NBER WORKING PAPER SERIES

HOUSE PRICES, HOME EQUITY AND ENTREPRENEURSHIP: EVIDENCE FROM U.S. CENSUS MICRO DATA

Sari Kerr
William R. Kerr
Ramana Nanda

Working Paper 21458
http://www.nber.org/papers/w21458

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
August 2015, Revised July 2022

Previously circulated as "House Money and Entrepreneurship." We thank Manuel Adelino, Nava Ashraf, Thomas Astebro, Jim Davis, Rob Fairlie, Iftekhar Hasan, Erik Hurst, Ari Hyytinen, Ross Levine, Josh Lerner, Debarshi Nandy, Martin Schmalz, Andrei Shleifer, Olmo Silva, Stijn Van Nieuwerburgh, Joseph Vavra, and Jeff Zabel. We are also grateful to seminar participants at the American Economic Association, Bank of Finland, Columbia GSB, the Entrepreneurial Finance and Innovation Conference, Federal Reserve Bank of New York, Fordham University, Georgia Tech, Harvard Business School, Imperial College London, the IZA Institute for the Study of Labor, London School of Economics, the National Bureau of Economic Research, New York University Stern, L'Université du Québec à Montréal, Northeastern University, Rensselaer Polytechnic Institute, Tufts University, University of Chicago, and Yale University for helpful comments. The research in this paper was conducted while the authors were Special Sworn Status researchers of the US Census Bureau at the Boston Census Research Data Center (BRDC). Support for this research from the NSF grant ITR-0427889 [BRDC], Kauffman Foundation and the Division of Research and Faculty Development at Harvard Business School is gratefully acknowledged. Any views expressed are those of the authors and not those of the U.S. Census Bureau. The Census Bureau's Disclosure Review Board and Disclosure Avoidance Officers have reviewed this information product for unauthorized disclosure of confidential information and have approved the disclosure avoidance practices applied to this release. This research was performed at a Federal Statistical Research Data Center under FSRDC Project Number 1352. (CBDRB-FY22-P1352-R9101). This research uses data from the Census Bureau's Longitudinal Employer Household Dynamics Program, which was partially supported by the following National Science Foundation Grants SES-9978093, SES-0339191 and ITR-0427889; National Institute on Aging Grant AG018854; and grants from the Alfred P. Sloan Foundation. Research results and conclusions expressed are the authors' and do not necessarily reflect the views of the Census Bureau, the NSF, or the National Bureau of Economic Research.

House Prices, Home Equity and Entrepreneurship: Evidence from U.S. Census Micro Data
Sari Kerr, William R. Kerr, and Ramana Nanda
NBER Working Paper No. 21458
August 2015, Revised July 2022
JEL No. E44,G21,L26,M13,R12,R31,R32

ABSTRACT

During 1992-2007, house price growth is strongly correlated with local entrepreneurship. We show with Census Bureau data that most of this entry is related to construction and real estate; these entrants tend to be small and short-lived. Using a 1998 Texas reform that allowed home equity lending for the first time in the state, we isolate that entrepreneurship through the collateral channel tends to be longer-lived and more balanced across sectors. The collateral channel is a tenth or less of the entry associated with house price increases, driven by a small share of homeowners who are constrained without price growth.

Sari Kerr
Wellesley College
106 Central Street
Wellesley, MA 02481
skerr3@wellesley.edu

William R. Kerr
Harvard Business School
Rock Center 212
Soldiers Field
Boston, MA 02163
and NBER
wkerr@hbs.edu

Ramana Nanda
Imperial College London
Exhibition Road
London SW7 2AZ
United Kingdom
ramana.nanda@imperial.ac.uk

1 Introduction

Factors that govern the borrowing capacity of individuals play a critical role in linking the financial sector to the real economy (e.g., Evans and Jovanovic, 1989; King and Levine, 1993; Kiyotaki and Moore, 1997; Bernanke et al., 1999). Many studies quantify this channel by examining the dramatic house price run-ups of the 2000s and their impact on home equity and consumption (e.g., Mian and Sufi, 2009, 2011, 2014). An important component of this work describes the heterogeneity in agent responses to house price changes for consumption (e.g., Campbell and Cocco, 2007; Guren et al., 2021) and geographic mobility (e.g., Sterk, 2015; Makridis and Ohlrogge, 2022). Beraja et al. (2019) show how an understanding of regional heterogeneity informs the aggregate consequences of monetary policy interventions.

Given the important role of household balance sheets for start-up and small business financing (e.g., Hurst and Lusardi, 2004; Robb and Robinson, 2014), recent research has also used the large house price run-ups of the 2000s to evaluate the role of home equity in enabling entrepreneurship (e.g., Adelino, Schoar and Severino, 2015). This and related research from other countries document a robust link between house price increases and entrepreneurship.[1] This connection is important to policy makers seeking to support job creation and economic dynamism (e.g., Decker et al., 2014; Glaeser et al., 2015; Alon et al., 2018; Pugsley and Sahin, 2019).

Despite this progress, existing work has not explored the heterogeneity across individuals that sits behind these average effects for entrepreneurship, especially in comparison to the empirical work on consumption and geographic mobility in response to house price increases. There is wide variation in entrepreneurial motivations and needs for external finance (e.g., Hurst and Lusardi, 2004; Hurst and Pugsley, 2011), making heterogeneous treatment effects quite likely. Many entrepreneurs respond to local opportunities, either in terms of existing demand or forward looking, and a booming housing market creates its own supporting opportunities (e.g., real estate agents).[2] Thus house price growth may correlate with rising local entry for reasons other than growing collateral. Additionally, while some potential entrepreneurs face binding financing constraints, the use of loans backed by home equity is not sufficient evidence that constraints exist. The lower interest rates and favorable tax treatments for home equity loans make them a useful tool for operating a small business even if the owner has ample other resources. Thus parsing the links between house prices, housing collateral and financing constraints is complex.

To address this gap, our paper uses micro-data from the Census Bureau during the US house price run-ups before the Great Recession. We begin with a comparison of firm-level entry in Texas and its surrounding regions

[1] Black, de Meza and Jeffreys (1996) provide the first study in the United Kingdom, with more recent UK evidence coming from Bahaj, Foulis and Pinter (2019). Further work documenting this linkage includes Fairlie and Krashinksky (2012), Corradin and Popov (2015) and Harding and Rosenthal (2017) for the United States; Schmalz, Sraer and Thesmar (2017) for France; and Hyytinen and Ylhäinen for Finland (2014). See also Jensen, Leth-Petersen and Nanda (2014) for home equity use in Denmark.

[2] Greater use of home equity by consumers and related increases in markups (Stroebel and Vavra, 2019) in hot real estate markets also increase the attractiveness of starting a business during local price booms.

following a 1998 reform that enabled Texas residents to finance their businesses with home equity for the first time. As Section 2 elaborates, while home equity lending in the rest of the United States boomed following the federal Tax Reform Act of 1986, a state constitutional restriction prevented such home equity lending in Texas. The 1998 constitutional amendment in Texas changed this restriction to allow home equity loans for the first time; further amendments also enabled home equity lines of credit (HELOCs) in 2003. The reform had bite, being linked to rising retail sales and home values.

Our empirical strategy exploits this reform to study entrepreneurship enabled by access to home equity in Texas after 1998. We look for evidence of 'excess' entrepreneurship in Texas following the reform compared to its region, potentially stemming from the unlocked home equity gains that relaxed financing constraints for potential Texas entrepreneurs that were not binding in neighboring states. In a contemporaneous paper, Lastrapes et al. (2021) document that business owners in Texas began using home equity as part of their financing strategy after 1998, growing from 0.3% in 1992 to 6.6% in 2007. Thus, knowing home equity lending for businesses took root after 1998, this study turns to the question of whether there was a material surge of entry indicative of relieved financing constraints. Additionally, we compare the types of entry linked to unlocked collateral in Texas to the more widespread entry connected across the country to the house price booms during the 1990s and 2000s.

Using the Longitudinal Business Database (LBD), our first analyses combine local house price growth and firm entry at the three-digit zip code level, measuring growth in entrepreneurship in Texas after 1998 compared to neighboring states. A 10% increase in house prices correlated with a 0.2 percentage point higher entry rate across the region, compared to a baseline entry rate of 8.8%. By contrast, the additional boost in the entry rate for Texas zip codes compared to peers with a 10% house price gain was 0.01 percentage points after the reforms. Although small, this collateral effect is precisely estimated due to our micro-data and the house price surges that often totaled to 50% or more during the early 2000s. Using a different set of techniques and data, Lastrapes et al. (2021) also estimate a modest growth in entry in Texas.

Looking next at firm-level heterogeneity, there are stark differences in the types of entrepreneurship connected to the Texas reform compared to the more general entry during this period of booming house prices. The macro correlation is mostly comprised of business entry in non-tradable sectors related to construction and real estate (e.g., offices of real estate agents). These businesses tend to be small, with 1-2 employees at entry, and shut down within four years of entry. On the other hand, the additional entry following the Texas reform was significantly more balanced across sectors and likely to survive for five or more years. This heterogeneity suggests important differences in the types of firms enabled by relaxed credit constraints compared to those entering more generally during the housing boom of the 2000s.

Our second analysis builds on these firm-level findings to explore heterogeneity at the individual-level, by combining the Longitudinal Employer-Household Dynamics (LEHD) database and the 2000 Decennial Census

of Population. This unique platform allows us to study heterogeneity in the individual response to house price increases, using price changes at the five-digit zip code level and information about the earnings, estimated wealth, and demographic attributes of individuals. For a set of wage workers in 2000 who own homes, we compare entry responses by 2004 for those with rising home equity compared to those limited by high loan-to-value ratios or experiencing local price declines. As with the LBD analysis, there is again a sizable baseline correlation between home equity growth and the likelihood of business entry. Most of this correlation, however, is explained by the wealth and other attributes of individuals, suggesting that individuals who tend to receive larger gains in home equity are more responsive to entrepreneurial opportunities independent of the home equity gains.

Our most stringent specifications find evidence that rising home equity enabled entrepreneurship for 3%-6% of wage workers for whom the price increases generated substantial deleveraging. Yet, zooming out, house price growth had little to no impact on the 85% of home owners that were unlevered, even if they experienced large increases in home equity. Said differently, most home owners already held enough home equity in 2000 to cover a bank loan for a new business had they wanted to start one, and thus the rising house prices did not further spark entry. In this regard, house price increases played a different role in stimulating entrepreneurship compared to household consumption: increased entry stemming from unlocked collateral was driven by a small group of individuals who were highly levered prior to the house price increases, as opposed to the broad-based increase in consumption described by Mian and Sufi (2011).

Finally, we examine the 2007 Survey of Business Owners (SBO), a representative survey that covers the universe of over 26 million employer and non-employer businesses. Around 12% of new businesses with at least one employee relied on home equity finance, comparable to the 16% of business owners that used bank finance and 18% using credit cards. Despite this material reliance on home equity finance in the cross section, house price increases over the 2000s did not lead to a substantial jump in the share of business owners using home equity loans, consistent with our LBD and LEHD analyses. A 10% increase in state-level house prices between 2000 and 2007 was associated with a 0.3 percentage point increase in the share of home equity use (compared to the 12.1% baseline). Growth in home equity use substituted for loans from friends and family, while bank loans were stable.

The LBD, LEHD and SBO analyses combine to yield an important and nuanced story of how house price growth links to entrepreneurship and the collateral mechanism specifically. House price increases during the 2000s unlocked entrepreneurship through growth in home equity, but collateral's role is small compared to the overall correlation of house price growth and business formation. Most home owners in 2000 already had sufficient home equity to start a business in the absence of house price increases if desired, and home equity financing is used as start-up capital by a small share of new business owners. Consequently, much of the broad-based correlation between house prices and entry is sector specific and short-lived. Yet, the treatment effect for levered individuals

is sizable, with more balanced and longer lived entry. For the modest set of individuals who are constrained, home equity growth matters a lot.

This granular perspective is important for policy makers. Subsidies to mortgage financing or homestead exemptions in bankruptcy procedures impact the relative costs of owning a home and the value of housing collateral to a bank, shaping the access of small businesses to external finance.[3] There may be good reasons to favor (or oppose) these broad-based policies to boost home ownership, but our results indicate that policy efforts to encourage entrepreneurship and associated job creation are more likely to be effective if they target the lending challenges experienced by the small share of constrained individuals who depend on home equity.

Our results also speak to the growing literature on the heterogeneity of potential entrepreneurs and financing constraints.[4] At the firm level, changes in local banking conditions have been connected with entrepreneurship (e.g., Black and Strahan, 2002; Cetorelli and Strahan, 2006; Kerr and Nanda, 2009). A number of models suggest that individuals are either precluded from entry or start under-sized due to financing constraints[5], and our estimations provide new insights into where these constraints are most severe.[6] Beyond entrepreneurship, our work is relevant to literature documenting the link between the value of housing assets and the impact through household balance sheets on aggregate consumption, employment, and household investment.[7]

The next section provides an overview of the Texas reform. Sections 3 and 4 describe our analyses connecting house price growth and entrepreneurship using the LBD and LEHD, respectively. Section 5 provides evidence on the use of home equity loans using the SBO. Section 6 compares the economic magnitudes of our empirical exercises, and the last section concludes.

2 Texas Home Equity Lending Reform

We begin by outlining relevant details of the Texas home equity lending reform. This section draws on Abdallah and Lastrapes (2012), who provide a detailed account of the restrictions in home equity financing in Texas prior to

[3] For example, Berkowitz and White (2004), Berger, Cerqueiro and Penas (2011), Cerqueiro et al. (2017), Cerqueiro and Penas (2017), and Bracke, Hilber and Silva (2018). See also Chaney, Sraer and Thesmar (2012).

[4] For example, Kerr and Nanda (2011), Åstebro and Thompson (2011), Åstebro et al. (2014), Levine and Rubinstein (2017), and Guzman and Stern (2020).

[5] Classic and recent work includes Evans and Jovanovic (1989), Holtz-Eakin, Joulfaian and Rosen (1994), Rajan and Zingales (1998), Cooley and Quadrini (2001), Gentry and Hubbard (2004), Cabral and Mata (2003), Cagetti and De Nardi (2006), Buera, Kaboski and Shin (2011), Chatterji and Seamens (2012), and Barrot (2016). Krishnan, Nandy and Puri (2015), Tsoutsoura (2015), Nguyen (2019), and Greenstone, Mas and Nguyen (2020) are recent contributions to a parallel literature on local lending conditions and existing firm and small business access to credit (Petersen and Rajan, 1994, 1995; Paravisini, 2008).

[6] Our work most closely connects to Lastrapes et al. (2021), who also use Census Bureau data in a contemporaneous investigation. By combining two rounds of confidential data on the Survey of Business Owners, they document the stark rise in home equity loan use in Texas by business owners from 1992 to 2007. This finding is very important, and their study also examines business dynamism beyond entrepreneurship, such as metrics of job creation and job destruction mechanisms. In the few places where we overlap, our findings complement each other despite independent research designs. Our core departure from Lastrapes et al. (2021) is our focus on using the Texas reform to study how house price growth links to firm entry and the underlying heterogeneity in this relationship as evidence for financing constraints.

[7] For example, Hurst and Stafford (2004), Lustig and Van Nieuwerburgh (2005), Benito (2009), Gerardi et al. (2010), Leth-Petersen (2010), Mian and Sufi (2011, 2014), Mian, Rao and Sufi (2013), Glaeser and Nathanson (2014), Mian, Sufi and Trebbi (2015), Favilukis, Ludvigson and Van Nieuwerburgh (2017), Berger et al. (2017), Hong and Zabel (2019), Chen et al. (2020), Guren et al. (2021), and Graham and Makridis (2022).

1998 and 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 it 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 also prohibited. While home equity lending in the rest of the United States boomed following the federal Tax Reform Act of 1986, which eliminated income tax deductibility on interest payments related to consumer credit other than mortgages, the constitutional restriction prevented such home equity lending from taking effect in Texas.

Abdallah and Lastrapes (2012) demonstrate the appropriateness of using January 1, 1998 as the start of the reform, 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 was 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.

These features of the Texas reforms—the introduction of home equity loans in 1998, the further introduction of HELOCs in 2003, and the 80% loan-to-value restriction—serve as sources of variation. Abdallah and Lastrapes (2012) show these reforms led to sustained increases of 2%-3% or more in retail sales for Texas, with an underlying heterogeneity in spending responses consistent with unlocking of housing collateral. Zevelev (2021) connects these reforms to a 4% increase in Texas home values, and Lastrapes et al. (2021) study the impact on business dynamism. We use this reform to analyze the role of rising home equity for reducing credit constraints and to assess how the entry linked to this reform in Texas resembled and differed from the broader correlation of house price growth and entrepreneurship.

3 LBD Analysis of Firm Entry

The Longitudinal Business Database (LBD) contains annual information on every private-sector establishment with payroll from 1976 onward. The underlying data are sourced from US tax records and Census Bureau surveys, and the LBD's complete accounting of small firms is important for our analysis of firm entry patterns. The data focus on employer firms and thus exclude self-employed individuals. The LBD assigns a firm identifier to each establishment that allows us to distinguish stand-alone firms from facilities of multi-unit firms.

3.1 LBD Data Platform

Our dependent variables focus on the entry of new single-unit firms by location, industry, and year over the 1992-2007 period.[8] We restrict the sample to the Texas region, defined to be Arkansas, Colorado, Kansas, Louisiana, New Mexico, Oklahoma, and Texas. An important empirical consideration is the span of geography to build into an analysis of house price growth and entrepreneurship. There is no one-size-fits-all answer, as an individual may be entering into entrepreneurship due to rising home equity in their own home or due to expanding local opportunities. Indeed, entrepreneurs entering for construction and related services may well be responding to rising home prices in areas across town versus their own dwelling. The LBD records the location of establishments, suggesting a wider region be modelled. (By contrast, the LEHD analysis centers on an individual's home.)

Our core empirical model for the LBD uses three-digit zip codes, with a robustness check using rings of five-digit zip codes described later. The Texas region contains more than 135 three-digit zip codes that we can match with housing price data over the 1992-2007 period, one-third of which lie in Texas. A small number of included zip codes lack house prices in early years, with the sample becoming a full panel from 1994 onwards.[9] Our housing price data come from the Federal Housing Finance Agency (FHFA), which is based on sales of single-family homes and considered representative of overall house price development.[10]

3.2 Baseline Empirical Results

The outcome variable in Table 1 is the entry rate of new single-unit firms in a given zip code and year, defined as the count of new entrants divided by the stock of firms in the same zip code in the prior year. To compare the entry in Texas following the home equity lending reform to the typical entry associated with rising house

[8] We define the entry year to be the first year of positive employment at an establishment. We exclude new firms that are likely spin-outs of existing corporations as evident by establishment identifiers existing before a firm is born, but our results do not depend on this choice.

[9] Three-digit zip codes compare in number to Commuting Zones. In terms of population count, the average (median) population for three-digit zip codes is 351,737 (188,225) compared to 9,506 (2,323) for five-digit zip codes. In the Texas region, states average 20 three-digit zip codes, 751 five-digit zip codes, and 96 counties.

[10] 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."

prices, the estimation reports coefficients for three blocks of time: 1992-1997 (pre-period), 1998-2002 (post initial lending reform), and 2003-2007 (post HELOC introduction).

For each of the three time blocks, we model a baseline relationship between annual log house prices and the rate of entry measured at the zip code level. Measured across the whole region surrounding Texas, these regressors capture the broad correlations of house price growth and firm entry. We next model an interaction for a zip code being within Texas, as well as two specific interactions for being a Texas zip code during the two time blocks after 1998. The interactions will shed light on whether regions in Texas behaved differently than peers before and after the reforms. The regressions are unweighted, have 2200 observations, cluster standard errors by zip code, winsorize rates at the 99% level, and include fixed effects for zip codes and years.

The bottom three coefficients in Column 1 demonstrate the typical strong correlation of house prices and new firm formation. The unweighted average rate of entry during the sample period at the three-digit zip code level is 8.82%. In all three time blocks, a 10% increase in local house prices is associated with a 0.21 percentage point higher entry rate. Moreover, the average entry response in zip codes within Texas is not meaningfully different from peers.

Post the reforms, however, there is greater entry in Texas with rising house prices, especially in the 2003-2007 period when HELOCs were first allowed. This pattern is consistent with potential entrepreneurs in Texas who were constrained taking advantage of better financing environments. The effect is precisely measured but also quite modest, with a size in 2003-2007 that is 4.1% of the total correlation observed (=0.088/2.142).

During the 16-year period of our sample, some places in the Texas region like Houston and Phoenix experienced significant local growth. Our use of an entry rate as the outcome variable provides stability against these trends, and Columns 2-5 additionally add three growth controls: the lagged log total payroll measured in the LBD for the zip code in the prior year, the contemporaneous rate of new plant entry for multi-unit firms (mirrors the outcome variable), and the expected contemporaneous rate of new single-unit entry developed with a Bartik-style estimator.[11] The introduction of these controls does not influence the estimation.

Finally, Column 6 uses Coarsened Exact Matching (CEM) techniques to weight zip codes inside and external to Texas for comparability. The CEM is set in 1997, just before the reform, using multiple traits of zip codes: total employment, total payroll, employment in entering firms, the local industry composition (five sector bins), and the local house price index. For disclosure purposes, we did not drop unmatched zip codes but assigned them a miniscule weight to keep the full sample intact. The coefficients are modestly larger in the CEM estimation, while the relative size of the post-reform effect in Texas remains very similar.

[11] The Bartik-style estimator combines the zip code's industry composition in 1991 with the contemporaneous growth rate across the Texas region in single-unit entry by industry. Karahan et al. (2022) emphasize how declines in start-up activity link to demographic trends, especially with respect to an aging population. During the 1992-2008 period, Texas' population growth (41%) is higher than in the control states (29%). To the degree this influences our estimations beyond our included controls for zip codes, it likely serves to exaggerate the collateral effect we measure with the Texas lending reforms.

Tables 2 and 3 consider the heterogeneity in entry. An advantage of our rate specification is that we can divide new entrants into groups and have coefficients approximately sum to the total effect. Table 2 considers the size of entrants, with the bottom three rows measuring that about 82% of the entry connected to house price gains during 2003-2007 was among firms entering with 1-2 employees (=1.883/2.286). This concentration was part of a trend from 1992-1997 to 2003-2007 that increasingly found the entrant size distribution shifting towards smaller firms during price booms. By comparison, the entry after the Texas reform appears modestly more balanced, with perhaps two-thirds of the total entry being among the 1-2 employee firms. As the post-reform coefficients for the 10+ employee firms are of border-line significance at best, this pattern should be treated as suggestive.[12]

Table 3 next divides the sample by whether entrants survive five or more years. Strikingly, the bottom three rows show that none of the entry linked to house price booms generally is long lasting during our sample period. By contrast, while there is not a statistically significant response for Texas in 2003-2007 among long-lived entrants with this specification, the coefficients are more balanced and tests do not reject that short- and long-term entry were equally supported by the reform.

Columns 4-5 in Table 3 consider entry by whether sectors are tradable. Non-tradable sectors are more tied to local demand than tradables, and we find some evidence of greater balance in Texas during 2003-2007 towards tradables compared to the broader correlation in the region. Moreover, Column 6 parses out industries connected to local construction and the real estate sector.[13] These entrants account for 65% of the typical entry linked to house price booms (=1.478/2.286). By contrast, we estimate about a quarter of the response in Texas during the post period comes from these industries. This provides important evidence consistent with a collateral effect unlocking a broader set of entrants, versus simply servicing the real estate sector.

To verify our results are not being driven by peculiarities of three-digit zip codes, we developed an algorithm that generated 275 rings of five-digit zip codes spaced out across the region. The centroid of each ring is a primary zip code that was chosen based upon its economic activity.[14] Estimations then varied the size of the ring drawn around each centroid. As a first and reassuring robustness check, the average distance between two five-digit zip codes within a three-digit zip code is about 30 miles, and we find similar results to those reported in Tables 1-3 when using 20- or 30-mile rings around centroids. This stability confirms the presented results are not due to peculiar features of three-digit zip codes.

Table 4 further considers results when we use a 15-mile ring, which contains on average 15.2 five-digit zip

[12] A log entry count specification finds a stronger and well measured increase among 10+ employee firms, but the small number of entrants of this size suggests treating with caution.

[13] Examples include construction, manufacturing of building related materials, dealers and stores related to building and lawn materials, and real estate agents and lessors. We model these as NAICS 23, 3211, 3212, 3219, 3273, 3371, 4233, 4441-2, and 5331-3.

[14] The algorithm began by selecting the five-digit zip code that held the most LBD firms during 1992-2007, placing it as the first entry to a centroid list. The algorithm continued by thereafter selecting the largest remaining five-digit zip code to add to the expanding centroid list that was not within 10 miles of any zip code already chosen as a centroid. This iterative process yielded about 290 centroids across the Texas region that were at least 10 miles apart and with full house price data and a consistent LBD presence. We retained the top 275 centroids for analysis, for a total panel sample size of 4400 observations. For a given ring distance, we aggregate LBD activity for included five-digit zip codes; for house prices, we use a weighted measure of zip code price movements.

codes. At the smaller scale, there continues to be a robust additional house price effect for Texas after the reforms. In this format, the home equity lending magnitude is closer to 7.9% in Column 2. Columns 3-6 of Table 4 additionally model log entry counts or log entry rates as the dependent variable, returning again estimates for the Texas reform that are precisely measured but less than a tenth of the overall typical correlation.[15]

To summarize Tables 1-4, while the additional entry post reform is quite modest in magnitude, the new firms are larger, more likely to live longer, and much less likely to be in sectors related to housing and real estate. We next move to entrepreneurial transitions at the individual level to explore why the use of home equity loans is less responsive to swings in housing prices. These transitions help isolate and quantify the pool of wage workers who are constrained from entrepreneurship by limited collateral and thus can benefit from price run-ups.

4 Longitudinal Employer-Household Dynamics Database

The LEHD complements the LBD's longitudinal analysis of the Texas reform with a quite different approach. The individual-level data on home values in the Decennial Census and entrepreneurial transitions present in the LEHD allow for sharp empirical analyses that exploit cross-sectional variation across individuals and states.

4.1 LEHD Data Platform

Our analysis combines the LEHD database and the 2000 Decennial Census of Population. Similar to the LBD, these datasets are confidential and housed by the 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 US firm and their quarterly compensation. It is longitudinally linked at both the firm and employee levels, allowing us to model how individuals transition into entrepreneurship. 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 to measure work histories and incomes before 2000.[16]

Unique person identifiers match the LEHD to individual-level records contained in the 2000 Decennial Census of Population (Census). The Census has long-form responses for one in six of the population, and thus, roughly speaking, we can match a similar ratio 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 wealth of information about individuals (e.g., level of education, occupation, marital status) and their households (e.g., family composition, household income by source). Importantly, the Census asks whether the housing unit occupied by the respondent

[15] Descriptive analysis of the border region between Texas and its neighboring states also suggest small, if any, differences after the reform in terms of excess entry. Similar to Columns 3 and 4 in Table 4, estimates using log employment in entering firms also find limited scope for collateral effects. With three-digit zip codes, we do not have a precisely estimated effect, and the point estimate is small at 1% of the macro correlation. With the ring approach, we have a 2003-07 Texas post-reform coefficient of 0.027 (0.013) that is 10.4% of the contemporaneous macro correlation.

[16] Included states are California, Colorado, Florida, Idaho, Illinois, Indiana, Louisiana, Maryland, New Mexico, North Carolina, Oklahoma, Oregon, Texas, Washington, and Wisconsin.

is rented or owned, how long the individual has been living there, how much the monthly rent or mortgage payment is, and what the market value of the unit is.[17]

4.2 Sample Design and Empirical Approach

We build a custom dataset for the analysis of house prices and entry, focusing our primary analysis on homeowners (70% of the data sample, which closely compares to a national average of 67% in 2000). Renters are used to formulate control variables described below. The sample is restricted to individuals who are in wage employment in 2000, and estimations examine their probability of transitioning into entrepreneurship by 2004. Since the LEHD does not have an official indicator for entrepreneurship, we define an individual as being an entrepreneur if they were among the top three earners in the entry year of a new firm (i.e., founding team). The online appendix provides details on the LEHD sample and this definition of entrepreneurial transition.

Estimations exploit differences across three groups of individuals in their exposure to the 2000-2004 house price upswing and their ability to take advantage of it. About 85% of the sample is part of an "unlevered" group that moved into their home before 1998 and held ample collateral even before the 2000-2004 boom. 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 2000-2004. 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. The responses that do occur may be behavioral (e.g., Lindh and Ohlsson, 1996; Anderson and Nielsen, 2012).

A second "levered" group represents about 13% of the sample and contains individuals who moved into their home after 1998. These individuals are expected to be the most sensitive to increases in house prices, 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.

Table 5 provides descriptive statistics on the LEHD sample, which is based on 529,600 individuals. 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 used in our analysis for all of these traits. Instead, Table 5 provides descriptive statistics separately for the unlevered group and those potentially constrained, the latter combining the levered and lending-constrained groups outlined above.

[17] 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. We perform a number of simple cross-checks on the data that are feasible with the long form of the 1990 Decennial Census.

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: the average homeowner in our sample is estimated to have about 57% 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 (2018) with their UK loan data. The average ratio of this home equity to household income is also consistent with other data sources (e.g., Gentry and Hubbard, 2004).[18]

Looking forward, house price growth from 2000 to 2004 is substantial and averages 43% for our sample. This results in an estimated home equity gain on the order of $85,000, a sizable wealth shock equal to one year's pre-tax household income on average. 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 owners enjoy all of this wealth gain regardless of whether their initial equity in 2000 is $10,000 or $250,000.

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. Rows 4-10 show that the potentially constrained group is 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 12-17 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 are roughly comparable to the unlevered set, but their estimated wealth in 2000 is substantially lower due to limited home equity. The final rows show that 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.

4.3 Empirical Results

Our approach uses cross-sectional variation across groups interacted with house price growth for identification. The lending constrained group serves as our baseline, given their 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. Our unlevered group can be seen as something of a placebo, and we anticipate a null response if our framework has mostly isolated the collateral channel.[19]

Table 6 reports regressions of business entry by 2004 for homeowners in wage work in 2000 due to home equity

[18] We estimate an individual's home equity in 2000 based upon time since home purchase and local price growth before 2000. 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 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. If no outstanding mortgage exists, we assign home equity to be the full value of the home in 2000.

[19] 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 annual rental payments multiplied by 20. In 2000, the average multiple was 21.6, using quarterly reports from Case-Shiller and FHFA data. Renters tend to live in dwellings of modestly less value, but the distributions overlap substantially. Owners have a significantly longer average tenure in their properties than renters.

gains. We group estimated home equity gains from 2000 to 2004 into four levels: <$25,000, $25,000-$75,000, $75,000-$150,000, and >$150,000. As noted in the next section, the middle bins include the ballpark range from the 2007 Survey of Business Owners for typical home equity usage in start-up capital when this form of financing is present. Estimations model these home equity gains separately for the levered and unlevered groups.

Column 1 models region fixed effects and indicator variables developed by initial financial status in 2000 and home equity gains during 2000-2004, allowing non-parametric measurement of effects relative to the lending constrained group. The coefficient pattern suggests entry transition is rising in the size of home equity gain for both groups. The coefficients are monotonic within each group and statistically significant for home equity gains greater than $25,000. These results hold with five-digit zip code fixed effects in Column 2. The LEHD is similar to the LBD analysis in terms of the macro relationship between entry and house price growth[20], leading to a stark implication that much of the local effect sits with individuals with higher priced dwellings.

Column 3 adds four indicator variables for initial wealth levels in 2000, which we estimate by aggregating home equity and household income. Up to this point, estimations 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 reasons beyond house price changes. Column 3 also includes controls for demographics, earnings histories, and mortgage payments and interacts these variables with zip code price growth.[21]

These simple additions eliminate the entry effects that were initially evident for the unlevered group. This is an important finding, as this group accounts for 85% of the total sample of homeowners. The conditional estimations suggest that this group does not transition to entrepreneurship at a different rate as house prices rise when compared to a group for which lending is constrained. Intuitively, most homeowners in 2000 already held borrowing capacity if they wanted it, and so the subsequent house price changes are not unlocking a collateral channel that had been previously closed to them. Column 4 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 also interesting. These individuals have much smaller home equity and do not face local price or legal constraints to benefiting from house price gains. This group, when achieving

[20] We derive a 0.0039 (0.0008) coefficient when regressing the transition probability on just the zip code level price growth and region fixed effects. This coefficient is 0.0119 (0.0016) when using CBSA prices. Compared to the baseline entry rate of 0.016, these coefficients would suggest a 10% increase in local prices links to a boost in overall entry by 2.5%-7.5%. Columns 3 and 4 of Table 4 imply a similar 5% relationship in the LBD analysis.

[21] 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, 2018). 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. While the wealth control has strong individual predictive power, the demographic controls and earnings histories collectively explain more of the variance.

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 house price gains are sufficient to boost entry rates by 50% compared to the sample average rate of 0.016 (=0.008/0.016). This segment is conceptually the most likely to benefit from house price growth, and the effects are strongest for them. For those experiencing weaker home equity gains of less than $75,000, the response is much more muted.[22]

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 house price growth relative to the group with lending constraints. For 85% of the sample, this is not too surprising (at least in hindsight) because they already had sufficient 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 3%-6% who experienced big gains and were highly levered beforehand, the growth in entrepreneurship was significant.[23] Figure 1 captures these core findings graphically.

The heterogeneity in these responses is quite stark. While house price increases are important in alleviating financing constraints for some homeowners, these findings suggest that the modest aggregate effects measured in Tables 1-4 are because most home owners do not face binding credit constraints that additional house price growth alleviate. 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).

5 Start-up Reliance on Home Equity Loans

We close our study with complementary evidence on home equity use in businesses captured by the 2007 Survey of Business Owners (SBO). The Census Bureau provides publicly available micro data for the 2007 SBO. The file contains over two million observations on employer and non-employer firms. 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.

The total number of firms represented by the data (weighted) is about 26.4 million, of which 5.3 million are employer firms. The Census Bureau has applied 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 includes 43 states that are separately identified, and we focus on

[22] In addition to looking at actual house price gains, we find similar outcomes when using an exogenous element of house price gains due to frothy markets developed by Charles, Hurst and Notowidigdo (2018, 2019). Some recent studies use geographic constraints of cities for housing supply growth, first measured by Saiz (2010), as instruments for credit growth. Davidoff (2016) describes the challenges to this approach, and we find this does not provide well-grounded identification in our setting.

[23] Lako (2020) also finds large intensive-margin treatment effects of house price increases among those who have taken out a mortgage for supporting their business.

businesses founded between 2000 and 2007. Firms with missing or unknown start-up financing history are excluded (accounting for about 12.5% of the base sample), and we merge at the state-level FHFA house price indices.

5.1 Descriptive Features

Column 1 of Table 7 shows that over 90% of employer firms report using start-up financing, with much of this share relying on personal savings and assets only. For the 40% of respondents using external financing, credit cards (18%), bank loans (16%), and home equity (12%) are the most frequently mentioned sources beyond personal savings. Respondents can check as many types of financing as applicable, and these raw statistics can represent modest or large contributions. Across sectors identified with the SBO, home equity usage for start-up financing ranges from less than 9% in Professional, Scientific, and Technical Services (NAICS 54) and Management Companies (55) to a high of 19.5% in Accommodation and Food Services (72).[24]

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. Among employer-firm start-ups, those relying on personal savings and credit cards report the smallest totals on average, followed by home equity loans at $140,931. This level is comparable to businesses backed by loans from friends and family and smaller than those backed by banks or venture investors. Thus, home equity appears to be a source that can be accessed by businesses with mid-sized financing needs. Estimates of the home equity loan amount are often in the $50,000 range.[25]

5.2 House Prices and Use of Home Equity Financing

While the cross-sectional portrait describes typical home equity financing in new ventures, we next turn to a more dynamic perspective of whether sources of start-up financing shift substantially when house prices move. Our empirical approach explores cross-state variation in house price swings leading up to 2007.[26]

Table 8 reports regressions of state-level financing behavior for start-up capital. The dependent variable in each analysis is a type of start-up financing used by entrants since 2000 in a state (e.g., the share of recent entrants using home equity loans). Our explanatory variables 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

[24] Columns 3 and 4 of Table 7 report similar statistics for non-employer firms, with only 5% of self-employed using home equity to support their business start. Among employer firms reporting that they expanded in 2007, home equity loans are used for expansion by 9% of the businesses.

[25] While the SBO data do not record what share of financing comes from home equity loans among those who use them, regressions of SBO financing amounts on indicators for the types of financing used by the entrepreneurs return marginal increments of around $50,000 associated with home equity use.

We assemble complementary evidence through a second data source as well. Among entrepreneurs surveyed by the 2001 and 2003 Panel Study of Entrepreneurial Dynamics (PSED), which includes non-employer firms, 7% report using home equity loans for an average of $20,000 in investment capital or roughly 40% of business financing. The PSED data are sparse and should be viewed with caution. Nonetheless, the PSED's 7% is consistent with our SBO figures (5% for self-employed and 12% for employer firms), and the 40% figure would suggest typical home equity usage of around $33,000-$56,000, although the variation would be substantial.

[26] Adelino, Schoar and Severino (2016) show rising home prices connect to greater refinancing and use of home equity lines of credit. By contrast, we are isolating the use of home equity loans for start-up capital specifically.

capital). We thus analyze whether strong house price growth during 2000-2007 for a state is correlated with a major shift in how young firms access capital compared to how older firms did when they got started.

Columns 1-3 divide the sample into businesses not raising external finance, those using home equity as a source of start-up financing, and those whose start-up financing does not include home equity. These categories are mutually exclusive and collectively exhaustive, such that the coefficients sum to zero, and the means of the dependent variables sum to one (weighted state-level averages): 8% of respondents did not raise external finance, 80% raised external finance without home equity loans, and 12% raised finance that includes home equity loans.

Estimations regress these shares on the log state-level house price change during 2000-2007, as well as unreported covariate controls for log house price levels in 2000, 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 Table 7 (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. Estimations weight states by their count of pre-2000 respondents.

House price growth during 2000-2007 is positively associated with a greater share of ventures in the state using home equity for start-up financing compared to pre-2000 entrants. This pattern suggests an intuitive substitution towards home equity financing as it becomes more available and is statistically significant. However, the magnitude of this effect is rather modest. A 10% price growth is associated with a 0.3 percentage point increase in the share of firms using home equity financing. These effects suggest that an enormous run-up in prices, along the lines of the 59% average state house price growth from 2000 to 2007, would be associated with just a two percentage point increase or less in the share of the state's entrants using home equity.

Columns 4-9 provide additional examples of start-up capital. These coefficients can be compared to the home equity loan regression in Column 2. House price growth leads to some substitution away from business loans by friends or family.[27]

6 Magnitudes of Results

This study has 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, they provide a consistent picture in terms of the implied size of effects.

As noted in footnote 20, the LBD and LEHD datasets show comparable macro correlations of higher entry rates with house price growth. These rates are also consistent with prior studies. We additionally estimated with

[27] Similar conclusions are derived when looking at log firm counts by loan type, examining expansion capital investments, or looking at non-employer firms. Table 7 reports 5% of self-employed using home equity. Home equity loans are used for expansion capital by 9% of growing businesses.

the LBD that the collateral channel unlocked by the Texas reform was a tenth or less of the magnitude of the macro correlation; specifically, Table 4 gives a range of 3%-8% across specifications. How well does this estimate align?

In the LEHD analysis, we can estimate the portion most likely linked to the collateral channel by comparing Columns 1 and 3 of Table 6 with each other. For Column 1, when excluding those with home equity gains of less than $25,000, which have zero-valued coefficients, we estimate a weighted-average entry response of 35.9% of the sample mean when we multiply the sample shares by their corresponding regression coefficients and then divide by the sample mean of 0.016. If the same procedure is done for Column 3, with a focus just on the bottom two rows for levered individuals experiencing gains of $75,000 or more, the weighted-average entry response is 2.8%. Thus, in proportionate terms, the entry that we can most consistently link to the collateral channel (Column 3) is around 7.8% (=2.8/35.9) of the total entry effect we initially linked to escalating home values.

The SBO tabulations are least comparable since they survey relative use of home equity loans in share terms, and these analyses do not isolate the collateral channel specifically. Yet, they conceptually too are of a similar magnitude. If the collateral channel is in the neighborhood of a tenth of entry during house price booms, as suggested by the LBD and LEHD work, we would not anticipate that the baseline SBO average of 12.1% of new businesses being backed by a home equity loan to move significantly with local price increases. This limited response is predicted by the new entrants using collateral (roughly a tenth or less) being of similar proportion to existing cross-sectional loan use (12.1%). In practice, a 10% price growth in the SBO linked to a marginal 0.3 percentage point increase in business use of mortgage loan products. This limited response in the SBO is consistent with house price growth increasing the attractiveness of home equity as a part of business financing, but not unlocking an exceptionally large pool of otherwise constrained entrepreneurs through the collateral channel.

Indeed, contrasting this SBO result with Lastrapes et al. (2021) shows an important nuance between our contemporaneous studies. These authors document how Texas business owners following the lending reform went from practically no use of home equity loans in 1992 (0.3% in Texas vs. 5.1% nationally) to comparable rates in 2007 (6.6% in Texas vs. 6.8% nationally) once the reform took root. Our study, by comparison, shows very modest adjustments in home equity loan use by new entrants with ups and downs in state-level house prices during the 2000s. These parallel results are consistent with home equity loans being an important tool for business owners to best finance their companies, especially to take advantage of lower interest rates, but that the specific channel of rising home equity during price run-ups being used to collateralize a loan for a new business is a much smaller component.

In summary, our estimated effects of housing collateral on entry are aligned over the three approaches, consistently pointing to a collateral channel that is a tenth or less of the overall entry linked to house price swings. The comparability is reassuring given the different empirical strategies, levels of analyses, and time

periods. These results portray how the collateral channel operates for the entry of employer firms, which would be the core channel for the collateral effect to influence broad economic outcomes. Self-employed entrepreneurs may show different dependencies on house prices growth. However, as the SBO data show an overall lower reliance among this group to home equity loans for start-up capital, sizable economic effects in this category are unlikely to emerge.

7 Conclusions

Using multiple datasets from the Census Bureau, together with a Texas mortgage reform in 1998, this paper considers the impact of unlocked home equity on entrepreneurship. We measure the relative size of the collateral channel for business entry compared to the broader macro relationship of house prices and start-ups during the US housing boom of the 2000s. This further sheds light on important heterogeneity in terms of the start-ups enabled by housing collateral.

At the individual level, we find that the aggregate impact of the collateral channel is determined by a small share of individuals—perhaps 3%-6% of wage workers—that were highly levered before house price increases of the 2000s. House prices gains could meaningfully relax constraints on these individuals, and they exhibit greater rates of firm entry. The effect on this group was sizable, at 50% of more of the baseline entry rate. Yet, by contrast, most homeowners in the 2000s already had sufficient home equity to finance their start-up before the house price increases began. Entry by these individuals appears less driven by collateral than by a response to emerging opportunities arising during housing booms. This connects to prior findings that entrepreneurs disproportionately arise from the top end of the wealth distribution for other reasons beyond credit constraints (Hurst and Lusardi, 2004). In total, we estimate that the collateral channel is a tenth or less of the total entry observed.

This magnitude is also evident in our firm-level analysis, which further depicts heterogeneity in start-ups. The macro correlation of entry to a booming housing market is driven by many short-lived entrants into non-tradable sectors, particularly those related to real estate. On the other hand, entrepreneurs entering due to unlocked collateral are longer-lived and more balanced across sectors. These results align with home equity loan data from the SBO. We conclude that unlocked home equity due to house price increases can be very important for a small share of constrained potential entrepreneurs, and result in meaningful businesses being started, but that this channel is a small share of the total entry linked to house price run-ups.

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 US (e.g., Davis and Haltiwanger, 2019; Lako, 2020). 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, 2022). Future research could also consider whether the collateral effect we measure in Texas in the early 2000s was partially linked/aided by rising oil prices at that time. 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 Levine and Rubinstein (2017) and Guzman and Stern (2020) 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. We likewise hope that future work can further study other forms of entry like Schedule C self-employment. These extensions will better define how house price changes link into local economic growth.

References

Abdallah, C. S., Lastrapes, W. D., 2012. Home equity lending and retail spending: evidence from a natural experiment in texas. American Economic Journal: Macroeconomics 4, 94–125.

Adelino, M., Schoar, A., Severino, F., 2015. House prices, collateral and self-employment. Journal of Financial Economics 117, 288–306.

Adelino, M., Schoar, A., Severino, F., 2016. Loan originations and defaults in the mortgage crisis: the role of the middle class. Review of Financial Studies 29, 1635–70.

Alon, T., Berger, D., Dent, R., Pugsley, B., 2018. Older and slower: the startup deficit's lasting impact on productivity growth. Journal of Monetary Economics 93, 68–85.

Anderson, S., Nielsen, K. M., 2012. Ability or finances as constraints on entrepreneurship? evidence from survival rates in a natural experiment. Review of Financial Studies 25, 3684–710.

Åstebro, T., Herz, H., Nanda, R., Weber, R. A., 2014. Seeking the roots of entrepreneurship: insights from behavioral economics. Journal of Economic Perspectives 28, 49–70.

Åstebro, T., Thompson, P., 2011. Entrepreneurs: jacks of all trades or hobos? Research Policy 40, 637–64.

Bahaj, S., Foulis, A., Pinter, G., 2019. Home values and firm behavior. Working Paper.

Barrot, J. N., 2016. Trade credit and industry dynamics: evidence from trucking firms. Journal of Finance 71, 1975–2016.

Benito, A., 2009. Who withdraws housing equity and why? Economica 76, 51–70.

Beraja, M., Fuster, A., Hurst, E., Vavra, J., 2019. Regional heterogeneity and the refinancing channel of monetary policy. Quarterly Journal of Economics 134, 109–83.

Berger, A. N., Cerqueiro, G., Penas, M. F., 2011. Does debtor protection really protect debtors? evidence from the small business credit market. Journal of Banking and Finance 35, 1843–57.

Berger, D., Guerrieri, V., Lorenzoni, G., Vavra, J., 2018. House prices and consumer spending. Review of Economic Studies 85, 1502–42.

Berkowitz, J., White, M. J., 2004. Bankruptcy and small firms' access to credit. RAND Journal of Economics 35, 69–84.

Bernanke, N., Gertler, M., Gilchrist, S., 1999. The financial accelerator in a quantitative business cycle framework. Handbook of Macroeconomics 1, 1341–93.

Black, J., de Meza, D., Jeffreys, D., 1996. House price, the supply of collateral and the enterprise economy. Economic Journal 106, 60–75.

Black, S. E., Strahan, P. E., 2002. Entrepreneurship and bank credit availability. Journal of Finance 57, 2807–33.

Bracke, P., Hilber, C., Silva, O., 2018. Mortgage debt and entrepreneurship. Journal of Urban Economics 103, 52–66.

Buera, F., Kaboski, J., Shin, Y., 2011. Finance and development: a tale of two sectors. American Economic Review 101, 1964–2002.

Cabral, L. M. B., Mata, J., 2003. On the evolution of the firm size distribution: facts and theory. American Economic Review 93, 1075–90.

Cagetti, M., De Nardi, M., 2006. Entrepreneurship, frictions, and wealth. Journal of Political Economy 114, 835–70.

Campbell, J. Y., Cocco, J. F., 2007. How do house prices affect consumption? evidence from micro data. Journal of Monetary Economics 54, 591–621.

Cerqueiro, G., Hegde, D., Penas, M. F., Seamans, R., 2017. Debtor rights, credit supply, and innovation. Management Science 63, 3311–27.

Cerqueiro, G., Penas, M. F., 2017. How does personal bankruptcy law affect start-ups? Review of Financial Studies 30, 2523–54.

Cetorelli, N., Strahan, P. E., 2006. Finance as a barrier to entry: bank competition and industry structure in local u.s. markets. Journal of Finance 61, 437–61.

Chaney, T., Sraer, D., Thesmar, D., 2012. The collateral channel: how real estate shocks affect corporate investment. American Economic Review 102, 2381–409.

Charles, K., Hurst, E., Notowidigdo, M., 2018. Housing booms and busts: labor market oppor- tunities, and college attendance. American Economic Review 108, 2947–94.

Charles, K., Hurst, E., Notowidigdo, M., 2019. Housing booms, manufacturing decline and labor market outcomes. Economic Journal 129, 209–48.

Chatterji, A., Seamens, R., 2012. Entrepreneurial finance, credit cards and race. Journal of Financial Economics 106, 182–95.

Chen, H., Michaux, M., Roussanov, N., 2020. Houses as atms? mortgage refinancing and macroeconomic uncertainty. Journal of Finance 75, 323–75.

Cooley, T. F., Quadrini, V., 2001. Financial markets and firm dynamics. American Economic Review 91, 1286–310.

Corradin, S., Popov, A., 2015. House prices, home equity borrowing and entrepreneurship. Review of Financial Studies 28, 2399–428.

Davidoff, T., 2016. Supply constraints are not valid instrumental variables for home prices because they are correlated with many demand factors. Critical Finance Review 5, 177–206.

Davis, S., Haltiwanger, J., 2019. Dynamism diminished: the role of housing markets and credit conditions. NBER Working Paper No. 25466.

Decker, R., Haltiwanger, J., Jarmin, R., Miranda, J., 2014. The role of entrepreneurship in us job creation and economic dynamism. Journal of Economic Perspectives 28, 3–24.

Dillon, E., Stanton, C., 2016. Self-employment dynamics and the returns to entrepreneurship. Harvard Business School Working Paper.

Evans, D. S., Jovanovic, B., 1989. An estimated model of entrepreneurial choice under liquidity constraints. Journal of Political Economy 97, 808–27.

Fairlie, R., Krashinksky, H., 2012. Liquidity constraints, household wealth, and entrepreneurship revisited. Review of Income and Wealth 58, 279–306.

Favilukis, J., Ludvigson, S. C., Van Nieuwerburgh, S., 2017. The macroeconomic effects of housing wealth, housing finance, and limited risk sharing in general equilibrium. Journal of Political Economy 125, 140–22.

Gentry, W. M., Hubbard, R. G., 2004. Entrepreneurship and household saving. Advances in Economic Policy and Analysis 4.

Gerardi, K., Rosen, H., Willen, P. S., 2010. The impact of deregulation and financial innovation on consumers: the case of the mortgage market. Journal of Finance 65, 333–60.

Glaeser, E. L., Kerr, S., Kerr, W., 2015. Entrepreneurship and urban growth: an empirical assessment with historical mines. Review of Economics and Statistics 97, 498–520.

Glaeser, E. L., Nathanson, C. G., 2014. Housing bubbles. NBER Working Paper No. 20426.

Graham, J., Makridis, C., 2022. House prices and consumption: a new instrumental variables approach. American Economic Journal: Macroeconomics, Forthcoming.

Greenstone, M., Mas, A., Nguyen, H. L., 2020. Do credit market shocks affect the real econ- omy? quasi-experimental evidence from the great recession and 'normal' economic times. American Economic Journal: Economic Policy 12, 200–25.

Guren, A., McKay, A., Nakamura, E., Steinsson, J., 2021. Housing wealth effects: the long view. Review of Economic Studies 88, 669–707.

Guzman, J., Stern, S., 2020. The state of american entrepreneurship: new estimates of the quantity and quality of entrepreneurship for 32 us states, 1988-2014. American Economic Journal: Economic Policy 12, 212–43.

Harding, J., Rosenthal, S. S., 2017. Homeownership, housing capital gains, and self-employment. Journal of Urban Economics 99, 120–35.

Holtz-Eakin, D., Joulfaian, D., Rosen, H. S., 1994. Sticking it out: entrepreneurial survival and liquidity constraints. Journal of Political Economy 102, 53–75.

Hong, G., Zabel, J., 2019. Housing and labor market spillovers. Working Paper.

Hurst, E., Lusardi, A., 2004. Liquidity constraints, household wealth, and entrepreneurship. Journal of Political Economy 112, 319–47.

Hurst, E., Pugsley, B., 2011. What do small businesses do? Brookings Papers on Economic Activity.

Hurst, E., Stafford, F., 2004. Home is where the equity is: liquidity constraints, refinancing and consumption. Journal of Money, Credit and Banking 36, 985–1014.

Hyytinen, A., Ylainen, I., 2014. Collateral channel and small business lending. Working Paper.

Jensen, T., Leth-Petersen, S., Nanda, R., 2014. Housing collateral, credit constraints and entrepreneurship: evidence from a mortgage reform. Working Paper.

Karahan, F., Pugsley, B., Sahin, A., 2022. Demographic origins of the startup deficit. American Economic Review, Forthcoming.

Kerr, W., Nanda, R., 2009. Democratizing entry: banking deregulation, financing constraints and entrepreneurship. Journal of Financial Economics 94, 124–49.

Kerr, W., Nanda, R., 2011. Financing constraints and entrepreneurship. In Handbook of Research on Innovation and Entrepreneurship. Cheltenham U.K.: Edward Elgar Publishing, 88–103.

King, R. G., Levine, R., 1993. Finance and growth: schumpeter might be right. Quarterly Journal of Economics 108, 717–37.

Kiyotaki, N., Moore, J., 1997. Credit cycles. Journal of Political Economy 105, 211–48.

Krishnan, K., Nandy, D., Puri, M., 2015. Does financing spur small business productivity? evidence from a natural experiment. Review of Financial Studies 28, 1768–809.

Lako, C., 2020. The long-run effects of mortgage credit access on entrepreneurship. Working Paper.

Lastrapes, W. D., Schmutte, I. M., Watson, T., 2021. Home equity lending, credit constraints and small business in the us. Economic Inquiry 60, 43–63.

Leth-Petersen, S., 2010. Intertemporal consumption and credit constraints: does total expenditure respond to an exogenous shock to credit? American Economic Review 100, 1080–103.

Levine, R., Rubinstein, Y., 2017. Smart and illicit: who becomes an entrepreneur and do they earn more? The Quarterly Journal of Economics 132, 963–1018.

Lindh, T., Ohlsson, H., 1996. Self-employment and windfall gains: evidence from the swedish lottery. Economic Journal 106, 1515–26.

Lustig, H. N., Van Nieuwerburgh, S. G., 2005. Housing collateral, consumption insurance, and risk premia: an empirical perspective. Journal of Finance 60, 1167–219.

Makridis, C. A., Ohlrogge, M., 2022. Moving to opportunity? the geography of the foreclosure crisis and the importance of location. Journal of Economic Geography 22, 159–80.

Manso, G., 2016. Experimentation and the returns to entrepreneurship. Review of Financial Studies 29, 2319–40.

Mian, A., Rao, K., Sufi, A., 2013. Household balance sheets, consumption, and the economic slump. Quarterly Journal of Economics 128, 1687–726.

Mian, A., Sufi, A., 2009. The consequences of mortgage credit expansion: evidence from the u.s. mortgage default crisis. Quarterly Journal of Economics 124, 1449–96.

Mian, A., Sufi, A., 2011. House prices, home equity based borrowing and the u.s. household leverage crisis. American Economic Review 101, 2132–56.

Mian, A., Sufi, A., 2014. What explains the 2007-2009 drop in employment? Econometrica 82, 2197–23.

Mian, A., Sufi, A., Trebbi, F., 2015. Foreclosures, house prices, and the real economy. Journal of Finance 70, 2587–634.

Nguyen, H.-L., 2019. Are credit markets still local? evidence from bank branch closings. American Economic Journal: Applied Economics 11, 1-32.

Paravisini, D., 2008. Local bank financial constraints and firm access to external finance. Journal of Finance 63, 2161–93.

Petersen, M. A., Rajan, R. G., 1994. The benefits of lending relationships – evidence from small business data. Journal of Finance 49, 3–37.

Petersen, M. A., Rajan, R. G., 1995. The effect of credit market competition on lending relationships. Quarterly Journal of Economics 110, 407–43.

Pugsley, B. W., Sahin, A., 2019. Grown-up business cycles. Review of Financial Studies 32, 1102–47.

Rajan, R. G., Zingales, L., 1998. Financial dependence and growth. American Economic Review 88, 559–86.

Robb, A. M., Robinson, D. T., 2014. The capital structure decisions of new firms. Review of Financial Studies 27, 695–722.

Saiz, A., 2010. The geographic determinants of housing supply. Quarterly Journal of Economics 125, 1253–96.

Schmalz, M. C., Sraer, D. A., Thesmar, D., 2017. Housing collateral and entrepreneurship. Journal of Finance 72, 99-132.

Sterk, V., 2015. Home equity, mobility, and macroeconomic fluctuations. Journal of Monetary Economics 74, 16–32.

Stroebel, J., Vavra, J., 2019. House prices, local demand, and retail prices. Journal of Political Economy 127, 1391–436.

Tsoutsoura, M., 2015. The effect of succession taxes on family firm investment: evidence from a natural experiment. Journal of Finance 70, 649–88.

Zevelev, A., 2021. Does collateral value affect asset prices? evidence from a natural experiment in texas. Review of Financial Studies 34, 4373–411.

Table 1: Entrepreneurship following the Texas home equity lending reform

Notes: This table reports the results from OLS regressions where the dependent variable is the count of new entrants in a given three-digit zip code and year divided by the count of all firms in existence in the same zip code in the prior year. Estimations model a baseline period of 1992-1997; a second period of 1998-2002 that follows the initial 1998 reform to allow home equity lending in Texas; and a third period of 2003-2007 that follows the introduction of home equity lines of credit. Columns 2-5 control for different measures of local economic activity, individually and jointly. Column 6 reports the results from the same estimation as Column 5 but where we use Coarsened Exact Matching to weight comparable zip codes in Texas and neighboring states. Regressions include zip code and year fixed effects and contain 2200 observations. Standard errors are clustered by zip code and *, ** and *** refer to statistical significance at the 10%, 5% and 1% level respectively.

	DV = New entrants/Prior year firm count					
	(1)	(2)	(3)	(4)	(5)	(6)
Log house price x 2003-2007 x Texas	0.088**	0.088**	0.085**	0.088**	0.086**	0.113*
	(0.039)	(0.039)	(0.039)	(0.039)	(0.039)	(0.061)
Log house price x 1998-2002 x Texas	0.040*	0.040*	0.037	0.041*	0.037	0.070*
	(0.024)	(0.024)	(0.023)	(0.024)	(0.023)	(0.036)
Log house price x Texas	0.287	0.271	0.236	0.273	0.208	-0.251
	(0.598)	(0.601)	(0.599)	(0.594)	(0.600)	(0.984)
Log house price x 2003-2007	2.142***	2.125***	2.273***	2.176***	2.286***	3.276***
	(0.650)	(0.653)	(0.641)	(0.657)	(0.651)	(1.027)
Log house price x 1998-2002	2.107***	2.089***	2.175***	2.133***	2.182***	3.389***
	(0.656)	(0.660)	(0.648)	(0.663)	(0.658)	(1.137)
Log house price x 1992-1997	2.112***	2.101***	2.229***	2.120***	2.224***	3.221**
	(0.700)	(0.702)	(0.698)	(0.703)	(0.701)	(1.399)
Log total payroll in prior year		0.040			0.039	0.128
		(0.075)			(0.073)	(0.083)
Rate of new plant entry for multi-unit firms			0.219***		0.218***	0.156***
			(0.054)		(0.054)	(0.058)
Log Bartik growth control based upon industry distribution in 1991				0.146	0.133	0.075
				(0.178)	(0.175)	(0.453)

Table 2: Entry response by firm size

Notes: See Table 1. This table reports the results from OLS regressions where the dependent variable is the count of new entrants in a given three-digit zip code and year divided by the count of all firms in existence in the same zip code in the prior year. Column 1 reports the results for all firms, equivalent to Column 5 of Table 1, while Columns 2-4 decompose the entry by firm entry size in terms of employees in the first year. The denominator across columns remains the same, such that Columns 2-4 approximately sum to Column 1. For example, about two-thirds of the additional total entry in Texas zip codes over the 2003-2007 period came from firms with 1-2 employees at entry. Regressions include zip code and year fixed effects. Local growth controls include log total payroll in prior year, rates of new plant entry of multi-unit firms, and a Bartik growth estimator based upon 1991 industry distributions for zip codes and contemporaneous entry rates by industry.

	Total	Firm size at entry		
		1-2 employees	3-9 employees	10+ employees
	(1)	(2)	(3)	(4)
Log house price x 2003-2007 x TX	0.086**	0.058**	0.009	0.015
	(0.039)	(0.025)	(0.018)	(0.010)
Log house price x 1998-2002 x TX	0.037	0.027*	-0.001	0.010*
	(0.023)	(0.016)	(0.010)	(0.005)
Log house price x Texas	0.208	-0.193	0.323	0.129
	(0.600)	(0.360)	(0.258)	(0.146)
Log house price x 2003-2007	2.286***	1.883***	0.256	0.043
	(0.651)	(0.448)	(0.266)	(0.109)
Log house price x 1998-2002	2.182***	1.463***	0.469*	0.138
	(0.658)	(0.445)	(0.265)	(0.112)
Log house price x 1992-1997	2.224***	1.226**	0.691**	0.209*
	(0.701)	(0.472)	(0.285)	(0.117)
Local growth controls	Yes	Yes	Yes	Yes

Table 3: Entry response by firm survival and sector

Notes: See Tables 1 and 2. This table reports the results from OLS regressions where the dependent variable is the count of new entrants in a given three-digit zip code and year divided by the count of all firms in existence in the same zip code in the prior year. Column 1 reports the results for all firms, equivalent to Column 5 of Table 1, while Columns 2-3 decompose the entry by whether the new firm survives for five or more years. Columns 4-5 decompose the entry by tradable vs. non-tradable sectors. Column 6 reports entry that is related to the construction and real estate sectors.

		Survival of entrants		Entry by sector		
	Total	Survive < 5 years	Survive 5+ years	Tradables	Non-Tradables	Sectors that are construction and real estate-related
	(1)	(2)	(3)	(4)	(5)	(6)
Log house price x 2003-2007 x Texas	0.086**	0.050*	0.035	0.029*	0.054*	0.023
	(0.039)	(0.027)	(0.022)	(0.016)	(0.030)	(0.015)
Log house price x 1998-2002 x Texas	0.037	0.027	0.010	0.016	0.019	0.020**
	(0.023)	(0.016)	(0.013)	(0.012)	(0.017)	(0.009)
Log house price x Texas	0.208	-0.140	0.360	0.167	0.063	-0.191
	(0.600)	(0.408)	(0.320)	(0.258)	(0.444)	(0.218)
Log house price x 2003-2007	2.286***	2.285***	-0.000	0.591*	1.586***	1.478***
	(0.651)	(0.404)	(0.313)	(0.349)	(0.438)	(0.236)
Log house price x 1998-2002	2.182***	2.130***	0.048	0.535	1.525***	1.582***
	(0.658)	(0.390)	(0.335)	(0.352)	(0.445)	(0.241)
Log house price x 1992-1997	2.224***	2.118***	0.098	0.206	1.926***	1.876***
	(0.701)	(0.426)	(0.367)	(0.372)	(0.465)	(0.237)
Local growth controls	Yes	Yes	Yes	Yes	Yes	Yes

Table 4: Variations in LBD specification design

Notes: See Table 1. This table considers estimations using three-digit zip codes (n=2200) and rings of five-digit zip codes around spaced-out centroids as described in the text (n=4400). Columns headers describe the modeled dependent variable.

	Rate of entry		Log new entrant count		Log rate of entry	
	Three-digit zip codes	Rings analysis	Three-digit zip codes	Rings analysis	Three-digit zip codes	Rings analysis
	(1)	(2)	(3)	(4)	(5)	(6)
Log house price x 2003-2007 x Texas	0.086**	0.115**	0.014**	0.029***	0.009*	0.017***
	(0.039)	(0.049)	(0.006)	(0.008)	(0.005)	(0.006)
Log house price x 1998-2002 x Texas	0.037	0.035	0.005	0.011**	0.004	0.006*
	(0.023)	(0.032)	(0.003)	(0.005)	(0.003)	(0.004)
Log house price x Texas	0.208	-1.066	0.030	-0.212**	0.069	-0.117
	(0.600)	(0.654)	(0.095)	(0.100)	(0.075)	(0.074)
Log house price x 2003-2007	2.286***	1.461	0.520***	0.492***	0.266***	0.204**
	(0.651)	(0.886)	(0.113)	(0.133)	(0.079)	(0.093)
Log house price x 1998-2002	2.182***	1.694**	0.465***	0.491***	0.265***	0.233**
	(0.658)	(0.841)	(0.110)	(0.122)	(0.079)	(0.091)
Log house price x 1992-1997	2.224***	2.131**	0.427***	0.505***	0.269***	0.261***
	(0.701)	(0.875)	(0.115)	(0.131)	(0.084)	(0.095)
Local growth controls	Yes	Yes	Yes	Yes	Yes	Yes
2003-2007 TX effect / 2003-2007 baseline effect	0.038	0.079	0.027	0.059	0.034	0.084

Table 5: 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.

		All	Unlevered	Potentially constrained
		(1)	(2)	(3)
(1)	N	529,600	452,100	77,500
(2)	Share		0.85	0.15
(3)	Entry as an entrepreneur	0.0159	0.0154	0.0189
(4)	Age	39.41	39.99	36.03
(5)	Male	0.5281	0.5224	0.5612
(6)	Hispanic	0.1082	0.1056	0.1235
(7)	African American	0.0533	0.0523	0.0593
(8)	Asian	0.0527	0.0511	0.0614
(9)	Immigrant	0.1432	0.1388	0.1685
(10)	Married	0.8262	0.8343	0.7785
(11)	Bachelor's education and higher	0.4173	0.4085	0.4685
(12)	Household income (max=$2.5 million)	88,575	89,086	85,594
(13)	Home value (max=$1 million)	187,947	185,284	203,485
(14)	Move-in date	1993	1991	1999
(15)	Estimated wealth	194,397	205,630	128,848
(16)	LEHD earnings 2000	51,253	51,088	52,219
(17)	LEHD earnings 2004	61,153	60,825	63,067
(18)	Zip code price growth 2000-2004	0.4262	0.4266	0.4240
(19)	Estimated home equity gains	85,481	84,519	91,093

Table 6: House prices and entry into entrepreneurship at the individual level

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. The explanatory 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. The entry projection used in Column 4 is based upon the entrepreneurial transitions of renters during 2000-2004 with traits similar to individuals. Estimations have 529,600 observations and cluster standard errors by zip code.

	Sample share	CBSA FE	Zip code FE	Wealth + covariates	Wealth + covariates + projection
		(1)	(2)	(3)	(4)
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%	-0.002	-0.001	-0.006	-0.005
		(0.001)	(0.001)	(0.008)	(0.008)
Home equity gains $25k-$75k	30%	0.003**	0.003	-0.004	-0.003
		(0.001)	(0.002)	(0.008)	(0.008)
Home equity gains $75k-$150k	16%	0.009***	0.008***	-0.001	-0.001
		(0.002)	(0.002)	(0.008)	(0.008)
Home equity gains >$150k	15%	0.015***	0.012***	0.001	0.000
		(0.002)	(0.002)	(0.008)	(0.008)
LEVERED, Post-1998 Move-In with Local Price Growth and No Legal Limits					
Home equity gains <$25k	3%	0.001	0.001	0.002	0.002
		(0.002)	(0.002)	(0.005)	(0.005)
Home equity gains $25k-$75k	5%	0.005***	0.005***	0.004	0.004
		(0.002)	(0.002)	(0.005)	(0.005)
Home equity gains $75k-$150k	3%	0.013***	0.012***	0.008*	0.008*
		(0.002)	(0.002)	(0.005)	(0.005)
Home equity gains >$150k	3%	0.020***	0.017***	0.008	0.008
		(0.002)	(0.002)	(0.005)	(0.005)

Table 7: Sources of start-up financing for businesses founded between 2000 and 2007

Notes: The sample includes firms founded in 43 states that are separately recorded by the public-use 2007 Survey of Business Owners. Row titles indicate forms of financing, and business owners can check as many boxes as applicable. Start-up capital amounts include all financing raised by ventures using that type 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).

Source of financing used	Employer firms (firms with at least one employee)		Non-employer firms (self-employed business owners)	
	Share using type of financing for start-up capital	Start-up capital when type of financing used	Share using type of financing for start-up capital	Start-up capital when type of financing used
	(1)	(2)	(3)	(4)
No financing	8%	n.a.	27%	n.a.
Financing used	92%	87,023	73%	33,689
Uses only personal savings and assets	52%	50,733	51%	20,650
Uses external financing	40%	133,774	22%	64,457
Personal savings	25%	134,444	14%	63,941
Personal assets	7%	158,944	3%	85,459
Home equity loan	12%	140,931	5%	82,095
Bank loan	16%	188,994	5%	154,742
Credit card	18%	91,590	13%	30,780
Business loan from friend or family	4.3%	163,746	1.5%	94,877
Government loans (direct and backed)	2.5%	237,424	0.5%	187,526
Angel or venture financing	0.7%	370,973	0.2%	265,324

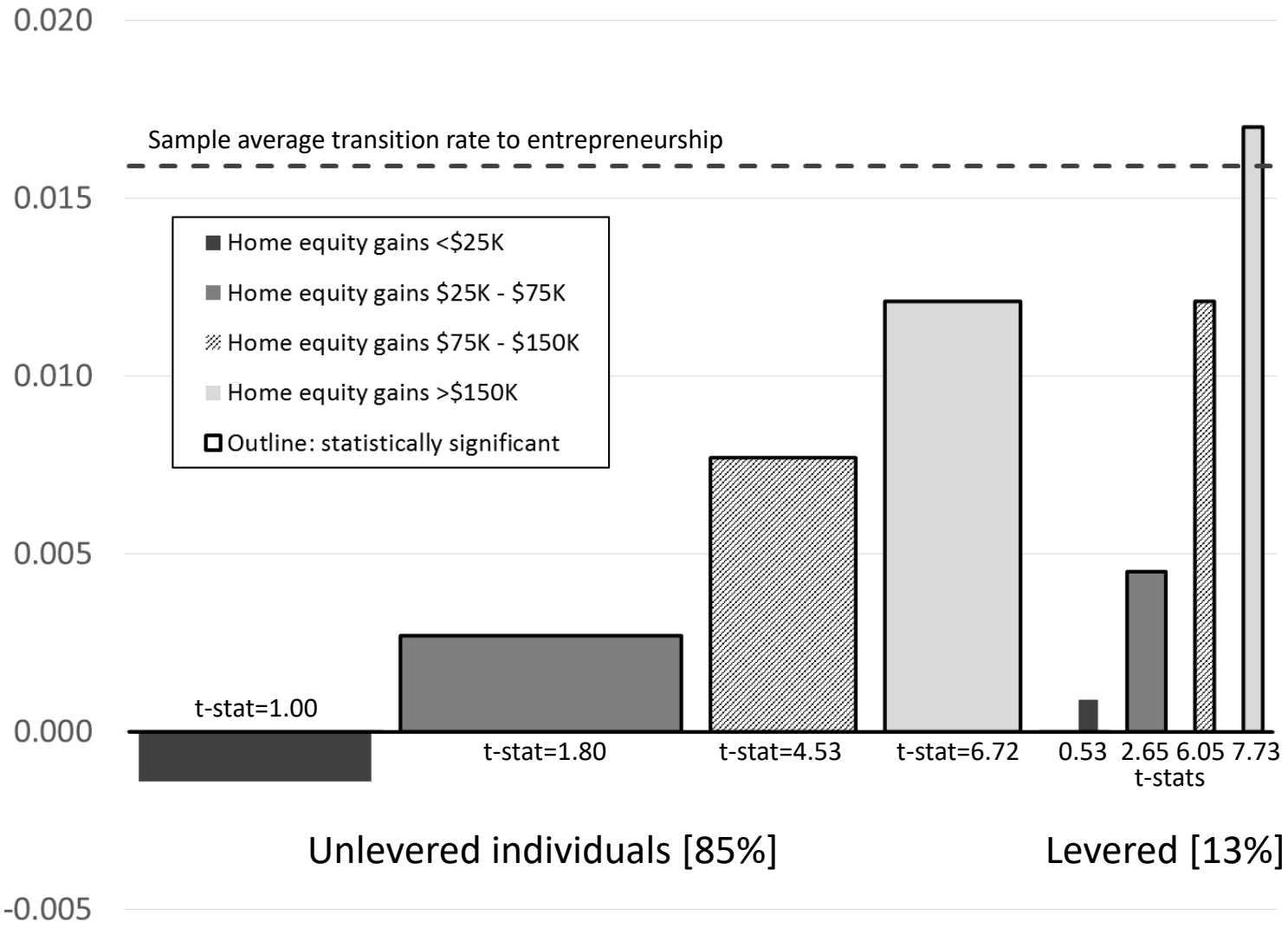
Table 8: House price growth and use of home equity loans for start-up financing

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 mutually exclusive and collectively exhaustive, such that the coefficients sum to zero. Unreported explanatory variables include the log count of SBO businesses among the pre-2000 firms and the shares by state of pre-2000 entrants using each form of financing listed in Table 7; these regressors are held constant over specifications for consistent baseline estimation and to 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.

	Share of firms entering between 2000 and 2007 indicating reported startup financing								
	No start-up capital raised	Uses home equity loans	Does not use home equity loans	Uses personal savings	Uses other personal assets	Uses business loan from a bank	Uses credit cards	Uses loan from family or friends	Uses government loans
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Log house price growth 2000-2007	0.005	0.034*	-0.040**	-0.004	-0.002	-0.027	-0.003	-0.019***	-0.015
	(0.014)	(0.020)	(0.017)	(0.024)	(0.016)	(0.038)	(0.019)	(0.007)	(0.010)
Mean of DV	7.9%	12.1%	80.0%	75%	12%	16%	18%	4.3%	2.5%
10% price growth effect relative to mean of DV	0.6%	2.7%	-0.5%	-0.1%	-0.2%	-1.6%	-0.2%	-4.2%	-5.6%

Figure 1a: Entry response without individual controls

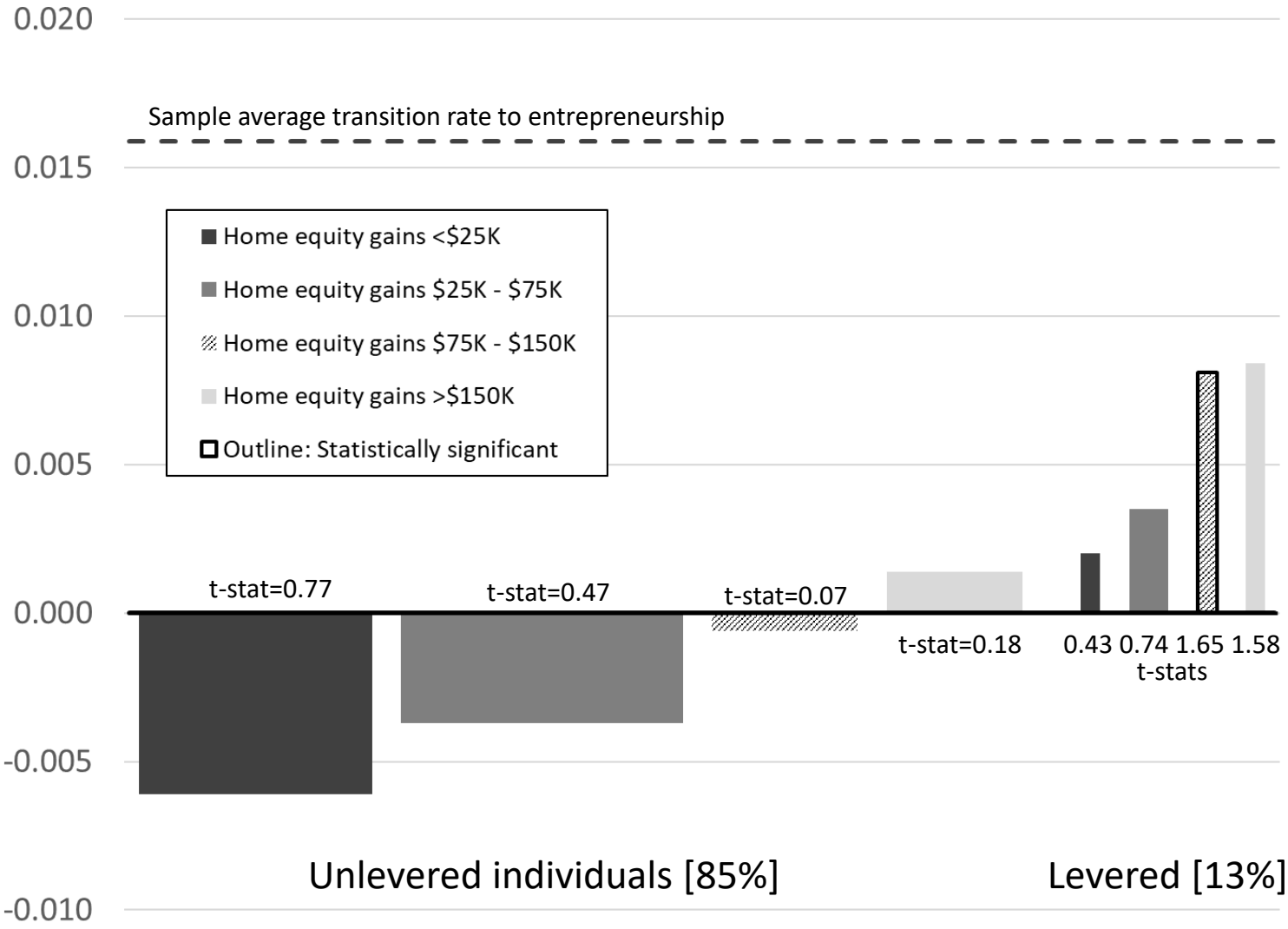
Transition increase measured relative to lending-constrained control group



Notes: Figure plots coefficients from Column 2 of Table 6. 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 1b: Entry response with individual controls

Transition increase measured relative to lending-constrained control group



Notes: See Figure 1a. Figure plots coefficients from Column 3 of Table 6.

LEHD Appendix to House Prices, Home Equity and Entrepreneurship: Evidence from U.S. Census Micro Data

We start by retaining 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. Our sample is also 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 those covered by the long-form questionnaire.[1] 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

[1]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.

this paper are disguised and rounded to the nearest 100 according to Census Bureau disclosure restrictions.

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 house 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.[2] Despite these issues, zip code prices carry the 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 US 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.

While quite representative, 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. 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.

[2]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.

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 house 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 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): 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 dates around 1992. 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.

From this, we identify entrepreneurial transitions through a combination of 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.[3] Following the procedures described in Haltiwanger, Jarmin, and Miranda (2013), 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.

More formally, our definition of "entrepreneur" requires a person be 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. We can think of our work as describing the formation of a top founding team and key early hires (e.g., Choi et al. 2019, Hyatt, Murray and Sandusky 2020). While noisy, this approach captures a substantive element of entrepreneurship. About 1.6% of our sample enters as an entrepreneur by 2004. 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. Additionally, we observe a different connection between house price growth and joining an early stage company versus being one the initial three top earners.

Additional References

Choi, J., N. Goldschlag, J.C. Haltiwanger and J.D. Kim. (2019). "Founding Teams and Startup Performance." SSRN Working Paper.

Guerrieri, V., D. Hartley and E. Hurst. "Endogenous Gentrification and Housing Price Dynamics." *Journal of Public Economics* 103, no. 5 (2013): 1664–96.

Haltiwanger J., R. Jarmin and J. Miranda. "Who Creates Jobs? Small vs. Large vs. Young." *Review of Economics and Statistics* 95, no. 2 (2013): 347–61.

[3] 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.

Hyatt, H., S. Murray and K. Sandusky. (2020). "Business Income Dynamics and Labor Market Fluidity." Working Paper.

Hyatt, H., E. McEntarfer, K. McKinney, S. Tibbets and D. Walton. "Job-to-Job (J2J) Flows: New Labor Market Statistics from Linked Employer-Employee Data." CES Working Paper 14-34. Center for Economic Studies, US Census Bureau, Washington DC (2014).

McKinney, K. and L. Vilhuber. "LEHD Data Documentation LEHD-OVERVIEW-S2008-rev1 LEHD Infrastructure files in the Census RDC – Overview Revision." CES Working Paper 11-43. Center for Economic Studies, US Census Bureau, Washington DC (2011).

Stevens, D. W. "Employment That Is Not Covered by State Unemployment Insurance Laws." Longitudinal Employer-Household Dynamics, Technical Paper No. TP-2007-04. US Census Bureau, Suitland, MD.