral channel alleviates credit constraints is thus of particular interest to policy makers, because subsidies to mortgage financing or reforms associated with homestead exemptions in bankruptcy can change the relative costs of owning a home or the value of housing collateral to the bank, and hence could directly impact the access of small businesses to external finance.¹ These financing conditions are of first-order importance given the role of new firms in generating economic growth (e.g., Haltiwanger, Jarmin, and Miranda, 2013; Decker et al., 2014; Pugsley and Sahin, 2015).


While our paper is related to this prior work, features of our data allow us to take a new empirical approach. First, we exploit legal changes in the pledgeability of housing collateral in Texas relative to neighboring states to directly study its impact on entrepreneurship. In par-

ticular, we exploit a 1997 constitutional amendment in Texas that relaxed stringent constraints on the ability of banks to lend against housing collateral. Prior to 1997, the home could only be used as collateral for an individual’s primary mortgage and related home improvement loans. The Texas amendment in 1997 first allowed for home equity loans—backed by housing collateral but used to finance consumption or other investments—and a subsequent reform in 2003 further allowed for home equity lines of credit. Texas was the only state with such restrictions at the time, which enables us to compare the relationship between house prices and entry rates in Texas relative to its neighbors, before and after the reform. We use the Longitudinal Business Database (LBD) to study this question, over the twenty-year period spanning 1988 to 2007. This empirical strategy allows us to decompose the aggregate relationship between house prices and entrepreneurship into the part stemming from relaxed collateral constraints versus the part stemming from other factors. In particular, if intra-city aggregate demand is an important driver of the relationship between house prices and entrepreneurship, studies using regional-level data will not be able to separate the specific role of the collateral channel.

Second, we match the Longitudinal Employer-Household Dynamics (LEHD) database and the 2000 Decennial Census of Population to create a dataset with detailed individual-level covariates and employment histories for a representative subset of the population. This unique dataset allows us to study heterogeneity in the individual response to house price increases, using zip-code level price changes and information about the earnings, wealth, estimated loan-to-value (LTV) ratio for the mortgage and other demographic attributes of the household. Home price appreciation during the 2000-2004 period was massive, averaging 45% for our sample and 43% for the country as a whole as shown in Figure 1. The average homeowner in our sample experienced equity gains on the order of $80,000. The advantage of this event study goes beyond the size of the treatment, as the decision to buy a house before 2000 was unlikely to be driven by the expectation of rapid increases in the availability of collateral. We compare the responses of those who are able to tap into rising home values with those limited by loan-to-value ratios that are too high or who experience rare local price declines. This approach enables us to look at the heterogeneity in individuals who are most responsive to house price increases in terms of founding new firms, and moreover to run placebo tests for “joiners” in young start-ups, who might experience similar wealth effects (e.g., greater willingness to take risk) from rising house prices but would not face collateral constraints for new venture financing.

These analyses yield a nuanced story of how rapid house price appreciation connects to entrepreneurship. First, relaxing collateral constraints leads to more entrepreneurship at an aggregate-level for Core Based Statistical Areas (CBSAs), but the magnitudes are small. Relative to CBSAs in neighboring states, Texan CBSAs showed a statistically similar link between entrepreneurship and home price changes in the decade prior to 1997. In the decade following
the constitutional reforms, the responsiveness of entry rates in Texas to house price changes increased relative to neighbors, a pattern that is consistent with relaxed liquidity constraints spurring entry. We estimate that unlocking the housing collateral channel in Texas led to 0.6% higher employment in start-ups for every 10% increase in house prices. Consistent with these modest aggregate patterns, we show using a broader set of states in the LEHD that most home owners have sufficient equity in their homes to be unconstrained even in the absence of house price increases. We again observe in the LEHD a small aggregate link of house price gains to entry, and we can moreover observe how it is being driven by a small share of the working population who were highly levered prior to rising house prices and experienced home equity gains in excess of $75,000.

These results show that intra-city aggregate demand and individual covariates are important for how house price increases link to entrepreneurship. For example, in regressions that control for aggregate demand at the regional level, we find entry elasticities of 0.6 with respect to house price increases, which are in line with the prior literature. As noted above, the Texas experiment allows us to isolate the part attributable to the collateral channel, and the elasticity of 0.06 highlights that it accounts for one-tenth of the overall relationship between house prices and entry in our setting, even after accounting for aggregate demand at the regional level. Thus, while housing collateral is essential for some entrepreneurs to access bank finance, its role is hard to discern in estimations relating city-wide house price growth to entrepreneurship due to other channels being present.

Like most of the literature, our LBD and LEHD analyses lack data on direct usage of home equity loans for business financing, requiring us to instead look for compelling evidence of its effects. Our final analysis uses new micro data from the 2007 Survey of Business Owners (SBO) to directly study entrepreneurs’ reliance on home equity loans. We show with the SBO data that states experiencing large house price growth have a greater use of home equity lines to finance new businesses among recent cohorts. This is important for this literature as it is the first direct link of house price changes to home equity loan data for start-ups of which we are aware. Our analysis shows, however, that these precisely-estimated impacts are again modest in size. For example, 13.2% of recent SBO entrants use home equity credit, and a 10% home price gain is associated with a 0.4% increase in this share. While cross-sectional in nature, this SBO work is important for being among the first to actually show the use of home equity lending for business financing, identifying both its saliency for those who use it and the relatively infrequent rate at which home equity is used for business purposes.

Section 2 reviews the literature on the relationship between rising house prices and entrepreneurship and outlines our empirical strategy. Sections 3, 4 and 5 describe our analyses of the LBD, LEHD and SBO, respectively, and Section 6 compares their economic magnitudes. The
last section concludes. Beyond the house price literature, our findings are also relevant to the extensive literature looking at financing constraints and entrepreneurship. A number of models suggest that individuals are either precluded from entry or that firms enter small and then grow because of the fact that they face initial financing constraints. Changes in local banking conditions have been connected with entrepreneurship (e.g., Black and Strahan, 2002; Cetorelli and Strahan, 2006; Kerr and Nanda, 2009). On the other hand, studies looking at entry have questioned the extent to which financing constraints are the leading driver behind entry decisions (Hurst and Lusardi, 2004). Our paper is very consistent with Jensen, Leth-Petersen, and Nanda (2014), who find a causal effect of an exogenous increase in home equity on entrepreneurship, but find that the effect is small. Our limited effects also parallel the findings of Bracke, Hilber, and Silva (2014) for the United Kingdom.

2 House Prices and Entrepreneurship

Since new businesses typically require some amount of capital investment before they can generate returns, the expected value of a new venture is an increasing function of the capital invested in the nascent firm, up to an optimal level. If individuals face credit constraints, then the amount they invest in the business will be less than the optimal level of capital, lowering expected income from entrepreneurship, and hence lowering the probability that the individual will become an entrepreneur. When the amount an individual is able to borrow is not directly observable, their personal wealth, and in particular their housing wealth, is a good proxy for the collateral they can post to access financing for their business. This is because debt financing is the principal form of external finance for most businesses (Robb and Robinson, 2014). Furthermore, banks often use the personal wealth of the owner to assess creditworthiness of new ventures, as they have no track record of the firm’s performance on which to base lending decisions, even if these are young incorporated firms (Berkowitz and White, 2000).

A systematic analysis of the importance of collateral in entrepreneurship faces some challenges, however. First, those who have more housing equity available to collateralize are likely to be wealthier. This correlation may descend from those who want to become entrepreneurs choosing to build up housing assets to collateralize instead of consuming them. Alternatively, higher-ability individuals may be able to generate more assets of all varieties, leading to a possi-
ble omitted variables bias problem when estimating the correlation between the stock of housing equity and propensity to engage in entrepreneurship. Therefore, recent studies have used house price appreciation to exploit exogenous increases in wealth as a way to identify the impact on entrepreneurship.

While house price appreciation leads to higher collateral values and hence a higher likelihood of receiving bank financing, exploiting house price appreciation faces two challenges. First, areas with high or rising levels of economic activity will generally be the ones where house prices increase and where entrepreneurship is likely to be particularly attractive. This could simply follow from strong local economic performance influencing many measures, with business starts and house prices being two of them. There could also be a systematic relationship, but with the causal connection being outside of loan markets. For example, entrepreneurs could be responding to changes in household consumption following adjustments in housing wealth (e.g., Mian and Sufi, 2011; Mian, Rao, and Sufi, 2013). Likewise, Stroebel and Vavra (2014) link house price growth to increases in local mark-ups, which could make new businesses more attractive. Thus, separating the impact of aggregate demand from the supply side drivers of credit is particularly important.

Second, even if one can convincingly show a causal impact of house price increases on entrepreneurship, more than one mechanism is potentially responsible. While increases in individual wealth may reduce credit constraints and facilitate bank lending, they may also make individuals more willing to experiment with entrepreneurship through lower risk aversion (e.g., Kihlstrom and Laffont, 1979; Evans and Jovanovic, 1989) and/or changing occupational preferences to “be one’s own boss” (e.g., Hamilton, 2000; Hurst and Lusardi, 2004; Åstebro and Thompson, 2011; Hurst and Pugsley, 2011; Åstebro et al., 2014). These mechanisms can lead to a positive association between wealth and entrepreneurship that is independent of the ability of the potential entrepreneur to access bank loans. Put differently, an exogenous increase in wealth may affect entrepreneurship through reduced credit constraints, through a series of mechanisms we broadly group together under the term “wealth effects,” or both.

We approach these challenges in several ways. First, we exploit the legal changes in the pledgeability of collateral in Texas to isolate the role of the collateral channel in entrepreneurship from broader economic factors related to house price increases. This provides us with a well-identified approach for isolating the collateral channel due to home equity when studying firm-level entry, along with a natural benchmark for comparison in the overall relationship between house prices and entry. Second, we use individual-level micro data on homeowners combined with zip-code level variation in prices to identify the specific individuals who are most responsive to increases in the value of their home equity. Third, we run a placebo test using the individual-level data by examining how the same zip-code level house price shocks are related to the decision
to join a young venture. Individuals joining start-ups face very similar wealth effects as their home prices grow, but they are not concerned with accessing bank credit for the venture. Thus, a comparison of the response of joiners to founders allows us to tease apart wealth effects from the bank lending channel. Finally, although not as granular as our micro data, we also directly study entrepreneurs’ reliance on home equity through the Survey of Small Business Owners.

3 Longitudinal Business Database

3.1 Data Construction

The Longitudinal Business Database (LBD) provides annual employments for every private-sector establishment with payroll from 1976 onward. The underlying data are sourced from US tax records and Census Bureau surveys, and we use micro-data spanning the period 1987–2007, constituting ten years before and after the Texas lending reform. The LBD’s complete accounting of very small firms and establishments, which are often excluded or sub-sampled in corporate surveys, is important for our analysis of entry patterns. The data focus on employer firms and thus exclude self-employed individuals who file tax returns via Schedule C or private household employees. The LBD also lists physical locations of establishments instead of states of incorporation, circumventing issues such as higher incorporation rates in Delaware. Jarmin and Miranda (2002) provide further details on the LBD construction.

The LBD assigns a firm identifier to each establishment that allows us to distinguish stand-alone firms from facilities of multi-unit firms. Our dependent variables focus on the entry of new single-unit firms by location, industry, and year, and we will use the entry rate of facility expansions as a control for local economic activity in many specifications. In various analyses, we further separate entrants by establishment size in year of entry. For each establishment, we define its entry year to be the first year of positive employment, and our analyses are robust to whether we include or drop the new firms believed to be spin-outs of existing corporations, which can be assessed through the establishment identifiers existing before a firm is born.

The LBD identifies the counties of each establishment. Our analysis mostly focuses on Core Based Statistical Areas (CBSAs), a geographic unit defined by the Office of Management and Budget to replace the prior focus on Metropolitan Statistical Areas. CBSAs consist of one or more counties that have an urban center of at least 10,000 people. Adjacent counties are included in the CBSA when they are socioeconomically tied to the urban center by worker

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3While self-employed individuals account for the vast majority of entrepreneurs, broadly defined, they represent a small share of employment and output and hence are typically excluded from Census Bureau statistics. For example, the Census Bureau estimates that non-employer firms account for less than 4% of annual sales in the United States (e.g., https://www.census.gov/programs-surveys/nonemployer-statistics/about.html).
commuting. There are over 900 CBSAs currently defined, and these include 388 Metropolitan Statistical Areas (MSAs, urban core >50,000) and Micropolitan Statistical Areas. We focus our LBD-based analysis on CBSAs in the Texas region, defined to be Texas and its neighbors of Arkansas, Colorado, Kansas, Louisiana, New Mexico, and Oklahoma. This region contains 56 CBSAs that we can match with housing price data over the 1987-2007 period. A small number of included CBSAs lack home prices in early years, with the sample becoming a full panel from 1994 onwards.

Our housing price data come from the Federal Housing Finance Agency (FHFA), following Adelino, Schoar, and Severino (2015). The FHFA data are reported at different levels of geographic detail and are considered reasonably representative of the overall home price development, although they are based on sales of single-family homes and do not include condos.4

3.2 Texas Reform

In this section, we draw extensively on Abdallah and Lastrapes (2012), who provide a detailed account of the restrictions in mortgage financing in Texas prior to 1998 as well as the political economy related to the Texas Constitutional Amendment to Article XVI, Section 50, which was approved by Texas voters on November 4, 1997 and became effective January 1, 1998. The constitutional amendment of 1998 allowed home equity loans for the first time in Texas, up to a loan-to-value ratio of 80% (inclusive of primary mortgage), without restrictions on how the funds could be used.

The sanctity of the homestead has been viewed as an essential right for Texas citizens ever since the Texas Homestead Act of 1839, and was enshrined into Texas’ original Constitution in 1845. As Abdallah and Lastrapes (2012) note, “Article XVI, Section 50 of the Texas Constitution of 1876, the fifth version of the document since statehood, protected homesteads from foreclosure except for nonpayment of the original loan to purchase the home or for debt incurred to finance home improvements.” This effectively restricted housing collateral to the mortgage and related home improvement credit, and housing collateral could not be used to finance consumption or investment beyond the home. Related products like “cash out” refinancings and reverse mortgages were prohibited. Although home equity lending in the rest of the United States boomed following the Tax Reform Act of 1986, which eliminated income tax deductibility on interest payments related to all forms of consumer credit other than mortgages, the constitutional restriction prevented such home equity lending from taking effect in Texas.

4 The FHFA website states: “The FHFA House Price Index (HPI) is a broad measure of the movement of single-family house prices. The HPI is a weighted, repeat-sales index, meaning that it measures average price changes in repeat sales or refinancings on the same properties. This information is obtained by reviewing repeat mortgage transactions on single-family properties whose mortgages have been purchased or securitized by Fannie Mae or Freddie Mac since January 1975.”
Abdallah and Lastrapes (2012) provide a detailed discussion on the appropriateness of using January 1, 1998 as the start of the period, highlighting how Section 50 had been amended only twice between 1876 and 1997, and that the actual passage of the law remained uncertain, having failed to receive legislative support when it had been first proposed in 1995. The details of the reform remained unclear even after its passage, with several rules being ironed out in the few years after 1998. One of these changes was a rule in 2003 that further loosened restrictions to allow home equity lines of credit (HELOCs). Throughout this period, however, the 80% loan-to-value remained the maximum borrowing limit, a legal restriction on pledgeability that did not exist in other states in the Texas region.

We use these three features of the Texas reforms—the introduction of home equity loans in 1998, the further introduction of home equity lines of credit in 2003, and the 80% loan-to-value restriction—as sources of variation in our analyses below. Abdallah and Lastrapes (2012) show that these reforms had bite for consumer spending in Texas, with sustained increases of 2%-3% in retail sales. Moreover, they demonstrate that the underlying heterogeneity in spending responses is consistent with home price gains and the unlocking of housing collateral. We analyze whether a similar effect exists for entry into new businesses.

3.3 Empirical Strategy

Our baseline LBD estimation takes the form

\[ \ln(Y_{c,t}) = \varphi_c + \eta_t + \sum_{p \in P_{full}} \beta_p \ln(HPI_{c,t}) \Upsilon_{tep} + \gamma \Upsilon_{cTX} \ln(HPI_{c,t}) \]

\[ + \sum_{p \in P_{post}} \zeta_p \Upsilon_{cTX} \Upsilon_{tep} \ln(HPI_{c,t}) + \varepsilon_{c,t} \]

where \( c \) indexes CBSAs and \( t \) indexes years. The dependent variable \( Y_{c,t} \) is the log employment in new single-unit entrants in the CBSA by year. Panel estimations control for CBSA and year fixed effects. We further group years into three time periods: 1987-1997, 1998-2002, and 2003-2007. These time periods represent a pre-period before the Texan reforms (1987-1997), the period with only the first reform in 1998 to allow home equity lending (1998-2002), and the period that starts after the second Texan reform in 2003 to allow HELOCs (2003-2007). We denote by set \( P_{full} \) the full set of three time periods spanning 1987-2007, and by set \( P_{post} \) the set of time periods coming after 1997.

The \( \beta_p \) coefficients measure the panel correlation of housing price index growth with growth in firm starts, allowing this coefficient to vary across each time period. \( \Upsilon_{cTX} \) is an indicator variable for a CBSA being part of Texas. The \( \gamma \) coefficient reflects consistent differences between
Texan CBSAs and the rest of the region across all time periods in terms of the correlation of house price growth and employment in firm starts. These differences could be due to industrial structures, workforce composition, migration responsiveness, or similar factors. We do not assign a strong interpretation to the $\gamma$ coefficient given the many potential factors at play, and regardless $\gamma$ is often small economically in size and statistically insignificant.

The $\zeta_p$ coefficients are the most interesting ones for this study. They capture differences in how responsive Texan CBSAs are in terms of entrepreneurship to house price changes after the reforms began compared to Texas’ behavior in the pre-period. Specification (1) allows us to evaluate directly the magnitude and statistical significance of the $\zeta_p$ coefficients as evidence for important changes in Texan outcomes after the amendments are enacted. We can also recover the full elasticity for Texas in each time period by adding $\beta_p + \gamma$ in the pre-period and $\beta_p + \gamma + \zeta_p$ in the post-periods. We report these summations at the bottom of Table 2 for reference. Estimations cluster standard errors by CBSA and weight CBSAs by their average annual firm count in the first three years observed.

3.4 Results

Table 1 provides the simplest evidence of the limited impact of the Texas reforms that opened up the collateral channel for entrepreneurship. Using a technique dating back to Holmes (1998), we look at counties that are part of CBSAs on the Texas border with its neighbors. If an interior county is part of a CBSA that touches the Texas border, it is retained in the sample. The core identification assumption in a state border analysis is that the counties on either side of the border would behave similarly excepting the legal change in Texas. If the neighboring entrepreneurs are subject to the same economic shocks and changes in local economic opportunities, we can look for evidence in changes in behavior on the Texas side that would indicate collateral being opened up.

Our tabulations simply aggregate activity on either side of the Texas border in the three time periods, normalizing by what is observed in the pre-period. The first two columns show that home price changes on both sides of the border look similar through 2007. The next two columns show that entry counts behave quite similarly. Entry counts as measured by the LBD have been in decline nationally (e.g., Decker et al., 2014), and we see this in our sample too. The more important trait is the parallel trends on either side of the border. The same again holds for entry employment in Columns 5 and 6.

We have conducted an extensive regression analysis on the border region, using techniques ranging from modeling house price changes like the empirical framework in specification (1) to a simpler set of indicator variables for being on either side. These analyses consistently find a null effect on the border, which is not too surprising given the tabulations in Table 1, and we
do not report them. Of course, while the identification provided by a border discontinuity is attractive, the amount of activity on the Texas border is limited compared to the big cities of Dallas, Houston, Denver, etc., and so we instead turn towards testing whether we observe an entrepreneurship response in the larger sample.

Table 2 documents results using specification (1) with the dependent variable of log entry employment. Column 1 of Table 2 estimates specification (1) without controls for lagged activity in the CBSA or the new plants of multi-unit firms. The $\beta_p$ elasticities in all three periods are quite strong, with magnitudes that are growing with time. Thus the correlation of firm entry and home price growth for CBSAs increased during 2003-2007 compared to earlier years, which perhaps hints at why policy interest itself has also been increasing for this topic. The elasticities are in the ballpark of others found in the literature. The $\gamma$ coefficient suggests Texan CBSAs behave quite similarly to the rest of the region in aggregate.

Finally, and most important, the $\zeta_p$ coefficients suggest a mild increase in the price-entry elasticity for Texan CBSAs after the home equity reforms began, consistent with heightened credit availability after 2003, possibly coinciding with the 2003 HELOC reform. While statistically significant, the effect is overall small in economic magnitude. Moreover, the full effect for Texas, as tabulated at the bottom of the table through $\beta_p + \gamma + \zeta_p$, tends to be quantitatively similar to the $\beta_p$ coefficients for CBSAs in neighboring states as seen in the top three rows.

Column 2 extends the estimation (1) to control for the log firm count in the CBSA in the prior year and the log count of new facilities being opened by multi-unit firms in the current year. These variables constitute strong controls for growth in local activity over time. To see the potential difference, note that the panel estimation in specification (1) does not model a location-specific trend. Thus, if a CBSA is growing due to an unmodelled factor (e.g., attractive climate), we may pick up a spurious correlation between increasing entrant counts (as a mechanical consequence of the city becoming larger) and house prices (as the stock of homes becomes more valuable). By controlling for the prior year’s firm count in the CBSA, we effectively ask whether the rate of new start-up formation changes with home price changes. The coefficient on this added control variable is approximately one in Column 2, and it is very similar if controlling instead for the prior year’s employment. By also controlling for the local expansion rate of multi-unit firms, we further safeguard against other local demand variations that could impact our results.

The most significant consequence of this adjustment is in the $\beta_p$ coefficients. With the exception of the construction sector, there is not a robust relationship of home price growth and entry in the 1987-1997 period in Texas or its neighboring states, once controlling for local activity with our two added regressors. The $\beta_p$ relationship does emerge after 1998, paralleling our comment on Column 1 that the correlation of firm entry and home price growth for CBSAs
was increasing during the sample period. With our added controls, the correlation only becomes meaningful after 1998.

Examining the interactions for Texas, we again observe evidence of a differential effect after 2003 that is precisely measured but overall small in economic magnitude. Taken at face value, one can interpret the $\zeta_p$ coefficients as measuring that this lending component would account for something in the range of 5%-10% of the total raw correlation evident in the data of house prices and entry. The combination of the negative $\gamma$ coefficient and positive $\zeta_p$ coefficients also suggests that Texan CBSAs are increasing their responsiveness to be closer to the typical behavior of their region.

Columns 3-5 evaluate this effect by entrant size. The smallest entrants with 1-2 persons behave quite similarly to the overall effect, as they constitute a large share of entrants. Entrants with 3-9 employees shows the weakest response. The strongest effect is evident in entrants with 10 or more employees. The $\zeta_p$ effects for the largest entrants are statistically significant, albeit still rather small in economic size. Partly related to this entrant size effect, unreported estimations also find that the Texas reform is more associated with the entry of firms that will survive for four or more years compared to very short-lived entry. Columns 6-9 quantify responses by sector of the economy. Entry in the construction and manufacturing sectors show the most significant overall link to house price growth in the $\beta_p$ coefficients, and entry in the manufacturing sector in 2003-2007 shows the most significant uptick for Texas after the reforms relative to other states.

Taken as a whole, these estimations suggest a limited impact of the Texan mortgage lending reforms on the level of new firm entry in Texan CBSAs relative to those in nearby states. Appendix Table 1 shows quite similar results when using entry counts that are not weighted by employment.\(^5\) We reach similar findings in many robustness checks: dropping the size weights given to the CBSAs, expanding the CBSA sample to include the whole United States vs. a focus on the Texan region (the $\gamma$ shifter adjusts due to regional differences, but little else), including region-year fixed effects, and similar variants. Most estimations show a statistical difference for Texas after 2003, indicative of the collateral channel being opened up, but the results remain modest in overall economic size. Unreported analyses also consider extending the sample onwards through 2012, when the LBD data end. The effects we measure in 2003-2007 are present in 2008-2012. Given the onset of the Great Recession and the increased time elapsing since the date of the Texas reform, we hesitate to emphasize these results too much, but the

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\(^5\)We prefer entry employment given the greater economic impact of a ten-person start-up compared to a sole entrant. This approach also better aligns with the upcoming individual-level transition estimations, as more individuals can potentially transition into entrepreneurship via a larger start-up team compared to a smaller one. Finally, the LBD displays a bumpiness for entry counts around Economic Census years that is not present for entry employment.
results suggest a persistent change.

In summary, our LBD results document a small but precisely estimated effect of the Texas reform on entrepreneurship. Our magnitudes imply that “unlocking” housing collateral in Texas led to 0.6% higher employment in start-ups for every 10% increase in house prices. Importantly, this housing equity channel accounted for one-tenth of the overall (6%) house price-employment relationship we estimated in the LBD for every 10% increase in house prices within the Texas region. These estimates highlight that factors like intra-city aggregate demand operate alongside the collateral channel when considering regional relationships between house prices and entry.

While the LBD results provide a well-identified measure of the impact that unlocking housing collateral has on entrepreneurship, there are two important questions that we cannot address at this level of analysis. First, unlocking housing collateral also has an impact on household consumption (e.g., Mian and Sufi, 2011). Specific to this Texas reform, Abdallah and Lastrapes (2012) find a significant increase in retail sales stemming from an increase in household expenditure, and some of this demand could have led to increased firm entry independent of the entrepreneur’s home equity being unlocked. Only a small fraction of home equity loans are used for business purposes (e.g., Benito, 2009), with most going towards home improvements or consumer purchases. In other words, our coefficients may pick up both the demand and supply effects of a relaxed collateral channel. Second, the supply-side effect of the home equity channel is itself a function of both the collateral channel and wealth effects. This ambiguity is similar to studies of other windfall gains leading workers to be more willing to experiment with starting a new business (e.g., Lindh and Ohlsson, 1996; Anderson and Nielsen, 2012; Manso, 2015), which we cannot isolate using firm-level data. We therefore turn to understanding these features through micro data at the individual-level.

4 Longitudinal Employer-Household Dynamics Database

We complement the LBD’s longitudinal analysis of the Texas reform with a quite different approach using the LEHD. The individual-level data on home values in the Decennial Census and entrepreneurial transitions present in the LEHD allow for sharp empirical analyses and many interesting extensions, but they also require that we exploit cross-sectional variation across individuals and states. We begin with a depiction of the data and then the empirical strategy.
4.1 Data Construction

4.1.1 LEHD Data Platform

Our analysis combines the Longitudinal Employer-Household Dynamics (LEHD) database and the 2000 Decennial Census of Population. Similar to the LBD, these datasets are confidential and housed by the US Census Bureau. The LEHD is built from quarterly worker-level filings by employers for the administration of state unemployment insurance benefit programs, identifying the employees of each firm in the United States and their quarterly compensation. It is longitudinally linked at both the firm and employee levels, allowing one to model how firm employment structures adjust over time, how new start-ups form, and how individuals transition into entrepreneurship. This rich data source is currently available for 31 states for research purposes. The initial dates differ across states in terms of inclusion in the LEHD, and we focus on states that have records that begin in 1995 or earlier to allow us to measure meaningful income accumulation over the prior decade (and better identify existing entrepreneurs and early joiners of young firms, as described below). Our sample of 15 states is shown with stars in Figure 2 and includes major states like California, Florida, Illinois, and Texas. The blue shading highlights for reference all states incorporated into the 2008 version of the LEHD. The LEHD directly records some information about individuals, such as age, gender, race, place of birth, and citizenship status as well as earnings and employment histories by job.

We match the LEHD to individual-level records contained in the 2000 Decennial Census of Population (Census) through unique person identifiers.\(^6\) The Census has long-form responses for 1 in 6 of the population, and thus, roughly speaking, we can match 1 in 6 of our LEHD workers. The long form is given to a random sample of households for a nationally representative population. With this match comes a treasure chest of information about individuals (e.g., level of education, occupation, marital status) and their households (e.g., family composition, household income by source, home ownership and values). Importantly for our purposes, the Census asks whether the housing unit occupied by the respondent is rented or owned, how long the individual has been living in the residence, how much the monthly rent or mortgage payment is, and what the market value of the unit is.\(^7\)

We build a custom dataset for the analysis of home prices and entry. We start by retaining

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\(^6\) The Census Bureau creates unique person identifiers (PIKs) that are based on Social Security Numbers (SSNs) and allow the linking of individuals across demographic surveys, censuses and administrative records. PIKs are internal Census identifiers that have a one-to-one correspondence with the SSNs.

\(^7\) The exact question in 2000 is “What is the value of this property; that is, how much do you think this house and lot, apartment, or mobile home and lot would sell for if it were for sale?” Respondents selected from 28 ranges of values, with a minimum of “Less than $10,000” to a maximum of “$1,000,000 or more.” We convert these to midpoints, excepting the last category, which is simply assigned $1,000,000. Our NBER working paper describes some simple cross-checks on the data that are feasible with the long form of the 1990 Decennial Census.
individuals who have positive earnings in any of our 15 states in each of the three focal years 2000, 2004, and 2008. We require individuals be present in the LEHD throughout the sample period to understand the medium-term career transitions of these workers. As the LEHD covers only a subset of states, and only businesses paying payroll tax within these states, we cannot verify whether a person who is not present is unemployed, an independent contractor, self-employed, working in an uncovered state, working in the uncovered public sector, or similar. Our focus on employer firms does not include Schedule C self-employed activity. While one could worry that this state selection procedure might limit the types of individuals considered (e.g., selecting less-mobile people who are then less inclined to start something new), this is not a material concern given the very large states we consider and the proximity of included states shown in Figure 2. Unreported tabulations show that our sample is not behaving differently with respect to mobility in the 2000 Census compared to the nation as a whole.

We match the LEHD individuals to the Census and retain persons covered by the long-form questionnaire. From the Census, we extract individual-level characteristics from the Person File, household and housing-unit characteristics from the Household File, and geographic location details from the Geocode File. We further restrict our sample to individuals aged 25 to 50 in 2000 with non-missing and non-imputed information on all key variables. This age restriction is such that we stay reasonably far away from retirement decisions, as the oldest member of the cohort in 2008 will be 58. Likewise, the minimum age of 25 in 2000 means that we can compute reasonable pre-period earnings for the sample. We finally require that the individual live in a CBSA for which we have house price data from 2000 to 2008, which we describe next. After these steps, we have a complete sample of 976,900 individuals. All observation counts in this paper are disguised and rounded to the nearest 100 according to Census Bureau disclosure restrictions. Appendix A compares this sample to what one observes in public-use Census IPUMS data, thereby emphasizing the relative impact of some of these data choices.

4.1.2 Geographic Matching and House Price Data

We extract the geographical location of the household at the spatial levels of states, counties, and five-digit zip codes. Similar to the LBD analysis, we merge in FHFA data for the 173 CBSAs in the 15 states covered by the LEHD sample. For about 85% of the persons in our base sample, we are further able to collect home price data from Zillow at the zip code level. Zillow is an online real estate database that uses information from the Multiple Listing Service (MLS) and public record. Zillow maintains data on average home sale prices and estimates of the average home values for zip codes. The coverage of the Zillow data is in part limited by the fact that the
data for small zip codes may be sparse to the extent that few home sales occur.\textsuperscript{8} Despite these issues, zip code prices carry the strong advantages of allowing us to estimate more precisely the expected price appreciation of an individual’s home and to control for CBSA-level aggregate demand, thus making sharper assessments about the impact of prices through housing collateral versus other channels. Guerrieri, Hartley, and Hurst (2013) document features of the variation in house price appreciation across zip codes within MSAs and demonstrate the high correlations across data sources for these localized measures.

Our sample is quite representative of the US housing market, and the opinions of respondents about their home values appear reasonable. To show this, we first take an unweighted average of the respondents’ estimated home values by zip code. Our unweighted average across zip codes is $188,000, compared to $186,000 for the United States as a whole in the 2000 Zillow data. Second, for the zip codes in our sample, the correlation of the average estimated 2000 value to that reported by Zillow is 0.91.

4.1.3 Home Equity and Potential Constraints

The Census collects information on whether the respondent owns his or her home, the estimated value of the home, whether there is an outstanding mortgage on the home, the date the individual moved into the home, and the monthly mortgage payment if it exists. The Census also collects some traits of the homes, such as the number of rooms, that we do not use here. Our baseline sample has a 70% home ownership rate that compares to a national average of 67% in 2000. The average value of a home in our sample is approximately $188,000.

Most homeowners in 2000 have a mortgage outstanding but also hold significant home equity. We estimate an individual’s home equity in 2000 based upon time since home purchase, home price growth from time of purchase to 2000, and similar data. Specifically, we collect from Freddie Mac the average value, interest rate, and number of points on 30-year fixed rate loans for the years in which homeowners in our sample moved into their homes. Using a mortgage calculator, we then quantify the expected equity levels by year of move-in for that cohort in 2000 against the original loan amount and price levels. Owners are assumed to have as further equity all additional price growth from the time of their home purchase until 2000, which can be material given the price increases in the 1990s. Moreover, if no outstanding mortgage exists, we assign home equity to be 100% of the value of the home in 2000.

With this approach, the average homeowner in our sample is estimated to have about 57%

\textsuperscript{8}Zillow has data on 110 million homes across the United States, and so its value series is not limited to just those homes that were recently sold or currently for sale. While the value estimates of a single home have measurement error, the Zillow price trend data can be quite representative of actual changes in market values for local areas and may also be a better proxy for the exogenous component of house price appreciation, independent of changes in value due to home improvement and the like.
of their home value as equity, or in the ballpark of $107,000. Our 57% estimate is very close to the 52% measure found by Bracke, Hilber, and Silva (2014) with their UK loan data. One can also benchmark this level of equity by combining it with the estimated household income for homeowners of about $89,000, making an assumption that non-housing wealth is about the same as one year’s household income. This delivers financial ratios quite like those in the literature. For example, Gentry and Hubbard (2004) measure a median wealth-to-income ratio of 1.8, and our calculations deliver an implied ratio of 2.2. Related, Gentry and Hubbard (2004) measure equity in primary homes as 41% of wealth portfolio share for wage workers, and this share would be 55% in our sample. We use this estimated wealth level as a control variable in some specifications.

Looking forward, home price growth from 2000 to 2004 is substantial and averages 42% for our homeowner sample. This results in an estimated home equity gain on the order of $80,000, which is a sizable wealth shock equal to one year’s pre-tax household income. It is important to note that the expected nominal gain in home equity, all else equal, is independent of the individual’s 2000 home equity level. That is, if the home value appreciates by $80,000, the owner enjoys all of this wealth gain regardless of whether their initial equity in 2000 is $10,000 or $250,000.

Our analysis exploits differences across individuals in their ability to take advantage of the 2000-2004 upswing. We define three groups of individuals that we expect to have different responses to the increases in house prices. About 85% of the sample is part of an “unlevered” group. These individuals moved into their home before 1998 and would be able to access home collateral if they wanted to, both before and during the 2000-2004 run up in prices. On average, these individuals held about $117,000 in home equity in 2000, compared to an increase in home equity of about $80,000 during the 2000-2004 period. Along the lines of the investment cash-flow sensitivity literature, we expect these individuals to have a small response, if any, to the 2000-2004 house price growth as they were already relatively unconstrained in 2000.

A second “levered” group represents about 13% of the sample and contains individuals who moved into their home after 1998. These are the individuals most sensitive to increases in house prices if they were financially constrained, as they have very little home equity available to borrow against in 2000. The final “lending constrained” group is about 2% of the sample. These are individuals who would be unlikely to borrow against any changes in home equity over this period, either because of legal limits on borrowing (e.g., to keep a loan-to-value ratio less than 0.8) or because their zip codes experienced price declines during the 2000-2004 period.\footnote{In defining these groups, there is some temptation to use additional features like the mortgage payment to infer whether the individual has loaded up more debt or substantially paid down the original loan. It is better, however, to stay with the baseline formulation as these adjustments, such as remodelling the kitchen, are often endogenous with entrepreneurial ambitions.}
We use cross-sectional variation across groups interacted with house price changes in the 2000-2004 as one source of identification. Specifically, the lending-constrained group serves as our baseline, as these are individuals with very limited access to financial markets via home equity gains in the 2000-2004 period. We anticipate the levered group to have the strongest response. Finally, our unlevered group provides reassurance that our effects are indeed capturing supply-side changes stemming from the collateral channel as opposed to also capturing demand-side factors.

To further undergird our empirical strategy, we combine two facts available from the 2001 and 2003 Panel Study of Entrepreneurial Dynamics (PSED) and the 2007 Survey of Business Owners (SBO). These surveys ask respondents about their use of home equity loans as collateral for business purposes. About 13% of recent entrepreneurs in the SBO suggest they use home equity to finance their business, a fact that we further analyze in Section 5, and the share in the PSED is 7%. Entrepreneurs in PSED suggest that home equity loans—when they are used—provide about $20,000 in investment capital or roughly 40% of business financing. As the PSED includes many non-employer and nascent entrants, the $20,000 figure is likely an underestimate for our employer firms. In the SBO, business owners using home equity lines tend to raise about $225,000 in start-up capital. While the SBO does not break this figure down by source, if we apply the PSED 40% share this would fall around $90,000. While we unfortunately can’t proceed farther in this line of inquiry, these estimates provide a rough ball park of typical use of home equity loans. This range compares to the average $117,000 in home equity held by our unlevered group before the price run ups begin, suggesting sufficient borrowing capacity already exists for many in the group.10

In some of our estimations, we also use renters and their entrepreneurial transitions to project the expected behavior for homeowners. These calculations model the housing stock of renters through their monthly rental payment. To assign an implied value to rental properties, we simply use 20 times the annual rent. In 2000, the average multiple was 21.6, using quarterly reports from Case-Shiller and FHFA data. Comparing the implied value of homes for renters with the actual home values of owners shows that renters tend to live in dwellings of modestly less value, but that the distributions overlap substantially. Owners have a significantly longer average tenure in their properties than renters.

10Section 5 analyses the 2007 SBO in a cross-sectional format. Unfortunately, while we do not see any evidence of an empirical relationship between changing home prices and home equity financing with the PSED samples, the data are too patchy and sample size too small to make any conclusive statements.
4.1.4 Identifying Entrepreneurship and Early Joiners

Having identified these three groups for analysis, we turn now to how we identify entrepreneurial transitions. Our approach combines the LEHD and LBD, which can be linked through State Employer Identification Numbers (SEINs) and the federal counterpart (EINs), which are created for tax purposes, and the Census Bureau’s overall company identifier (ALPHA) that links the establishments of multi-unit companies together.\footnote{The data structure of the LEHD and LBD allow for establishments within each firm to have different industries and locations. Where used in this study, we define the main industry and main location of a multi-unit firm through the facility with the largest number of employees.} Following the procedures described in Haltiwanger, Jarmin, and Miranda (2013) and Decker et al. (2014), we trace each establishment to its parent firm and identify the first year the firm was in operation. We also measure the number of employees that the LBD reports were working for this firm in the initial year. Approaching entrant definition in this way accomplishes several things—it builds off of the national LBD database to avoid issues related to the partial LEHD state coverage, connects SEINs as appropriate into parent firms, and ensures a consistent definition of entry with prior academic work using the Census Bureau data. Thus, our approach focuses on the formation of employer establishments, excluding Schedule C self-employed activity and also private employer households. This set of entrants connects most directly to job creation and economic growth, but does not encompass all form of entrepreneurial activities, which is important to bear in mind when comparing our work to other studies.

The LEHD does not designate the founders of a new firm. The earnings data include bonus pay and similar compensation, but equity ownership stakes are not recorded. We use the term “entrepreneur” to describe anyone present in the data who is 1) in an entering firm per the Haltiwanger, Jarmin, and Miranda (2013) definition, 2) present in the LEHD in the first year that the firm enters and among the top three earners of the firm in that entry year, and 3) in a firm that entered after 1995. The second key condition uses the initial compensation of firm workers to identify founders, and thus will in some cases include employees other than true business owners. We can think of our work as describing the formation of a top founding team and key early hires, and we use terms like business ownership and entry in this context, testing variations below. The Survey of Business Owners records that over 80% of business owners derive the majority of their income from their business. The third condition for entry after 1995 is imposed by our data. Given the LEHD start dates of 1995 for some states, we are unable to uniformly identify the initial workers for older firms. Thus, in 2000, our designated entrepreneurs are in young firms only. Wage workers are defined as those employees not among the top three initial earners, those hired after the first year in young firms, or those working in an establishment founded prior to 1995.
We also evaluate the transition from wage work to becoming a “joiner” of a young company (Roach and Sauermann, 2015). Joiners are an important comparison point as they experience much of the employment volatility, wage uncertainty, and emotional highs and lows of being in a young company, but they rarely invest financial equity into the company. Given this lack of investment, the home collateral channel is not important for financing their joining of the company. Thus, joiners provide a way for us to study whether large home price gains have wealth effects that lead individuals to take entrepreneurial risks but don’t involve the collateral channel directly. We define joiners as anyone who joins a new company that is one or two years old.

Thus, to summarize, we contemplate four groups of workers for each business: entrepreneurs (top 3 initial earners), initial employees in the first year beyond the top three earners, joiners to the company over the next two years, and all other employees who come to work for a firm that has been in operation for more than three years. These definitions are mutually exclusive and collectively exhaustive.

4.1.5 Sample Design and Descriptive Statistics

Our total available sample contains a little under one million individuals, and our NBER working paper reports analyses using this full sample. For this revised analysis, we put two large additional restrictions on our reported results. First, we only focus on homeowners, who constitute about 70% of the sample, and use renters to instead formulate control variables that are described below. Second, we exclude anyone who in 2000 is a founder or joiner of their current firm. The rationale for this second restriction is that we want to keep a consistent sample for estimations about whether home equity changes impact a person’s tendency to start a new firm or to be an early hire at one.

These adjustments leave us with a regression sample of 529,600 individuals. While using this sample exclusively going forward, we pause to note its robustness. Our estimations of how home equity gains increase one’s propensity to start a new firm are not dependent upon whether the sample includes early joiners in 2000 or not. Similarly, our NBER working paper discusses “net entry” estimations that include existing entrepreneurs in 2000, such that we can simultaneously model transitions into and out of entrepreneurship as prices rise. These again deliver similar findings and implications to those reported below. Thus, our sample choice is driven only by the cleanest and most transparent way to present the core findings, facilitating the comparisons we seek to make across groups within our samples.

Table 3 provides descriptive statistics on our sample. Column 1 reports averages for the key variables across all groups, and the next two columns split them by group. Disclosure restrictions on the Census data prevent us from splitting the sample into the three groups we
use in our analysis for all of these traits. Instead, we provide descriptive statistics separately for the unlevered group (which we expect not to be financially constrained and therefore not as responsive to house price increases) and those potentially constrained. This latter set contains the levered and lending-constrained groups outlined above.

Due to the large sample size, virtually all traits are statistically different between the two reported groups, even when the differences are small in magnitude. About 1.6% of our sample enters as an entrepreneur by 2004, 3.7% as an initial employee in the first year, and 2.2% as a joiner over the next two years. These transition shares are higher for the potentially constrained group. As an external benchmark, entry rates into employer firms are typically estimated to be about 0.6% per year. Without any churn, this would lead to a 2.4% entry rate from 2000-2004. However, about half of entrants fail within the first four years of entry, so accounting for such churn makes the entry rates we measure via the LEHD very reasonable.

Rows 6-12 show that the potentially constrained group is also somewhat younger, more male, more minority and immigrant, and more single than the baseline group. The potentially constrained group is more educated on average, partly reflecting their younger average age. Rows 14-20 show traits of income and home values of the groups. Potentially constrained individuals live in more valuable homes, on average, and with recent move-in dates. Their household income in 2000 and LEHD earnings from 2000 to 2008 are roughly comparable to the unlevered set, but their wealth in 2000 is estimated to be substantially lower due to limited home equity.

Rows 21-24 show that actual price increases and estimated home equity gains are also comparable across groups. There is a small positive correlation of zip code price growth to higher home values in 2000. In addition to actual price gains, we will use in a reduced-form exercise the exogenous element of home price gains developed by Charles, Hurst and Notowidigdo (2015, 2017), described in further detail below. This exogenous element is also comparable across groups.

4.2 Empirical Strategy

Our baseline LEHD estimation takes the form

$$Y_i = \varphi_z + \sum_{g \in G, c \in C} \beta_{g,c} Y_{i,g,c} + \gamma X_i + \varepsilon_i,$$  \hspace{1cm} (2)$$

where $i$ indexes individuals. The dependent variables $Y_i$ are indicators for types of entrepreneurial transitions from 2000 to 2004. $\varphi_z$ is a vector of zip code fixed effects for where an individual lived in 2000, with some estimations instead modeling regional or CBSA fixed effects. We cluster standard errors by zip code.

Individuals are grouped by two dimensions. First, the set $G$ groups expected home equity
gains from 2000 to 2004 into four levels: <25,000, 25,000-75,000, 75,000-150,000, and >150,000. Second, the set C groups whether individuals are unlevered or levered, with the lending-constrained group serving as the reference category. Thus, operationally, we estimate eight indicator variables for levered and unlevered individuals by their home price appreciation, with the $\beta_{g,c}$ coefficients measuring the difference in entrepreneurial transition relative to those precluded from using bank finance to tap into home collateral. The first column of Table 4 reports the share of the sample that falls into each of these eight bins, with the bins having been chosen to provide meaningful counts in each bin—both for the purposes of estimation and also for the purposes of ensuring disclosure, as each indicator must contain minimum counts of individuals from at least three states. The middle bins include the ballpark range that we determined above with the PSED and SBO for typical home equity usage in business formation capital when this form of financing is present.

The $X_i$ vector contains additional traits of individuals used as controls. We model fixed effects for estimated initial wealth levels in 2000 that use the same four increments as home equity gains: {<25,000, 25,000-75,000, 75,000-150,000, >150,000}. Additional covariates are also introduced as fixed effects, with category counts in parenthesis: age (9), education (6), gender (1), race (4), immigration status (1), marital status (1), LEHD earnings in 2000 (10), accumulated LEHD earnings to 2000 (10), and monthly mortgage payment levels (9). The latter are included due to the challenges that debt repayment creates for entrepreneurial transitions (Bracke, Hilber, and Silva, 2014). Accumulated earnings are measured relative to the respondent’s state due to different durations of states in the LEHD sample. Each of these control variables is also interacted with the individual’s zip code price growth.

An important consideration is the exogeneity of local house price changes for entrepreneurial transitions. Common problems include omitted variable bias (e.g., strong migration into a zip code could bid up home prices and also create entrepreneurial opportunities) and reverse causality (e.g., a very astute business person picks a home in anticipation of an area turning into a hot market). While we believe our estimation strategy and use of very tight fixed effects for the zip code alleviate most of these concerns, we also take advantage of the powerful identification opportunity developed by Charles, Hurst and Notowidigdo (2015, 2017). These authors note that local real estate markets often entered a hot run-up period during 2000-2005 where the price gains were escalating too fast to be a consequence of slower-moving fundamentals. The authors estimate on a city-by-city basis where trend breaks exist, and then isolate the price escalation that happens around that trend break. This rapid escalation makes for a convincing exogenous component to local house price increases.

We incorporate the Charles, Hurst and Notowidigdo (2015, 2017) approach and data into our work by creating a second measure of anticipated home equity gains due only to this exogenous
trend break component. This measure is naturally smaller in magnitude than the realized home equity gains, as we have carved out one aspect of the total price appreciation, and so we change the groups $G$ for this exercise to be just \{<$25,000, $25,000-$75,000, >$75,000\}. The first column of Table 5 shows that the bin composition is substantially tilted towards the <$25,000 gain group. Nevertheless, this exogenous component provides a strong identification element to the work that follows.\(^{12}\)

4.3 Results

Table 4 reports estimates of the transition into business ownership by 2004 for homeowners not in entrepreneurship in 2000. The sample only includes people working for wages in 2000 who joined a company three or more years after that firm’s founding. Column 1 models region fixed effects and the eight indicator variables to measure effects relative to the lending-constrained group. An intuitive coefficient pattern emerges: entry transition is rising in the size of home equity gain for both the baseline and levered groups. The coefficients are monotonic within each group and statistically significant for groups with home equity gains greater than $25,000. These results hold with the substitution of tighter geographic fixed effects for CBSAs and zip codes in Columns 2 and 3, respectively.\(^{13}\)

Column 4 adds the four indicator variables for initial wealth levels in 2000, aggregating home equity and household income. Up to this point, we have not incorporated controls to model that wealthy individuals are more likely to experience larger home equity gains (as they own more valuable properties) but are also more likely to enter into entrepreneurship for many reasons beyond home price changes. This addition brings the coefficients down a little bit.

Column 5 next adds the many controls noted above, including their interactions with local price growth. These simple additions wipe out all of the transition effects evident for the unlevered group. This is an important finding, as this group accounts for 85% of the total sample of homeowners. The estimations show that this group does not transition to entrepreneurship at a different rate as home prices rise, even for very large home price shocks, when compared to a group for which lending is constrained. At a more intuitive level, it simply highlights that most homeowners in 2000 already held borrowing capacity if they wanted it, and so the subsequent

\(^{12}\)We thank Erik Hurst for sharing these data with us. Our NBER working paper shows results where we link home price gains to the geographic constraints of cities for housing supply growth, first measured by Saiz (2010). The appropriateness of this technique is debated, by ourselves in the NBER working paper and even more forcefully by others like Davidoff (2016), and so we do not bring forward those results.

\(^{13}\)While our focus is on heterogeneity, the LEHD sample behaves much like the LBD analysis in terms of aggregate relationships. We derive a 0.0039 (0.0008) coefficient when simply regressing the transition probability on the zip code level price growth for an individual and region fixed effects. This coefficient is 0.0119 (0.0016) when using CBSA prices. Compared to the baseline entry rate of 0.0159, these coefficients would suggest a 10% increase in local prices boosts overall entry by a relative rate of 2.5%-7.5%.
home price changes are not unlocking a collateral channel that had been previously closed to them. Column 6 further shows that the results are robust to including a projection of the likelihood of transition, given a homeowner’s traits, based upon what we observe for renters with similar traits during 2000-2004.

The response of the levered group is even more interesting. These are individuals who have moved into their home recently, have much smaller home equity, and face no local price or legal constraints to benefiting from home price gains. This group, when achieving equity gains in excess of $75,000, continues to show a heightened rate of entrepreneurial transition compared to the lending-constrained group. Even with the many controls in place, the home price gains are sufficient to boost entry rates by 50% compared to the sample average rate. It is most plausible that this group would be the one to benefit from home price growth, and this is where the effects take their strongest root. For those experiencing weaker home equity gains of less than $75,000, the response is much more muted.

This contrast provides the essence of our LEHD results and connects back to the limited response we estimated in a longitudinal manner with the LBD. For most homeowners, it is hard to identify an entry effect following home price growth relative to the group with lending constraints. For the baseline set of homeowners moving in before 1998, which constitutes 85% of the sample, this is not too surprising (at least in hindsight) because they already had home equity capacity if they wanted to use it. Similarly, 6% of homeowners are individuals who could have benefited from home equity gains but simply did not experience them in a very large way. On the other hand, for the 6% who experienced big gains and were highly levered beforehand, the growth in entrepreneurship was significant. Figure 3 captures these core findings graphically, and Appendix Table 2 shows similar results when using CBSA price series or when examining entry to 2008.

Table 5 also finds comparable results when using the Charles, Hurst and Notowidigdo (2015, 2017) estimate for exogenous local price increases. We again find very little evidence in the presence of covariates to suggest that the baseline of 85% of homeowners is responding much to home equity increases in the form of entrepreneurship. The levered group shows a greater responsiveness, similar to Table 4. The interesting difference in this analysis is that the transition effect is now present across all non-constrained individuals, a broader effect than what was observed before. These results suggest that a causal interpretation for our LEHD-based findings is reasonable.

Tables 6 and 7 repeat this analysis with the dependent variable being whether an individual transitions to join a young company by 2004, becoming employed after the year in which the company was founded. The heterogeneity across individuals in these estimations is quite different from that evident for becoming a founder. The negative coefficients suggest that the
lending-constrained group is the mostly likely to join, and the differences in transition within the baseline and non-constrained groups in terms of the size of home equity shocks are quite small. Comparing Columns 4-6 of Tables 5 and 7 highlights what appears to be an interesting element of substitution for the levered group: highly leveraged people experiencing large and exogenous home equity shocks are more likely to start a company, while those experiencing weaker shocks are more likely to join one.

This joiner analysis corroborates in a new way that home equity can be important for the specific act of founding a business. It shows that the collateral channel has some bite. Joiners likely face a lot of the same rewards and risks associated with entrepreneurial ventures, but they do not need to put up starting capital. Thus, the absence of a tight linkage to size of home equity gains for joiners suggests that we can place greater confidence in the limited effects that are present in Tables 4 and 5.

Table 8 extends these analyses by reporting a battery of estimations that model different types of entrepreneurial transitions. Each row represents a different outcome variable, with the first block of rows focusing on the top-three-earner definition. Column 1 provides the baseline transition rate. Column 2 reports the transition coefficient for the levered group that obtains a >$150,000 home equity gain, measured relative to the lending constrained group, in an estimation that models zip code fixed effects and wealth levels. To benchmark, this 0.0153 coefficient is identical to that in the last row of Column 4 of Table 4. Column 3 provides for easy reference the relative effect by dividing Column 2’s coefficient by the average transition rate in Column 1. Column 4 further adds covariates to the estimation, with the 0.0084 value being equivalent to what is estimated in Column 5 of Table 4.

This approach allows us to cycle quickly through many traits of the new entrants that are being encouraged by home equity gains. These firms tend to be more capital intensive, more likely to survive to 2008, and more likely to employ more than 15 workers compared to the typical cohort of entrants. These three dimensions are qualitatively similar to what we observed with the Texas reform in Table 2 using the panel variation across states with the LBD. Thus, while a small portion of homeowners are enticed into entrepreneurship through home equity growth via the collateral channel, those who do become entrepreneurs tend to start bigger and stronger businesses than typical. By contrast, we do not find material differences in the rates at which new entrepreneurs switch industries or move cities. The next block repeats this analysis with the adjustment that all people working in the firm in the first year are considered founders, rather than just the top 3 earners. The first row shows the important robustness check that our results are not dependent upon the top 3 earner definition, and most of the other patterns are

\[^{14}\text{Capital-intensive sectors include agriculture, utilities, heavy construction, manufacturing, and wholesale and retail trade.}\]
In summary, our results using individual-level data highlight two points. First, we use an empirical strategy that is inspired by the investment-cash flow sensitivity literature to document that the large majority of individuals, including many who experienced substantial increases in home equity due to house price run-ups, were no more likely to become entrepreneurs than our control group that was lending-constrained due to legal limits or local price declines. A small group of individuals who were highly levered and also experienced large house price gains did increase their entry rate substantially. Second, our estimations on joiners show no response across the board, highlighting the distinct difference in the impact of house price increases on those who found new ventures. These results point to home equity increases unlocking collateral for founders, over and above any other factors that might make individuals more likely to engage in entrepreneurship when their home goes up in value (e.g., being more willing to work in a venture that has a high likelihood of failure because of the ability to tap into home equity for consumption if needed).

While house price increases are important in alleviating financing constraints for some homeowners, these findings suggest that the reason that the aggregate effects measured in Table 2 are modest is that the vast majority of homeowners already have sufficient equity in their homes, and that for these individuals house price increases do not alleviate any binding credit constraints. Our setting is particularly attractive in this regard, as we can show that the response is a null effect for 85% of our sample. This includes a number of individuals with home equity gains over $150,000, which is well beyond the starting capital required for a typical new venture (Hurst and Lusardi, 2004). In other words, our zero response is not due to home equity gains being insufficiently large to overcome potential financing constraints.

5 Survey of Business Owners Database

The LBD- and LEHD-based analyses yield consistent evidence of an important, but limited, role that home equity plays in the financing of new businesses. However, as with most other studies in this domain, our base data do not contain direct measures of home equity financing by new entrepreneurs and business owners, and as a consequence inference must come through empirical connections between home prices and entrepreneurship without this missing link. Our LBD- and LEHD-based data allow us a novel and powerful approach to discerning the collateral channel and its heterogeneity, but the arguments remain somewhat indirect as in prior work.

The Survey of Business Owners (SBO) provides validating evidence. The 2007 SBO contains a direct question regarding home equity financing by entrepreneurs that allows us to shed new light on the empirical relationship of home price growth to entrepreneurship. We use publicly
available micro data released by the Census Bureau for the 2007 SBO. The file contains over two million observations on employer and non-employer firms, and the data contain detailed information about the firm and its owners. Each firm has a recorded state and industry; sales and receipts, employment, and payroll from 2007; the year the business was established; and the sources of financing for start-up capital and for expansion capital. For each business owner, the SBO reports the owner's age in 2007, the highest level of education they completed, the number of hours per week spent working in the business, the owner's primary functions in the business, and when and how each owner acquired or started the business. The SBO data also tell whether the business provided the owner's primary source of personal income, with 81% of primary respondents for employer firms reporting yes.

The Census Bureau has applied certain statistical safeguards to ensure that the public-use data do not identify any individuals or businesses. Most important for our purposes, the data do not separately identify the District of Columbia and seven states: North Dakota, South Dakota, Rhode Island, Vermont, Alaska, Wyoming, and Delaware. Our sample thus focuses on 43 states that are separately identified, and we link to these states the FHFA state-level price indices for 2000-2007.

The total number of firms represented by the data (weighted) is about 26.4 million, of which 5.3 million are employer firms. Our analysis in this paper focuses on employer firms to match the LBD and LEHD, and we exclude firms with missing or unknown start-up financing history (accounting for about 12.5% of the base sample). Over 90% of firms report using some form of start-up financing, with two-thirds reporting personal savings were used to acquire or start the business. Following personal savings, bank loans (20%), credit cards (11%), other personal assets (10%), and home equity (9%) are the most frequently mentioned sources. These raw statistics can represent even very modest contributions (e.g., simply using a credit card that is paid off each month for initial business transactions vs. carrying large credit balances), but they do show a basic importance of home equity for new businesses.

The total value of start-up financing is not split by source, but interesting differences emerge among the firms depending on which sources they report having used. Those relying on credit cards and personal savings report the smallest totals on average ($135,959 and $125,591, respectively), followed by home equity loans at $224,867. Thus, home equity appears to be a source that can be accessed by smaller businesses. Firms that use home equity loans as part of their start-up capital also tend to utilize a mixture of other financing sources. Personal savings (65%), credit cards (38%), bank loans (27%), and other personal assets (26%) are the most frequently

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15 Data and descriptions are available at https://www.census.gov/econ/sbo/pums.html. This is the first-ever SBO Public Use Microdata Sample and it allows researchers to create their own tabulations and analyses on entrepreneurial activity, including the relationships between firm characteristics such as sources of capital, number of owners, firm size, and firm age.
cited additional sources, while grants (0.2%) or venture capital (1%) are rarely used by those firms.

Home equity loans are used less frequently to expand businesses. Among the employer firms responding to the SBO financing questions, 7.2% say that they have used home equity to expand the business or to make capital improvements. Among those firms saying that they did expand in 2007, home equity loans are reported as a financing source by 9.4% of the businesses. Again, firms using home equity loans for expansion also report a mix of other sources including personal savings (62%), credit cards (57%), bank loans (32%), other personal assets (25%) and business profits/assets (20%).

The use of home equity for start-up capital shows a bulge during our sample period consistent with some form of home price growth effect. Caution must be exercised with the statistics that we provide next because we only have a 2007 cross-section, and we are thus unable to separate age from cohort effects. For firms founded in 2000-2002 that are alive in 2007, 10.4% report using home equity in start-up financing. This share grows to 13%-14% from 2003-2006, before falling back down to 12.5% in 2007. This reversion signals to us that cohort effects associated with the price run-ups may have played a role here, whereas a monotonic relationship would have been much harder to argue for over age and survival effects. A similar, but much weaker, bulge is evident for use of home equity in expansion capital. This bulge is interesting in its own right as it provides something of an upper bound on how large the home equity loan effects could be during this period of price expansion.\footnote{16}

To test whether a more systematic relationship exists, Table 9 reports regressions of state-level financing behavior for start-up capital of non-public companies recorded in the 2007 SBO. The sample includes 43 states that are separately identified by the public-use files. We face standard challenges for inference when dealing with a cross-section. Our approach is to estimate as outcome behaviors the types of start-up financing used by entrants since 2000 in each state (e.g., the share of recent entrants that used home equity loans for start-up capital). Our explanatory variables then control for the type of start-up financing used by older firms that entered before 2000 (e.g., the share of pre-2000 entrants that used home equity loans for start-up capital). We are thus seeking evidence for whether strong home price growth during 2000-2007 for a state is correlated with a major differential between how young firms access capital in the state compared to how older firms did it when they started. Specifically, we want to test whether young firms in states with high home price appreciation show a substantially larger rate of use of home equity loans than older companies in the same state, compared to states with less home price growth. We also want to assess whether home equity loans behave differently with respect to home price

\footnote{16 Adelino, Schoar, and Severino (2015) demonstrate rising home prices connect to greater refinancing and use of home equity lines of credit in cities. The important difference in our estimations is that we are isolating the use of home equity loans for start-up capital specifically.}
changes compared to other financial sources.

Panel A of Table 9 considers the share of firms entering during 2000-2007 indicating reported financing, which implicitly focuses attention on the composition of start-up financing. Columns 1-3 divide the sample into businesses not raising external finance, those that raise finance that does not include home equity, and those that raise capital that includes home equity. These categories are collectively exhaustive and mutually exclusive, such that the coefficients sum to zero, and the means of the dependent variables sum to one (state-level averages): 8% of respondents did not raise external finance, 79% raised external finance that does not include home equity loans, and 13% raised finance that includes home equity loans. We regress these outcome variables on log home price levels in 2000, log home price changes during 2000-2007, and unreported covariate controls for the log count of pre-2000 entrants by state and the share of older firms in each state that used the forms of financing listed in Columns 2-8 (seven regressors in total). These unreported regressors are held constant over specifications to provide a consistent baseline estimation and control for long-standing financing behavior in the state. We weight states by their count of pre-2000 respondents.

The main coefficient of interest is the one for log house price growth during 2000-2007, which shows a strong positive association with use of home equity for start-up financing. This suggests an intuitive substitution towards home equity financing as it becomes available, and it is very important for the literature focusing on home prices and entrepreneurship to observe this connection. Yet these effects again appear modest. The average state home price gain through 2007 is 59%, but we use a 10% increase to provide easier comparison to our LEHD- and LBD-based results. This level of price growth is associated with a 0.4% increase in the share of firms using home equity financing, or a 2.8% relative increase in home equity financing off of the 13% baseline.

Columns 4-8 provide additional examples of capital included in initial financing. These other five outcomes are a subset of varieties of capital reported, and other forms of capital may be used by the firm, as well; these coefficients are comparable to home equity loans in Column 3. The encouraging news is that home equity stands out against this backdrop in terms of both statistical significance and economic importance. If anything, these extra outcomes suggest that part of the substitution in the presence of home equity financing comes from other loans, either business loans from banks or from family and friends.

Panel B of Table 9 repeats these estimates using log counts rather than shares. The results get a little murkier here but still speak to the special connection of home equity financing to home price growth. Unreported estimations also find a link of house price growth to home equity being used for expansion capital, but the relationship is smaller than for start-up capital and no longer stands out as strongly against other forms of financing. This is especially true for
retained earnings, which is not possible for start-up financing, and is consistent with booming local conditions associated with house price growth making firms more profitable and allowing them internal capital to further expand.

6 Magnitudes of Results

We have used three datasets, multiple levels of analysis, different sources of identification, and somewhat different time periods to study the relationship between house prices and entrepreneurship. Although the magnitudes are not directly comparable across approaches due to these differences, we next verify that they provide a consistent picture in terms of the implied size of effects. This is first done with a focus on elasticities, by comparing the effect through the collateral channel of a 10% increase in house prices for entrepreneurship. We also quantify the share of the house price-entry relationship that is explained by the collateral channel in our context.

Focusing first on Column 2 of Table 2, our LBD estimations measure that a 10% increase in house prices in the overall Texas region was associated with a 4% increase employment among entering firms in the 1998-2002 period, and a 6% increase in entering employment in the 2003-2007 period. The Texas interactions that isolate the role of home equity collateral channels yield elasticities of 0.2% and 0.6%, respectively. Thus, when including CBSA and year fixed effects and accounting for economic trends in CBSA entry over time, about one-tenth of the overall relationship between house prices and entrepreneurship is attributed to the collateral channel.

The LEHD estimations model individual-level entry into entrepreneurship in the 2000-2004 period among homeowners in wage work, but nevertheless find comparable results. Column 5 of Table 4 shows that levered individuals with over $75,000 in home equity gains experienced a 0.0081-0.0084 increase in entrepreneurial transitions, a sizeable boost of slightly more than 50% to the baseline entry rate of 0.0159 shown in Table 3. These individuals account for 6% of the population, and strong responses are not evident for other groups. The estimates thus suggest a 3% aggregate (50% × 6%) increase in entry during a period that experienced a 43% increase in house prices. Reporting this in terms of a 10% increase, therefore, we estimate a 0.7% increase in entry, which is very consistent with the 0.2%-0.6% numbers found in the LBD. If we re-do this exercise for Column 3 of Table 4, where we model zip code fixed effects but do not control for individual covariates, we obtain a 6% impact that is more than eight times larger, similar to the LBD analysis.

The SBO analysis is not directly comparable to the LBD and LEHD estimations, since the SBO data condition on being an entrepreneur in 2007. Yet, the implied entry elasticities are again quite consistent. This can be seen through a sample model where 100 of every 1000
entering firms in 2000 used home equity (the exact fraction is 10.4% for 2000-2002 entrants alive in 2007). We can then use the point estimates from Panel B of Table 9 to study how many more firms would have entered over the 2000-2007 period using home equity. The coefficient on log house price growth in Column 3 of Table 9 is 0.52, implying that a 10% increase in prices would have led to a 5% increase in entry among firms using home equity. These extra five firms would constitute 0.5% of the 1000 firm baseline. While this type of calculation is not exact, it suggests that the magnitude evident within the SBO using cross-sectional variations over states is comparable to the panel variation in other datasets.

In summary, our estimated effects of housing collateral on entry are aligned over the three approaches, consistently pointing to about a 0.6% increase in start-up activity for every 10% gain in home prices due specifically to the collateral channel. The comparability is reassuring given the very different empirical strategies, levels of analyses, and time periods. As noted earlier, we emphasize that these results portray how the collateral channel operates for the entry of employer firms that we can measure, and other forms of entrepreneurial efforts may have different dependencies.

7 Conclusions

The financing conditions of entrepreneurs is a topic of central importance given the link of young firms to economic growth. The massive recent swings in home prices in the United States and other countries have brought renewed interest to the role of adjustments in home equity in decisions to start new firms. Home equity has the potential to play an important role since it is amenable to pledging against bank loans and because its swings can provide substantial windfalls or losses. Yet, looking at the massive price growth in the early 2000s, we find only modest connections between home price changes and rates of entrepreneurship that we can link to home equity growth experienced by individuals.

We use three different approaches: looking at employment in entering firms, individual-level transition rates, and the sources of financing used by new entrants. Overall, the three approaches provide a very consistent picture despite using slightly different time periods, levels of analysis and empirical strategies. They show that in the U.S., over the 2000-2008 period, (i) most entrepreneurs did not rely on home equity to finance their businesses; (ii) most homeowners already had sufficient housing collateral to pledge for a bank loan even in the absence of house price increases; and (iii) because of these two facts, the substantial house price increases in the 2000s impacted only a fraction of potential entrepreneurs via the collateral channel.

Nevertheless, like much prior work, we also find a strong overall relationship between house price increases and entry. In fact, the 6% increase in entry that we find to be associated with a
10% increase in house prices is close to the magnitude reported by several other papers. Once we account for aggregate demand and control of individual covariates, we estimate that the collateral channel is perhaps one-tenth of this overall effect. While housing collateral is clearly important for some entrepreneurs in accessing bank credit, the role of house price increases in alleviating financing constraints appears small in aggregate and highly correlated with many other factors that influence potential entrepreneurs’ entry decisions. We hope that future work can further study in a related manner other forms of entry like Schedule C self-employment, to complement our analysis of employer firms.

There are several opportunities for future research. Our analysis ends before the Great Recession and the relative collapse of housing prices in many areas of the United States. It is important in future work to consider whether price expansions and contractions have different properties for the collateral channel, as the latter could undermine the entrepreneurial efforts of existing borrowers if banks retract lending in a contagion effect that operates along the intensive margin of borrowers (e.g., Makridis and Ohlrogge, 2017). Second, a longer panel of employment data will allow a consideration of the long-term career implications for those drawn into entrepreneurship or the joining of young firms by house price gains. The nature of entrepreneurial experimentation suggests the ability to test business ownership as a career has benefits beyond the immediate job consequences (e.g., Manso, 2016; Dillon, and Stanton, 2016). Third, work by Guzman and Stern (2017) highlights new ways to differentiate entrepreneurs entering with high growth ambitions for their firms, and it would be attractive to marry the LEHD transitions with these types of quality indicators as they become incorporated into the Census Bureau data family. These extensions will better define how home price changes link into local economic growth.
References


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Appendix A: LEHD Sample Comparison to Census IPUMS

The LEHD sample of one million people is small compared to the 15 included states, and it is helpful to review the numbers in greater detail to place our sample within the broader population. As a starting point of comparison, the 15 states in our sample account for about 133 million people in the public-use 2000 Census IPUMS. This number declines to 52 million when considering those aged 25 to 50, and then further to about 21 million when restricted to people in known MSAs with private-sector employment who are living outside of group quarters. This 21 million includes irregular workers, and one would find a base of 18 million individuals if additionally screening for a wage income of $10,000 or more, usual weeks worked of 40 or more, and usual hours worked per week of 20 or more. A 1-in-6 sample of this latter group would be about 3 million people, or three times larger than our core LEHD sample.

Three factors are mostly responsible for the difference. First, we require individuals be present in the data in 2004 and 2008, thereby excluding those who leave the private sector or migrate out of the 15 covered states. The annual migration rate (interstate and globally) during the 2000-2008 period averages 2.7%, as measured by the American Community Survey, and cumulatively this rate would reduce the sample size by 20%. There are multiple reasons why this 20% would not be exact—e.g., we focus on employed adults and not sedentary elderly or transient college students—but the benchmark provides a useful reference point. Transitions to being unemployed, out of the labor force, or being employed in an uncovered sector (e.g., public sector) would also result in additional sample reductions.

Second, we require that the individual’s SEIN match in the LEHD to the LBD to obtain the important information in that database and to align with our LBD-based results. This LEHD-LBD establishment match rate is a little under 80% in the Business Registry Bridge, as the LEHD contains more types of legal entities than the LBD. While these LEHD-LBD differences lie along several dimensions, the most important factor for this study relates to the elimination of private employer households (e.g., legal employment of a nanny by a household) that are contained in the LEHD (and IPUMS) but excluded from the LBD. This LEHD-LBD match must again be present in 2000, 2004, and 2008, and we estimate that the cumulative impact of this requirement is about a third of potential individuals being eliminated. Additional resources on these issues include Stevens (2007), McKinney and Vilhuber (2011) and Hyatt et al. (2014).

With both of these requirements, it is important to highlight that illegal immigrants are not captured in our sample as they are not part of official administrative payrolls. It is often estimated that 10% of California workers are illegal immigrants. Over half of our sample comes from California, Florida and Texas, where illegal immigration could play a non-trivial factor.

A final and mundane requirement is to have full home price series for the CBSA of the individual from 2000 to 2008, which affects about 20% of the workforce.
These differences account for the size of this study’s sample compared to IPUMS, and some of these differences are important in framing the types of entrepreneurial transitions captured. Overall, the sample still lines up quite well with what one observes from IPUMS (the following traits are listed as LEHD vs. IPUMS and use the home owners grouping portrayed in Table 3): average age of 39.4 vs. 38.4, male share of 53% vs. 59%, Hispanic share of 10.8% vs. 14.2%, African American share of 5.3% vs. 7.6%, Asian share of 5.3% vs. 6.2%, immigrant share of 14.3% vs. 17.2%, married share of 83% vs. 73%, college-educated share of 42% vs. 32%, household income of $88,575 vs. $84,669, home value of $187,947 vs. $178,919, and move-in date of 1992.5 vs. 1992.9. The differences that exist are usually intuitive in terms of the requirement to match LEHD-LBD linked work over the eight years and other sample traits set out.
Figure 1: Average US House Prices

Data Source: Federal Housing Finance Agency

Our sample using zip code prices:
45% price growth 2000→2004
59% price growth 2000→2008
Figure 2: LEHD State Coverage

Our sample

Blue shading: all states present in 2008 LEHD files
Figure 3a: Entry response without individual controls

Transition increase measured relative to lending-constrained control group

Sample average transition rate to entrepreneurship

- Home equity gains <$25K
- Home equity gains $25K - $75K
- Home equity gains $75K - $150K
- Home equity gains >$150K
- Outline: statistically significant

Notes: Figures plots coefficients from Column 3 of Table 4. Effects are measured relative to a lending-constrained control group that faced either local price declines or legal limits for borrowing [2% of sample]. Sample is restricted to home owners in 2000 who are working as a wage employee in a firm that they did not found or join within the first three years. Group size indicated by bar width.
Figure 3b: Entry response with individual controls

Transition increase measured relative to lending-constrained control group

Sample average transition rate to entrepreneurship

Notes: See Figure 3a. Figures plots coefficients from Column 5 of Table 4.
Table 1 - Texas border analysis

Comparison of price changes and entry rates for CBSAs on Texas border

Notes: Counties part of CBSAs along the border are grouped into those on the Texas side versus opposite. Average annual price and entry levels are prepared for each period and divided by baseline rate in 1987-1997.

<table>
<thead>
<tr>
<th></th>
<th>Price Index</th>
<th>Entry count</th>
<th>Entry employment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>non-Texas (1)</td>
<td>Texas (2)</td>
<td>non-Texas (3)</td>
</tr>
<tr>
<td>1987-1997</td>
<td>1.000</td>
<td>1.000</td>
<td>1.000</td>
</tr>
<tr>
<td>1998-2002</td>
<td>1.048</td>
<td>1.048</td>
<td>0.763</td>
</tr>
<tr>
<td>2003-2007</td>
<td>1.103</td>
<td>1.098</td>
<td>0.737</td>
</tr>
</tbody>
</table>
### Table 2 - Longitudinal Business Database analysis of Texas collateral reform

**Estimations of Texas reform impact on entry employment in Texas CBSAs compared to CBSAs in neighboring states**

Notes: This table reports regressions of log employment in new firm entrants with CBSA-level home price changes from 1987-2007. The dependent variables are given by column headers. The house price index is in log form, and the first three rows interact the price index with each of the three time periods. Estimations include CBSA and year fixed effects, such that coefficients measure the correlation between changes in log entry employment in the period with changes in prices in the period. The fourth row reports the interaction of the price index with the CBSA being in Texas. This provides the overall magnitude difference in Texas. The final two interactions further interact the price index for being a Texan CBSA in each of the two post periods: after the initial 1998 reform to allow home equity lending and after the 2003 reform to allow home equity lines of credit. Coefficients on these variables measure the difference for Texan CBSAs relative to their behavior in the period before 1998. Estimations report standard errors clustered by CBSA. Estimations weight CBSAs by the number of individual observations that are included in the CBSA for the worker type being studied. Estimations include CBSA and year fixed effects and have 1,132 observations. Columns 2-9 include controls for lagged total firm count and contemporaneous establishment expansion rate in the CBSA.

<table>
<thead>
<tr>
<th>Employment in entry year</th>
<th>Employment in entry year</th>
<th>Log employment by entry size</th>
<th>Log employment by sector</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1-2 empl.</td>
<td>3-9 empl.</td>
</tr>
<tr>
<td>Log house price x 1988-1997</td>
<td>0.5152</td>
<td>0.1560</td>
<td>-0.0655</td>
</tr>
<tr>
<td></td>
<td>(0.2198)</td>
<td>(0.2324)</td>
<td>(0.1406)</td>
</tr>
<tr>
<td>Log house price x 1998-2002</td>
<td>0.7818</td>
<td>0.3954</td>
<td>0.3989</td>
</tr>
<tr>
<td></td>
<td>(0.3132)</td>
<td>(0.2882)</td>
<td>(0.0980)</td>
</tr>
<tr>
<td>Log house price x 2003-2007</td>
<td>1.0796</td>
<td>0.6036</td>
<td>0.5047</td>
</tr>
<tr>
<td></td>
<td>(0.4129)</td>
<td>(0.3535)</td>
<td>(0.1086)</td>
</tr>
</tbody>
</table>

**Texas Interactions with:**

| Log house price (all years) | -0.0939 | -0.1729 | -0.2532 | 0.1409 | -0.3219 | 0.4785 | -0.8368 | 0.1245 | -0.0819 |
|                            | (0.2063) | (0.2244) | (0.0884) | (0.0842) | (0.3002) | (0.4096) | (0.6475) | (0.3037) | (0.3621) |
| Log house price x 1998-2002 | 0.0252 | 0.0242 | 0.0165 | 0.0013 | 0.0361 | 0.0103 | 0.0538 | 0.0069 | 0.0227 |
|                            | (0.0173) | (0.0163) | (0.0061) | (0.0072) | (0.0233) | (0.0317) | (0.0512) | (0.0160) | (0.0247) |
| Log house price x 2003-2007 | 0.0643 | 0.0631 | 0.0348 | -0.0001 | 0.0865 | -0.0036 | 0.1272 | 0.0322 | 0.0454 |
|                            | (0.0303) | (0.0312) | (0.0098) | (0.0097) | (0.0421) | (0.0479) | (0.0637) | (0.0365) | (0.0410) |

Log firm count in prior year:

| Log employment by sector |
|--------------------------|--------------------------|--------------------------|--------------------------|
|                           |                          | 1-2 empl. | 3-9 empl. | 10+ empl. | Construction | Mfg. | Transport and Trade | Services |
| Log firm count in prior year | 0.9646 | 1.0699 | 0.6330 | 1.0431 | 0.3010 | 0.3835 | 0.8186 | 1.2119 |
|                            | (0.1893) | (0.1238) | (0.1160) | (0.2738) | (0.3010) | (0.6104) | (0.1884) | (0.2695) |

Log new plants for multi-unit firms:

| Log employment by sector |
|--------------------------|--------------------------|--------------------------|--------------------------|
|                           |                          | 1-2 empl. | 3-9 empl. | 10+ empl. | Construction | Mfg. | Transport and Trade | Services |
| Log new plants for multi-unit firms | 0.0422 | 0.0549 | 0.0886 | 0.0430 | 0.2175 | -0.1710 | 0.0022 | 0.2547 |
|                            | (0.0950) | (0.0372) | (0.0384) | (0.1323) | (0.1281) | (0.2778) | (0.0815) | (0.1297) |

Texas full effect by time period:

<table>
<thead>
<tr>
<th></th>
<th>Employment in entry year</th>
<th>Employment in entry year</th>
<th>Log employment by entry size</th>
<th>Log employment by sector</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>1-2 empl.</td>
<td>3-9 empl.</td>
</tr>
<tr>
<td>1988-1997</td>
<td>0.4213</td>
<td>-0.0169</td>
<td>-0.3187</td>
<td>0.0973</td>
</tr>
<tr>
<td>1998-2002</td>
<td>0.7131</td>
<td>0.2467</td>
<td>0.1622</td>
<td>0.5014</td>
</tr>
<tr>
<td>2003-2007</td>
<td>1.0500</td>
<td>0.4938</td>
<td>0.2863</td>
<td>0.1765</td>
</tr>
</tbody>
</table>

Notes: This table reports regressions of log employment in new firm entrants with CBSA-level home price changes from 1987-2007. The dependent variables are given by column headers. The house price index is in log form, and the first three rows interact the price index with each of the three time periods. Estimations include CBSA and year fixed effects, such that coefficients measure the correlation between changes in log entry employment in the period with changes in prices in the period. The fourth row reports the interaction of the price index with the CBSA being in Texas. This provides the overall magnitude difference in Texas. The final two interactions further interact the price index for being a Texan CBSA in each of the two post periods: after the initial 1998 reform to allow home equity lending and after the 2003 reform to allow home equity lines of credit. Coefficients on these variables measure the difference for Texan CBSAs relative to their behavior in the period before 1998. Estimations report standard errors clustered by CBSA. Estimations weight CBSAs by the number of individual observations that are included in the CBSA for the worker type being studied. Estimations include CBSA and year fixed effects and have 1,132 observations. Columns 2-9 include controls for lagged total firm count and contemporaneous establishment expansion rate in the CBSA.
Table 3 - Descriptive statistics on LEHD sample

Notes: The LEHD sample includes working individuals present in 2000, 2004, and 2008 in one of 15 states: CA, CO, FL, ID, IL, IN, LA, MD, NC, NM, OK, OR, TX, WA, and WI. Sample focuses on wage workers in 2000 with home locations to which we can map zip code prices. Demographic traits are measured in 2000. Per Census Bureau disclosure requirements, the listed observation counts are rounded. Most traits are statistically different between Columns 2 and 3.

<table>
<thead>
<tr>
<th></th>
<th>All (1)</th>
<th>Baseline (2)</th>
<th>Potentially constrained (3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) N</td>
<td>529,600</td>
<td>452,100</td>
<td>77,500</td>
</tr>
<tr>
<td>(2) Share</td>
<td></td>
<td>0.85</td>
<td>0.15</td>
</tr>
<tr>
<td>(3) Entry as a top-three earner</td>
<td>0.0159</td>
<td>0.0154</td>
<td>0.0189</td>
</tr>
<tr>
<td>(4) Entry as an initial employee</td>
<td>0.0367</td>
<td>0.0357</td>
<td>0.0422</td>
</tr>
<tr>
<td>(5) Joining a firm 1-2 years old</td>
<td>0.0218</td>
<td>0.0208</td>
<td>0.0276</td>
</tr>
<tr>
<td>(6) Age</td>
<td>39.41</td>
<td>39.99</td>
<td>36.03</td>
</tr>
<tr>
<td>(7) Male</td>
<td>0.5281</td>
<td>0.5224</td>
<td>0.5612</td>
</tr>
<tr>
<td>(8) Hispanic</td>
<td>0.1082</td>
<td>0.1056</td>
<td>0.1235</td>
</tr>
<tr>
<td>(9) African American</td>
<td>0.0533</td>
<td>0.0523</td>
<td>0.0593</td>
</tr>
<tr>
<td>(10) Asian</td>
<td>0.0527</td>
<td>0.0511</td>
<td>0.0614</td>
</tr>
<tr>
<td>(11) Immigrant</td>
<td>0.1432</td>
<td>0.1388</td>
<td>0.1685</td>
</tr>
<tr>
<td>(12) Married</td>
<td>0.8262</td>
<td>0.8343</td>
<td>0.7785</td>
</tr>
<tr>
<td>(13) Bachelor's education and higher</td>
<td>0.4173</td>
<td>0.4085</td>
<td>0.4685</td>
</tr>
<tr>
<td>(14) Household income (max=$2.5 million)</td>
<td>88,575</td>
<td>89,086</td>
<td>85,594</td>
</tr>
<tr>
<td>(15) Home value (max=$1 million)</td>
<td>187,947</td>
<td>185,284</td>
<td>203,485</td>
</tr>
<tr>
<td>(17) Wealth</td>
<td>194,397</td>
<td>205,630</td>
<td>128,848</td>
</tr>
<tr>
<td>(18) LEHD earnings 2000</td>
<td>51,253</td>
<td>51,088</td>
<td>52,219</td>
</tr>
<tr>
<td>(19) LEHD earnings 2004</td>
<td>61,153</td>
<td>60,825</td>
<td>63,067</td>
</tr>
<tr>
<td>(20) LEHD earnings 2008</td>
<td>70,814</td>
<td>70,096</td>
<td>75,005</td>
</tr>
<tr>
<td>(21) Zip code price growth 2000-2004</td>
<td>0.4262</td>
<td>0.4266</td>
<td>0.4240</td>
</tr>
<tr>
<td>(22) Estimated home equity gains</td>
<td>85,481</td>
<td>84,519</td>
<td>91,093</td>
</tr>
<tr>
<td>(23) Charles et al. exogenous local price increase</td>
<td>0.0574</td>
<td>0.0578</td>
<td>0.0551</td>
</tr>
<tr>
<td>(24) Estimate Charles et al. home equity gains</td>
<td>12,191</td>
<td>12,145</td>
<td>12,462</td>
</tr>
</tbody>
</table>
Table 4 - Transition estimations using sample of non-entrepreneur home owners in 2000 -- Top 3 earners

**Estimations for levered and unlevered individuals based upon local price growth and state laws**

Notes: Table reports coefficients from regression of entry into business ownership by 2004 for home owners not in entrepreneurship in 2000. The sample only includes people working for wages in 2000 who joined a company three or more years after that firm's founding (i.e., it drops top earners and early employees) to provide a consistent baseline across entrepreneur and joiner estimations. The RHS variables are indicator variables for the estimated dollar value of home equity increase during 2000-2004 using the local price growth and the value of the property in 2000. Separate indicator variables are included for "unlevered" and "levered" groups, with effects measured relative to lending-constrained individuals. The unlevered group includes people who would not be constrained towards home equity borrowing based upon move-in dates before 1998 or owning their home outright. The levered group have post-1998 move-in dates and face no state-level legal limits on borrowing and experience positive local price growth. The omitted group have post-1998 move-in dates and face either state-level limits on borrowing or local price declines. Wealth FE are built by group and use increments similar to home equity gains. Covariates include demographics, earnings histories, and mortgage payments and interact these variables with zip code price growth. Projections are made for Column 6 of probability of entry based upon renter behavior using a full specification similar to Column 5 in an auxiliary regression. Estimations have 529,600 observations and cluster standard errors by zip code.

<table>
<thead>
<tr>
<th>Entry as top-3 initial earners, no covariates</th>
<th>Adding covariates to Column 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample share</td>
<td></td>
</tr>
<tr>
<td>Region FE</td>
<td>CBSA FE</td>
</tr>
<tr>
<td>Zip code FE</td>
<td></td>
</tr>
<tr>
<td>Wealth</td>
<td></td>
</tr>
<tr>
<td>Wealth + Covariates</td>
<td></td>
</tr>
<tr>
<td>Wealth + Covariates + Projection</td>
<td></td>
</tr>
<tr>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td>(3)</td>
<td>(4)</td>
</tr>
<tr>
<td>(5)</td>
<td>(6)</td>
</tr>
</tbody>
</table>

**LENDING-CONSTRAINED CONTROL GROUP: Local Price Declines or Legal Limits [2% of sample]**

**UNLEVERED, Pre-1998 Move-In with Local Price Growth**

Home equity gains <$25k 25% -0.0011 (0.0013) -0.0021 (0.0013) -0.0014 (0.0014) -0.0024 (0.0073) -0.0061 (0.0079) -0.0049 (0.0079)
Home equity gains $25k-$75k 30% 0.0032 (0.0014) 0.0030 (0.0014) 0.0027 (0.0015) 0.0017 (0.0073) -0.0037 (0.0079) -0.0031 (0.0079)
Home equity gains $75k-$150k 16% 0.0061 (0.0015) 0.0086 (0.0016) 0.0077 (0.0017) 0.0064 (0.0073) -0.0006 (0.0079) -0.0009 (0.0079)
Home equity gains >$150k 15% 0.0106 (0.0015) 0.0146 (0.0017) 0.0121 (0.0018) 0.0108 (0.0074) 0.0014 (0.0080) -0.0002 (0.0080)

**LEVERED, Post-1998 Move-In with Local Price Growth & No Legal Limits**

Home equity gains <$25k 3% 0.0022 (0.0017) 0.0007 (0.0017) 0.0009 (0.0017) 0.0023 (0.0038) 0.0020 (0.0047) 0.0022 (0.0047)
Home equity gains $25k-$75k 5% 0.0051 (0.0016) 0.0047 (0.0016) 0.0045 (0.0017) 0.0053 (0.0037) 0.0035 (0.0047) 0.0036 (0.0047)
Home equity gains $75k-$150k 3% 0.0112 (0.0018) 0.0132 (0.0020) 0.0121 (0.0020) 0.0119 (0.0038) 0.0081 (0.0049) 0.0081 (0.0049)
Home equity gains >$150k 3% 0.0158 (0.0019) 0.0197 (0.0021) 0.0170 (0.0022) 0.0153 (0.0039) 0.0084 (0.0053) 0.0079 (0.0053)
### Table 5 - Transition estimations using sample of non-entrepreneur home owners in 2000 -- Top 3 earners

**Estimations for levered and unlevered individuals based upon exogenous local price growth and state laws**

Notes: See Table 4. Estimations utilize the Charles et al. (2015, 2017) local price growth due to exogenous market reasons for calculating home equity gains.

<table>
<thead>
<tr>
<th>Sample share</th>
<th>Region FE</th>
<th>CBSA FE</th>
<th>Zip code FE</th>
<th>Wealth</th>
<th>Wealth + Covariates</th>
<th>Wealth + Covariates + Projection</th>
</tr>
</thead>
<tbody>
<tr>
<td>LENDING-CONSTRAINED CONTROL GROUP: Local Price Declines or Legal Limits [2% of sample]</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>UNLEVERED, Pre-1998 Move-In with Local Price Growth</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Home equity gains &lt;$25k</td>
<td>71%</td>
<td>0.0001</td>
<td>-0.0004</td>
<td>0.0000</td>
<td>-0.0022</td>
<td>-0.0022</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.0013)</td>
<td>(0.0014)</td>
<td>(0.0014)</td>
<td>(0.0076)</td>
<td>(0.0078)</td>
</tr>
<tr>
<td>Home equity gains $25k-$75k</td>
<td>14%</td>
<td>0.0062</td>
<td>0.0067</td>
<td>0.0043</td>
<td>0.0015</td>
<td>-0.0003</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.0015)</td>
<td>(0.0015)</td>
<td>(0.0016)</td>
<td>(0.0076)</td>
<td>(0.0079)</td>
</tr>
<tr>
<td>Home equity gains &gt;$75k</td>
<td>1%</td>
<td>0.0200</td>
<td>0.0224</td>
<td>0.0170</td>
<td>0.0143</td>
<td>0.0107</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.0027)</td>
<td>(0.0028)</td>
<td>(0.0030)</td>
<td>(0.0080)</td>
<td>(0.0082)</td>
</tr>
<tr>
<td>LEVERED, Post-1998 Move-In with Local Price Growth &amp; No Legal Limits</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Home equity gains &lt;$25k</td>
<td>10%</td>
<td>0.0036</td>
<td>0.0028</td>
<td>0.0030</td>
<td>0.0063</td>
<td>0.0084</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.0015)</td>
<td>(0.0015)</td>
<td>(0.0015)</td>
<td>(0.0038)</td>
<td>(0.0040)</td>
</tr>
<tr>
<td>Home equity gains $25k-$75k</td>
<td>3%</td>
<td>0.0114</td>
<td>0.0117</td>
<td>0.0091</td>
<td>0.0087</td>
<td>0.0105</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.0019)</td>
<td>(0.0020)</td>
<td>(0.0021)</td>
<td>(0.0038)</td>
<td>(0.0042)</td>
</tr>
<tr>
<td>Home equity gains &gt;$75k</td>
<td>0.2%</td>
<td>0.0200</td>
<td>0.0222</td>
<td>0.0170</td>
<td>0.0137</td>
<td>0.0147</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.0052)</td>
<td>(0.0053)</td>
<td>(0.0056)</td>
<td>(0.0064)</td>
<td>(0.0067)</td>
</tr>
</tbody>
</table>
Table 6 - Transition estimations using sample of non-entrepreneur home owners in 2000 -- Joiners
Estimations for levered and unlevered individuals based upon local price growth and state laws

Notes: See Table 4.

<table>
<thead>
<tr>
<th>Sample share</th>
<th>Entry as joiner, no covariates</th>
<th>Adding covariates to Column 3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Region FE</td>
<td>CBSA FE</td>
</tr>
<tr>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
</tr>
</tbody>
</table>

LENDING-CONSTRAINED CONTROL GROUP: Local Price Declines or Legal Limits [2% of sample]

UNLEVERED, Pre-1998 Move-In with Local Price Growth

- Home equity gains <$25k: 25% -0.0058 -0.0038 -0.0036 -0.0078 -0.0241 -0.0240
  (0.0018) (0.0019) (0.0019) (0.0089) (0.0098) (0.0098)
- Home equity gains $25k-$75k: 30% -0.0053 -0.0065 -0.0065 -0.0074 -0.0244 -0.0243
  (0.0019) (0.0020) (0.0020) (0.0089) (0.0099) (0.0099)
- Home equity gains $75k-$150k: 16% -0.0056 -0.0093 -0.0100 -0.0087 -0.0259 -0.0259
  (0.0020) (0.0021) (0.0022) (0.0090) (0.0099) (0.0099)
- Home equity gains >$150k: 15% -0.0061 -0.0100 -0.0103 -0.0074 -0.0239 -0.0241
  (0.0020) (0.0022) (0.0023) (0.0090) (0.0099) (0.0100)

LEVERED, Post-1998 Move-In with Local Price Growth & No Legal Limits

- Home equity gains <$25k: 3% -0.0004 0.0024 0.0024 -0.0046 -0.0049 -0.0048
  (0.0023) (0.0022) (0.0024) (0.0050) (0.0066) (0.0066)
- Home equity gains $25k-$75k: 5% 0.0012 0.0000 -0.0004 -0.0044 -0.0051 -0.0051
  (0.0022) (0.0022) (0.0023) (0.0048) (0.0065) (0.0065)
- Home equity gains $75k-$150k: 3% 0.0029 -0.0009 -0.0017 -0.0039 -0.0050 -0.0050
  (0.0024) (0.0025) (0.0025) (0.0048) (0.0067) (0.0067)
- Home equity gains >$150k: 3% 0.0000 -0.0040 -0.0048 -0.0055 -0.0061 -0.0061
  (0.0023) (0.0024) (0.0025) (0.0048) (0.0070) (0.0070)
**Table 7 - Transition estimations using sample of non-entrepreneur home owners in 2000 -- Joiners**

Estimations for levered and unlevered individuals based upon exogenous local price growth and state laws

Notes: See Table 5.

<table>
<thead>
<tr>
<th>Sample share</th>
<th>Entry as joiner, no covariates</th>
<th>Adding covariates to Column 3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Region FE</td>
<td>CBSA FE</td>
</tr>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
</tr>
</tbody>
</table>

**LENDING-CONSTRAINED CONTROL GROUP: Local Price Declines or Legal Limits [2% of sample]**

**UNLEVERED, Pre-1998 Move-In with Local Price Growth**

Home equity gains <$25k  71%  -0.0058  -0.0047  -0.0046  -0.0073  -0.0232  -0.0232
(0.0019) (0.0019) (0.0019) (0.0092) (0.0093) (0.0093)

Home equity gains $25k-$75k  14%  -0.0076  -0.0077  -0.0083  -0.0087  -0.0243  -0.0243
(0.0020) (0.0020) (0.0021) (0.0092) (0.0094) (0.0094)

Home equity gains >$75k  1%  0.0014  -0.0028  -0.0063  -0.0064  -0.0212  -0.0212
(0.0028) (0.0030) (0.0032) (0.0096) (0.0097) (0.0097)

**LEVERED, Post-1998 Move-In with Local Price Growth & No Legal Limits**

Home equity gains <$25k  10%  0.0007  0.0017  0.0016  -0.0049  -0.0048  -0.0048
(0.0020) (0.0021) (0.0021) (0.0048) (0.0049) (0.0049)

Home equity gains $25k-$75k  3%  -0.0006  -0.0008  -0.0017  -0.0065  -0.0055  -0.0055
(0.0023) (0.0024) (0.0024) (0.0048) (0.0051) (0.0051)

Home equity gains >$75k  0.2%  0.0107  0.0069  0.0036  -0.0007  0.0005  0.0005
(0.0058) (0.0056) (0.0055) (0.0069) (0.0072) (0.0072)
Table 8 - Transition rates of non-entrepreneur home owners in 2000

Heterogeneity in firm entry types for levered home owners experiencing high equity gains

Notes: Estimations report variants on entry definition and the indicator for levered individuals experiencing >$150k in home equity gains. All other aspects of estimations are the same as in Table 4.

<table>
<thead>
<tr>
<th>Baseline rate</th>
<th>Zip code FE and wealth FE</th>
<th>Zip code FE and wealth FE and full covariates</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Levered group; home equity gains &gt;$150k; coefficient and standard error</td>
<td>Relative effect compared to baseline</td>
</tr>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
</tr>
</tbody>
</table>

Top 3 initial earners
- All new firms: 0.0159 (0.0039) 96% 0.0084 (0.0053) 53%
- High capital intensity: 0.0035 (0.0014) 140% 0.0029 (0.0022) 83%
- Low capital intensity: 0.0123 (0.0035) 84% 0.0055 (0.0048) 45%
- Closed by 2008: 0.0063 (0.0024) 68% 0.0034 (0.0036) 54%
- Survived to 2008: 0.0096 (0.0029) 115% 0.0051 (0.0039) 53%
- Less than 15 employees: 0.0077 (0.0029) 45% 0.0032 (0.0039) 42%
- More than 15 employees: 0.0081 (0.0025) 146% 0.0052 (0.0035) 64%
- Industry switching: 0.0113 (0.0032) 98% 0.0108 (0.0044) 96%
- Non-industry switching: 0.0046 (0.0021) 91% -0.0024 (0.0029) -52%
- CBSA switching: 0.0041 (0.0019) 95% 0.0005 (0.0028) 12%
- Non-CBSA switching: 0.0117 (0.0034) 97% 0.0080 (0.0046) 68%

All initial earners
- All new firms: 0.0367 (0.0051) 53% 0.0170 (0.0079) 46%
- High capital intensity: 0.0104 (0.0026) 58% 0.0126 (0.0043) 121%
- Low capital intensity: 0.0263 (0.0044) 51% 0.0044 (0.0064) 17%
- Closed by 2008: 0.0167 (0.0038) 19% 0.0004 (0.0055) 2%
- Survived to 2008: 0.0199 (0.0038) 82% 0.0167 (0.0058) 84%
- Less than 15 employees: 0.0081 (0.0031) 33% -0.0005 (0.0042) -6%
- More than 15 employees: 0.0285 (0.0004) 59% 0.0175 (0.0064) 61%
- Industry switching: 0.0234 (0.0042) 46% 0.0091 (0.0064) 39%
- Non-industry switching: 0.0133 (0.0032) 65% 0.0079 (0.0047) 59%
- CBSA switching: 0.0085 (0.0029) 33% -0.0017 (0.0045) -20%
- Non-CBSA switching: 0.0281 (0.0045) 59% 0.0169 (0.0066) 60%
**Table 9 - Survey of Business Owners analysis of home equity loans**

**Estimations of state-level house price changes and use of home equity loans for start-up capital**

Notes: This table reports regressions of state-level financing behavior for start-up capital of non-public companies recorded in the 2007 Survey of Business Owners (SBO). The sample includes 43 states that are separately recorded by the public-use 2007 SBO. Column headers indicate forms of financing. Observations with missing records or the respondents not knowing the financing history of their business are excluded from these shares (accounting for about 12.5% of the base sample). The categories in Columns 1-3 are collectively exhaustive and mutually exclusive, such that the coefficients sum to zero. Additional examples of capital are included in Columns 4-8. These other five outcomes are a subset of varieties of capital reported, and other forms of capital may be used by the firm as well; these coefficients are comparable to home equity loans in Column 3. Panel A reports the share of firms entering during 2000-2007 indicating reported financing, with covariate controls described below for the share of firms entering before 2000 indicating reported financing. This approach implicitly focuses on composition of financing. Panel B reports the log count of firms entering during 2000-2007 indicating reported financing, with comparable covariate controls for the log count of firms entering before 2000 indicating reported financing. This approach allows greater scope for growth. Reported explanatory variables are the log house price index for the state in 2000 and the log change from 2000 to 2007. Unreported explanatory variables include the log count of SBO businesses among the pre-2000 firms and the pre-2000 share (Panel A) or log count (Panel B) of each form of financing listed in Columns 2-8 (7 regressors each panel); these regressors are held constant over specifications for consistent baseline estimation and control for long-standing financing behavior in the state. Estimations have 43 observations, are weighted by count of pre-2000 respondents, and report robust standard errors.

<table>
<thead>
<tr>
<th>Sample breakdown</th>
<th>Capital used does not include home equity loans</th>
<th>Capital used includes home equity loans</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
<th>(7)</th>
<th>(8)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No start-up capital raised</td>
<td>-0.0344</td>
<td>0.0119</td>
<td>-0.0080</td>
<td>0.0013</td>
<td>0.0101</td>
<td>-0.0296</td>
<td>-0.0145</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Log house price levels in 2000</td>
<td>0.0226</td>
<td>(0.0153)</td>
<td>(0.0200)</td>
<td>(0.0165)</td>
<td>(0.0365)</td>
<td>(0.0141)</td>
<td>(0.0174)</td>
<td>(0.0379)</td>
<td>(0.0130)</td>
<td></td>
</tr>
<tr>
<td>Log house price growth from 2000-2007</td>
<td>0.0043</td>
<td>(0.0119)</td>
<td>(0.0160)</td>
<td>(0.0158)</td>
<td>(0.0281)</td>
<td>(0.0114)</td>
<td>(0.0153)</td>
<td>(0.0354)</td>
<td>(0.0070)</td>
<td></td>
</tr>
<tr>
<td>Mean of dependent variable</td>
<td>0.0804</td>
<td>0.7875</td>
<td>0.1321</td>
<td>0.7267</td>
<td>0.1307</td>
<td>0.0822</td>
<td>0.2291</td>
<td>0.0523</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10% price growth effect</td>
<td>0.0004</td>
<td>-0.0041</td>
<td>0.0037</td>
<td>-0.0007</td>
<td>0.0016</td>
<td>0.0005</td>
<td>-0.0023</td>
<td>-0.0011</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Growth effect / mean of DV</td>
<td>0.0051</td>
<td>-0.0052</td>
<td>0.0279</td>
<td>-0.0010</td>
<td>0.0123</td>
<td>0.0062</td>
<td>-0.0102</td>
<td>-0.0216</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

A. Dependent variable is share of firms entering during 2000-2007 indicating reported financing

B. Dependent variable is log count of firms entering during 2000-2007 indicating reported financing

<table>
<thead>
<tr>
<th>Log house price levels in 2000</th>
<th>0.6473</th>
<th>0.3955</th>
<th>0.5022</th>
<th>0.4157</th>
<th>0.4374</th>
<th>0.4947</th>
<th>0.1288</th>
<th>0.1769</th>
</tr>
</thead>
<tbody>
<tr>
<td>Log house price growth from 2000-2007</td>
<td>0.3665</td>
<td>0.2025</td>
<td>0.5165</td>
<td>0.2569</td>
<td>0.3727</td>
<td>0.3682</td>
<td>-0.0601</td>
<td>0.0382</td>
</tr>
<tr>
<td>Mean of dependent variable</td>
<td>0.0804</td>
<td>0.7875</td>
<td>0.1321</td>
<td>0.7267</td>
<td>0.1307</td>
<td>0.0822</td>
<td>0.2291</td>
<td>0.0523</td>
</tr>
<tr>
<td>10% price growth effect</td>
<td>0.0004</td>
<td>-0.0041</td>
<td>0.0037</td>
<td>-0.0007</td>
<td>0.0016</td>
<td>0.0005</td>
<td>-0.0023</td>
<td>-0.0011</td>
</tr>
<tr>
<td>Growth effect / mean of DV</td>
<td>0.0051</td>
<td>-0.0052</td>
<td>0.0279</td>
<td>-0.0010</td>
<td>0.0123</td>
<td>0.0062</td>
<td>-0.0102</td>
<td>-0.0216</td>
</tr>
</tbody>
</table>
### Appendix Table 1 - Longitudinal Business Database analysis of Texas collateral reform

**Estimations of Texas reform impact on entry counts in Texas CBSAs compared to CBSAs in neighboring states**

**Notes:** See Table 2. This table set measures entry through count of new firms.

<table>
<thead>
<tr>
<th>Log new entrances</th>
<th>Log new entrances</th>
<th>Log entrants by entry size</th>
<th>Construction</th>
<th>Mfg.</th>
<th>Transport and Trade</th>
<th>Services</th>
</tr>
</thead>
<tbody>
<tr>
<td>Log house price x 1988-1997</td>
<td>0.4077</td>
<td>0.0496</td>
<td>0.0534</td>
<td>-0.0700</td>
<td>0.1124</td>
<td>0.9145</td>
</tr>
<tr>
<td></td>
<td>(0.1716)</td>
<td>(0.0914)</td>
<td>(0.0883)</td>
<td>(0.1336)</td>
<td>(0.1158)</td>
<td>(0.2217)</td>
</tr>
<tr>
<td>Log house price x 1998-2002</td>
<td>0.7101</td>
<td>0.3256</td>
<td>0.3205</td>
<td>0.3583</td>
<td>0.4886</td>
<td>0.9847</td>
</tr>
<tr>
<td></td>
<td>(0.0925)</td>
<td>(0.0560)</td>
<td>(0.0539)</td>
<td>(0.1200)</td>
<td>(0.1719)</td>
<td>(0.2163)</td>
</tr>
<tr>
<td>Log house price x 2003-2007</td>
<td>0.7878</td>
<td>0.3199</td>
<td>0.3442</td>
<td>0.0984</td>
<td>0.1514</td>
<td>0.5226</td>
</tr>
<tr>
<td></td>
<td>(0.1496)</td>
<td>(0.0665)</td>
<td>(0.0666)</td>
<td>(0.1387)</td>
<td>(0.1910)</td>
<td>(0.2946)</td>
</tr>
<tr>
<td>Texas Interactions with:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Log house price (all years)</td>
<td>0.0268</td>
<td>-0.0525</td>
<td>-0.0756</td>
<td>0.1252</td>
<td>-0.2053</td>
<td>-0.0811</td>
</tr>
<tr>
<td></td>
<td>(0.1481)</td>
<td>(0.0673)</td>
<td>(0.0711)</td>
<td>(0.0745)</td>
<td>(0.1414)</td>
<td>(0.1835)</td>
</tr>
<tr>
<td>Log house price x 1998-2002</td>
<td>0.0058</td>
<td>0.0048</td>
<td>0.0047</td>
<td>0.0028</td>
<td>0.0261</td>
<td>0.0073</td>
</tr>
<tr>
<td></td>
<td>(0.0066)</td>
<td>(0.0043)</td>
<td>(0.0043)</td>
<td>(0.0067)</td>
<td>(0.0093)</td>
<td>(0.0134)</td>
</tr>
<tr>
<td>Log house price x 2003-2007</td>
<td>0.0148</td>
<td>0.0136</td>
<td>0.0143</td>
<td>0.0027</td>
<td>0.0497</td>
<td>0.0015</td>
</tr>
<tr>
<td></td>
<td>(0.0122)</td>
<td>(0.0067)</td>
<td>(0.0073)</td>
<td>(0.0082)</td>
<td>(0.0157)</td>
<td>(0.0167)</td>
</tr>
<tr>
<td>Log firm count in prior year</td>
<td>0.9457</td>
<td>0.9968</td>
<td>0.6668</td>
<td>0.7565</td>
<td>-0.1177</td>
<td>0.1397</td>
</tr>
<tr>
<td></td>
<td>(0.0778)</td>
<td>(0.0804)</td>
<td>(0.1160)</td>
<td>(0.1419)</td>
<td>(0.1954)</td>
<td>(0.2097)</td>
</tr>
<tr>
<td>Log new plants for multi-unit firms</td>
<td>0.0533</td>
<td>0.0477</td>
<td>0.0891</td>
<td>-0.0112</td>
<td>0.1463</td>
<td>0.1251</td>
</tr>
<tr>
<td></td>
<td>(0.0237)</td>
<td>(0.0247)</td>
<td>(0.0383)</td>
<td>(0.0590)</td>
<td>(0.0511)</td>
<td>(0.0501)</td>
</tr>
<tr>
<td>Texas full effect by time period</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1988-1997</td>
<td>0.4345</td>
<td>-0.0029</td>
<td>-0.0222</td>
<td>0.0552</td>
<td>-0.0929</td>
<td>0.8334</td>
</tr>
<tr>
<td>1998-2002</td>
<td>0.7427</td>
<td>0.2779</td>
<td>0.2496</td>
<td>0.4863</td>
<td>0.3094</td>
<td>0.9109</td>
</tr>
<tr>
<td>2003-2007</td>
<td>0.8294</td>
<td>0.2810</td>
<td>0.2829</td>
<td>0.2263</td>
<td>-0.0042</td>
<td>0.4430</td>
</tr>
</tbody>
</table>
### Appendix Table 2 - Extensions on Table 4

<table>
<thead>
<tr>
<th></th>
<th>Entry by 2004 using CBSA prices</th>
<th>Entry by 2008 using zip code prices</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Zip code FE + Wealth</td>
<td>Zip code FE + Wealth + Covariates</td>
</tr>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
</tr>
</tbody>
</table>

**LENDING-CONSTRAINED CONTROL GROUP: Local Price Declines or Legal Limits [2% of sample]**

**UNLEVERED, Pre-1998 Move-In with Local Price Growth**

Home equity gains <$25k
-0.0024 (-0.0073)

Home equity gains $25k-$75k
0.0023 (0.0073)

Home equity gains $75k-$150k
0.0069 (0.0074)

Home equity gains >$150k
0.0126 (0.0074)

**LEVERED, Post-1998 Move-In with Local Price Growth & No Legal Limits**

Home equity gains <$25k
0.0034 (0.0039)

Home equity gains $25k-$75k
0.0062 (0.0038)

Home equity gains $75k-$150k
0.0142 (0.0039)

Home equity gains >$150k
0.0143 (0.0040)

Notes: See Table 4.
Entry by 2004 using CBSA prices
Entry by 2008 using zip code prices