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Sari Pekkala Kerr
William R. Kerr
Ramana Nanda

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Sari Pekkala Kerr
Wellesley College

William R. Kerr
Harvard Business School

Ramana Nanda
Harvard Business School

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Abstract: We examine the relationship between house prices and entrepreneurship using micro data from the US Census Bureau. Increases in house prices are often thought to drive entrepreneurship through unlocking the collateral channel for bank loans, but this interpretation is challenged by worries regarding omitted variable biases (e.g., rising local demand) or wealth effects (i.e., that people with more valuable homes are more likely to enter entrepreneurship for reasons other than access to collateral). We construct an empirical environment that utilizes very localized price changes, exploits variations in initial home values across residents in the same zip code, and embeds multiple comparisons (e.g., owners vs. renters, homestead exemption laws by state). For the United States during the 2000-2004 period, the link of home prices to the rate of entrepreneurship through home equity channels is modest in economic magnitude. This is despite a focus on a time period that experienced the largest concentration of US home price growth over the last two decades. Even when we do connect home equity to entrepreneurship, part of the effect is linked to an increased demand for entrepreneurship. While housing collateral plays a role in the entry that we observe, it does not seem to be a major barrier to entrepreneurship in our context.

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

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

1 Introduction

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

The potential role of the collateral channel in entrepreneurship is intuitive. Debt financing is important for small and young businesses (e.g., Berger and Udell, 1998; Robb and Robinson, 2014), but the challenges associated with asymmetric information in small business lending are difficult for banks to overcome (e.g., Stiglitz and Weiss, 1981). Pledging personal collateral against business loans aids the lending process, and thus an increase in the value of a potential or current entrepreneur's home raises the value of the collateral they can pledge to the bank and may therefore boost the willingness of banks to lend to their business. The degree to which the collateral channel alleviates credit constraints is thus of particular interest to policy makers, because reforms associated with homestead exemptions in bankruptcy or subsidies to mortgage financing can change the relative costs of owning a home or the value of housing collateral to the bank, and hence could directly impact small businesses' access to external finance (e.g., Berkowitz and White, 2000; Cerqueiro and Penas, 2014; Bracke, Hilber, and Silva, 2014).

Studies that exploit regional variation in house price changes to quantify the impact of the collateral channel often judge the effects to be significant. For example, Schmalz, Sraer, and Thesmar (2014), Fairlie and Krashinksky (2012), Harding and Rosenthal (2013) and Corradin and Popov (2015) find large elasticities when examining entry into entrepreneurship. Adelino, Schoar, and Severino (2013) trace the collateral channel to job creation by US small firms, and Hyytinen and Ylhäinen (2014) find related evidence in Finland. Black, de Meza and Jeffreys (1996) provide some of the earliest evidence in this regard. While our paper is related to this work, features of our data allow us to take a new empirical approach and consider detailed variation across home owners within zip codes. This affords greater assurance against omitted variables, such as booming local demand and economic growth, that can bias estimates on house prices and their relationship to new firm formation. The data also allow greater progress at disentangling collateral effects from other channels that could couple house price appreciation and entry—most prominently, wealth effects, where growing house prices increase the wealth levels of entrepreneurs and lead them to start new businesses, *independent of collateral requirements of banks*. As Hurst and Lusardi (2004) demonstrate, the non-linear nature of wealth levels and

entrepreneurship make this question especially tricky.

Our setting is a unique laboratory to study these questions—the United States after 2000. We focus on 2000-2004, using data both before and after as described below. Home price appreciation during this period was massive, averaging 45% for our sample and 43% for the country as a whole. The average home owner in our sample experienced equity gains on the order of $80,000. Figure 1 shows how this period holds the most rapid price appreciation since 1990, and provides a special opportunity to look for effects. The advantage of this "event study" goes beyond the size of the treatment, as the decision to buy a house before 2000 was unlikely to be driven by the expectation of rapid increases in the availability of collateral. Further, many accounts of the price increases like Mian and Sufi (2009) emphasize supply-side drivers stemming from changes in lending practices. Mian and Sufi (2011) demonstrate a willingness and ability of individuals to borrow against these rapid price appreciations for uses like consumption or home improvements, and perhaps others used this opportunity to access loans for starting new businesses.

Our work is similar to recent studies that have studied the role of the collateral channel in entrepreneurship through house price changes (e.g. Schmalz, Sraer, and Thesmar, 2014; Corradin and Popov, 2015) but has some key differences. Most importantly, we have the precise locations of the individuals in our sample, allowing us to use zip code prices in our estimations. As we document below, moving from the MSA level (as with prior work) to the zip code level suggests that a substantial element of aggregate demand operates within cities—that is, entry by an individual with stagnant home prices who might respond to demand effects coming from other booming parts of the city. In addition, direct measures of an individual's house value, date of move in, outstanding mortgage, and so on allow us to separate out the portions of zip code price changes on entrepreneurship that arise through the home equity channel vs. other reasons that an individual may start a business when prices in their neighborhood are increasing, for example through raising the returns to entrepreneurship by allowing for higher markups.

Our analysis yields a nuanced story of how house price appreciation connects to entrepreneurship. We estimate that the 45% price increases connects to a 0.12% higher likelihood of transitioning into entrepreneurship through the home equity channel, compared to a sample average of 1.73%. In relative terms, this is a 8.7% boost and our preferred estimate of the role of home equity and about a third of the estimated effect in prior studies when factoring in the magnitude of US house price gains. We more broadly show that our data exhibit substantially larger aggregate effects, but that these additional effects are either due to renters transitioning into entrepreneurship or to home owners transitioning into entrepreneurship in ways that we cannot link to home equity changes. When we combine all of these effects together, along with relative proportions of owners and renters in the economy, we estimate that 40% of the total

entry response that one would estimate for home price appreciations can be linked directly to home equity channels.

Thus, one central finding of this study is that house price growth during this period had modest consequences for entry decisions in specifications formulated to discern potential roles for the collateral channels and/or wealth effects. We also validate this finding using data from the 2007 wave of the Survey of Business Owners (SBO), which has information on the sources of financial capital for US small business owners. We show with the SBO data that states experiencing large house price growth have a greater use of home equity lines to finance new businesses among recent cohorts. This is important for this literature as it is the first direct link of house price changes to home equity loan data for start-ups of which we aware. Our analysis shows, however, that these precisely-estimated impacts are again modest in size. For example, a 45% home price growth would shift only 1.4% of entrants into financial structures that would involve home equity loans, which is a relative effect of 11% compared to the baseline of 13.2% of recent SBO entrants using home equity credit lines.

The home equity effects that we measure are free of aggregate demand biases, but their interpretation remains challenging. The average estimated $80,000 growth could mean that banks are more willing to lend to the new business due to the increased value of collateral, which is often assumed to be the driving role. However, individuals are also wealthier, and this fact alone may be driving the estimated transition differential. We broadly refer to this as 'wealth effects'—factors that could lead to an increased demand for entrepreneurship when an individual's house goes up in value, independent of the willingness of banks to lend to businesses. This could encompass engaging in entrepreneurship as a luxury/consumption good when individuals are more wealthy (Hurst and Lusardi, 2004), having a greater nest egg or 'insurance' in the event of failure and thus being more willing to experiment with entrepreneurship (Hombert et al., 2014; Olds, 2014; Manso, 2015), changes in risk aversion (Paravisini, Rappoport and Ravina, 2015), and similar. It is essential to note that in these settings, the home equity elasticity for entry is properly identified and causal in nature, but the interpretation of collateral effects is incorrect.

We are not able to fully decompose these two, but we do provide evidence that suggests wealth effects are least partially responsible for entry choices. For example, there is extensive cross-state variation in homestead exemptions associated with personal bankruptcies. These exemptions are designed to protect home owners from losing their homes to creditors, and they vary dramatically across states (e.g., being unlimited in Florida to being limited to less than $20,000 in some states). Prior work shows these exemptions impact credit access from banks, even for collateralized loans, because banks foresee the limits on their ability to seize collateral in defaults (e.g., Cerqueiro et al., 2014). Thus, states with lower homestead exemptions are believed to have more robust use of homes as collateral for bank loans since banks know that

they can collect more back, and we show some tabulations in this regard from the Survey of Business owners for start-up financing. When we split our sample, however, states with unlimited homestead exemptions show a stronger elasticity than other states, which is the opposite of what one would expect if collateral played the key role. These findings, along with others noted later, suggest overall that increased demand for entrepreneurship associated with greater wealth is likely to be an important driver of our results. At the very least, our analyses suggest that we are estimating an upper bound for the importance of the collateral channel in entrepreneurship.

Section 2 reviews the literature on the relationship between house prices and entrepreneurship, and Section 3 describes our data. We construct a unique platform that combines the Longitudinal Employer-Household Database (LEHD) and the 2000 Decennial Census of Population. The LEHD provides linked employer-employee records such that we can identify the formation of new firms and the initial employees within these firms. Our sample includes the universe of private-sector employer firms in 16 states, including very large states like California, Florida, Illinois, and Texas. The 2000 Census provides us many important details for respondents: income, employment, demographic characteristics, home ownership status, home values, etc. One key piece is the zip code location of a person's home in 2000. This information, combined with trends in house prices for zip codes, allows us to construct very localized price changes and expected price appreciations. A second key piece of information is the reported value of homes in 2000. Due to our large sample, we can use this variation across initial home values to identify home price appreciation effects even after controlling for zip code fixed effects. This platform thus offers us a tighter connection than previously possible for linking appreciations in home value with economic behavior while also controlling very closely for aggregate demand effects and other correlated factors.

Moreover, we are able to use renters as a "placebo" test for our specifications. As we describe in more detail later, renters are not a true placebo given both positive and negative spillover effects from local house price appreciation, but they do provide us an important comparison point for assessing whether we have identified effects that are truly consistent with collateral or wealth effects. Our data provide monthly rental payments, from which we can estimate the value of the dwellings occupied by renters in 2000. We construct a mirror-image analysis using these initial implied values for renters and local house price growth, and we argue that a necessary, but not sufficient, condition for associating entrepreneurship growth due to collateral mechanisms following house price gains is that a null effect be observed for renters. We establish econometric conditions that achieve this goal in Section 4, and also show how weaker conditions allow a renter effect to emerge.

The last section concludes. Our findings are relevant to the literature examining the importance of the collateral channel in driving entrepreneurial outcomes. Several papers document

a strong relationship between house price changes and entrepreneurship, as noted above. Although not always directly comparable, our preferred estimates are smaller in economic terms than many of the previous studies. We conclude from this work that housing prices impact entrepreneurship, but that much of this effect operates through channels not linked to home equity and that aggregate demand effects are a challenge to tame. We come to a tentative conclusion that, even after the removal of aggregate demand effects, wealth effects are likely important drivers of this relationship, rather than it being only due to the collateral channel.

Our findings are relevant also to the extensive literature looking at financing constraints and entrepreneurship. A number of models suggest that individuals are either precluded from entry or that firms enter small and then grow because of the fact that they face initial financing constraints.[1] Changes in local banking conditions have been connected with entrepreneurship (e.g., Black and Strahan, 2002; Cetorelli and Strahan, 2006; Kerr and Nanda, 2009). On the other hand, studies looking at entry have questioned the extent to which financing constraints are the leading driver behind entry decisions (Hurst and Lusardi, 2004). Our paper is very consistent with Jensen, Leth-Petersen, and Nanda (2014), who find a causal effect of an exogenous increase in home equity on entrepreneurship, but find that the effect is small. Our limited effects also parallel the findings of Bracke, Hilber, and Silva (2014) for the United Kingdom.

2 House Prices and Entrepreneurship

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

[1] 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 (2004), Cagetti and De Nardi (2006), Buera, Kaboski, and Shin (2011), Chatterji and Seamens (2012) and Barrot (2015).

Greenstone, Mas, and Nguyen (2014), Krishnan, Nandy and Puri (2015), Tsoutsoura (2015), and Nguyen (2015) 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). Similar to entrepreneurship studies, this work emphasizes the very localized nature of lending relationships to small businesses.

are young incorporated firms (Berkowitz and White, 2000).

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

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

Second, even if one can convincingly show a causal impact of house price increases on entrepreneurship, it still does not fully isolate the mechanism behind the increase in entrepreneurship. While increases in individual wealth reduce credit constraints, they also have the potential to generate wealth effects. For example, increases in wealth may make individuals more willing to experiment with entrepreneurship, impact risk aversion (e.g., Kihlstrom and Laffont, 1979; Evans and Jovanovic, 1989), or change preferences (e.g., Hamilton, 2000; Hurst and Lusardi, 2004; Astebro and Thompson, 2011; Hurst and Pugsley, 2011; Astebro et al., 2014). If these mechanisms are important, they can lead to a positive association between wealth and entrepreneurship that is independent of the ability of the potential entrepreneur to access bank loans. Put differently, an exogenous increase in wealth may affect entrepreneurship through reduced credit constraints, through wealth effects, or both.

We approach these challenges in several ways. First, we isolate the role of house price increases from local aggregate demand by controlling for aggregate factors at the zip code level and by further comparing the response by home owners to that of renters. Our use of very localized

price changes is also important for truly grounding the expected appreciation of the property. To parse out credit from wealth effects, we decompose our sample in ways that can shed light on the likelihood of a bank loan being important or even possible: the capital intensity of the industry entered, the homestead exemptions present in the state, and similar. Many of these techniques have been used at least once in the prior literature. We are able to bring them into the unique laboratory offered by the data depicted in the next section and to structure them in settings where very localized prices and controls are used to guard against aggregate demand confounders.

3 Data Construction and Sample Statistics

3.1 Data Sources

Our study relies on a unique combination of the Longitudinal Employer-Household Dynamics (LEHD) database and the 2000 Decennial Census of Population. These datasets are confidential and housed by the US Census Bureau. Built from quarterly worker-level filings by employers for the administration of state unemployment insurance (UI) benefit programs, the LEHD identifies the employees of each firm in the United States and their quarterly compensation.[2] It is longitudinally linked at both the firm and employee levels, allowing one to model how firm employment structures adjust over time, how new entrepreneurial firms form, and how individuals transition into entrepreneurship. This rich data source is currently available for 31 states for research purposes. The initial dates differ across states in terms of inclusion in the LEHD, and we focus on 16 states that have records that begin in 1995 or earlier. This sample is shown with stars in Figure 2 and includes major states like California, Florida, Illinois, and Texas. The blue shading highlights for reference all states incorporated into the 2008 version of the LEHD. The data extend through 2008. The LEHD directly records some information about individuals, such as age, gender, race, place of birth, and citizenship status. Through employment history files, one can also discern earnings and employment histories by job. While our sample period runs 2000-2008, our focus on states starting no later than 1995 allows us to measure meaningful income accumulation over the prior decade (and better identify existing entrepreneurs, as described below).

Using the unique person identifiers, we match the LEHD to individual-level records contained in the 2000 Decennial Census of Population (Census).[3] The Census has long-form responses for 1-

[2]The state UI systems cover 95% of private sector employment (Hyatt et al., 2014). Stevens (2007) provides a detailed discussion of the coverage issues.

[3]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.

in-6 of the population, and thus roughly speaking we can match 1-in-6 of our LEHD workers. The long-form is given to a random sample of households for a nationally representative population. With this match comes a true treasure chest of information about individuals (e.g., level of education, occupation, marital status) and their households (e.g., family composition, household income by source, home ownership and values). Importantly for our purposes, the Census asks whether the housing unit occupied by the respondent is rented or owned, how long the family has been living in the residence, how much the monthly rent or mortgage payment is, and what the market value of the unit is.[4]

We build a tailored dataset for the analysis of home prices and entry. We start by retaining individuals who have reported positive earnings in any of our 16 states in each of the three focal years 2000, 2004, and 2008. We require presence at all three points in order to understand the long-term career transitions of these workers. As the LEHD covers only a subset of states, and only businesses paying payroll tax (UI records) 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 federal public sector, or similar. As we elaborate in greater detail below, our focus on employer firms does not include Schedule C self-employed activity. One potential worry with this approach is that the 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 high clustering of included and adjacent states shown in Figure 2. Tabulations available from the authors also show that our sample is not behaving differently with respect to mobility in the 2000 Census compared to the nation as a whole.

We match the LEHD individuals to the Census and retain persons covered by the long form. 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

PIKs are internal Census identifiers that have a one-to-one correspondence with the SSNs.

[4]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 that is simply assigned $1,000,000.

For a limited number of individuals we are further able to match them to the 1990 Decennial Census. The creation of individual identifiers in the 1990 Census is based on tax address files from the Internal Revenue Service, and therefore the matching is mostly limited to individuals who file for taxes as household heads. The overall match rate of the 1990 Census to the LEHD is lower and concentrated on white, non-Hispanic males who reside in urban locations and are household heads. These data confirm the accuracy of our 2000 information (e.g., we can verify that individuals saying in 2000 that they moved into their home in early 1970s also said this in the 1990 questionnaire). The process of assigning personal identifiers and weaker home price data for the 1990s limit the use of the 1990 match for analytical work.

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.

3.2 Geographic Matching and House Price Data

We extract the geographical location of the household at the spatial levels of states, counties, and five-digit zip codes. The county of residence is first used to merge in housing price data collected from the Federal Housing Finance Agency (FHFA), following Adelino, Schoar, and Severino (2013). The FHFA data are reported at different levels of geographic detail and are considered reasonably representative of the overall home price development, although they are based on sales of single-family homes and do not include condos.[5] As the lowest level of geographic detail in the FHFA data is a metropolitan or a micropolitan statistical area, we use the county of residence to assign the Census respondents into Core Based Statistical Areas (CBSAs), and merge the house price data into the LEHD-Census platform at the CBSA level. A CBSA is one or more adjacent counties that have at least one urban core area of 10,000 or more in population, plus adjacent territory that has a high degree of social and economic integration with the core as measured by commuting ties. There are over 900 CBSAs currently defined, and these include 388 Metropolitan Statistical Areas (MSAs, urban core >50,000) and Micropolitan Statistical Areas. Our data cover a total of 173 CBSAs.

For about 85% of the persons in our base sample, we are also able to collect home price data from Zillow at the zip code level. Zillow is an online real estate database that uses information from the Multiple Listing Service (MLS) and public record. Zillow maintains data on average home sale prices and estimates of the average home values for zip codes. The coverage of the Zillow data is in part limited by the fact that the data for small zip codes may be sparse to the extent that few home sales occur.[6] Despite these issues, Zillow data have several advantages. First and most important, the use of zip code information on price changes allows us more extensive controls for aggregate demand changes and more refined statements about the impact of prices through housing collateral versus other channels. Guerrieri, Hartley, and Hurst (2013)

[5]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."

[6]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.

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. Second, showing our results with two sources of price data is important for robustness and confidence in the patterns observed.

To maintain a consistent sample across specifications, all analyses reported in this paper are developed through individuals for which we have both FHFA- and Zillow-based price indices. All of our results with the FHFA price data are very similar when using the larger sample that does not condition on Zillow prices being available. Our sample is quite representative of the US housing market and the opinions of respondents about their home values appear reasonable. To show this, we first take an unweighted average of the respondents' estimated home values by zip code. Our unweighted average across zip codes is $188,000, compared to $186,000 for the United States as a whole in the 2000 Zillow data. Second, for the zip codes in our sample, the correlation of the average estimated 2000 value to that reported by Zillow is 0.91.

3.3 Identifying Firm Entry

Our evaluation of firm entry utilizes the Longitudinal Business Database (LBD), another restricted-access Census Bureau dataset that records annual employment at the firm and establishment level. Both the LBD and the LEHD use several levels of establishment and firm identifiers, including the State Employer Identification Number (SEIN) and its federal counterpart (EIN), that are created for tax purposes, and the overall company identifier (ALPHA) that links the establishments of multi-unit companies together.[7] Following the procedures described in Haltiwanger, Jarmin, and Miranda (2013) and Decker et al. (2014), we identify for each establishment the first year during which the firm that the establishment belongs to was observed to be in operation within the LBD. The LBD runs from 1976 to 2012 and fully covers the period that we analyze. We also measure for each firm 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. Specifically with respect to entry definition, our approach focuses on the formation of employer establishments, whereas the commencement of Schedule C self-employed activity is unmeasured and not considered to be entrepreneurship in this sample.

The LEHD does not designate the founders of a new firm.[8] We use the term "entrepreneur" to

[7] 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.

[8] Our data do not record equity ownership of individuals, but the LEHD earnings do include bonus pay and

describe anyone present in the data who is 1) in an entering firm per the Haltiwanger, Jarmin, and Miranda (2013) definition, 2) present in the LEHD in the first year that the firm enters and among the top three earners of the firm in that entry year, and 3) in a firm that entered after 1995. The second key condition uses the initial compensation of firm workers to identify founders, and thus will in some cases include employees other than true business owners. We can think of our work as describing the formation of a top founding team and key early hires, and we use terms like business ownership and entry in this context. The third condition for entry after 1995 is imposed by our data. Given the LEHD start dates of 1995 for some states, we are unable to uniformly identify the initial workers for older firms. Thus, in 2000, our designated entrepreneurs are in young firms only. Wage workers are defined as those employees not among the top three initial earners, those hired after the first year in young firms, or those working in an establishment founded prior to 1995.[9,10]

3.4 Sample and Key Variables

Table 1 provides descriptive statistics on our sample. Our primary sample contains 807,800 wage workers in 2000 for whom we have zip code price data.[11] As shown in Row 2 of Table 1, 70% of individuals in this sample owned homes in 2000 and 30% rented. Rows 3-6 show home price appreciation at the zip code and CBSA levels for our sample using Zillow and FHFA data, respectively. Our focus is on the 2000-2004 period, where prices increased substantially, between 43%-51% for the groups at the zip code. This period provides a strong laboratory for exploring the connection between home prices and entry given the massive adjustments that occurred. Our "event study" window is also dictated by the fact that we only observe respondent home values in 2000. Rows 3-6 show that renters generally live in areas with greater price appreciation.

Rows 7-8 show that of the wage workers in 2000 who owned homes, 1.7% start a business

similar compensation.

[9] We later in the paper discuss evidence from the Survey of Business Owners that suggests over 80% of business owners derive the majority of their income from their business.

[10] Our analyses mostly focus on the transition of wage workers in 2000 into entrepreneurship, and extensions to consider net entry outcomes incorporate the survival and growth of businesses and entrepreneurs present in 2000. There are multiple conceptual definitions feasible with respect to survival. Perhaps the most natural is to model the persistence of an individual in entrepreneurship. In this approach, individuals are considered to have survived in entrepreneurship if they are still entrepreneurs in 2004, even if they have changed companies (in other words, they have founded a new company between 2000 and 2004). Related, individuals are said to have left entrepreneurship if they are a wage worker in 2004, even if the original company survived. We find very similar results to those reported below when instead modelling the survival of a business itself. These cases allow the survival of the SEIN without the continued presence of the focal entrepreneur (e.g., the sale of the company), who may now be designated a wage worker in another firm.

[11] All observation counts in this paper are disguised and rounded to the nearest 100 according to Census Bureau disclosure restrictions. Our larger complete sample of wage workers and entrepreneurs who have linked FHFA data includes 976,900 individuals.

by 2004, and 2.5% do so by 2008. These are net effects that do not capture very short-lived entry that fails before 2004, and the 2008 figure allows transition back out of entrepreneurship for the 2004 entrants. These four- and eight-year entry rates are quite reasonable given what is typically reported in the literature.[12] On average, renters are slightly less likely to transition into entrepreneurship compared to home owners.

Rows 9-26 compare the traits of renters and home owners that are used as controls in the regression analyses. Renters tend be younger, are more likely to be minorities and immigrants, and are less likely to be married or hold a college degree. The Census collects information on whether the respondent's home is owned, the estimated value of the home, whether there is an outstanding mortgage on the home, and the monthly mortgage payment if it exists. (The Census also collects some traits of the homes, such as the number of rooms, that we do not use here.) Our 70% home ownership rate compares to a national average of 67% in 2000. Most of the Census home owners have a mortgage outstanding. With the $1,000,000 cap, the average value of a home in our sample is $188,764. For renters, we know the monthly rental payment. To assign an implied value to rental properties, we simply use 20 times the annual rent.[13] Comparing the implied value of homes for renters with the actual home values of owners shows that renters tend to live in dwellings of modestly less value, but that the distributions will overlap substantially. The Census collects the date when the household moved into their home, and owners not surprisingly have a significantly longer average tenure in their properties.

From the Census long form, we collect total household income in 2000, which includes earned income, business income, and passive income. We will control for this in our estimations and contrast it with home values and price appreciation. From the LEHD, we first collect total earnings in 2000 for the individual (summing across all SEINs associated with the jobs held by the individual). We also calculate for the individual the sum of all LEHD earnings across all jobs during 1990-2000. This accumulated earnings measure is used as a proxy for the wealth of the individual in 2000, while clearly recognizing the imperfect degree to which it captures all potential elements of wealth. Rows 23-26 show that renters have significantly lower household income and earnings than owners.

As noted above, one of our approaches to isolate aggregate demand from the home equity channel is to compare the entry response of owners to that of renters. While our approach is similar to that of Schmalz, Sraer and Thesmar (2014), the strong differences in the demographics, stage of life cycle, and financial position of renters and home owners lead us to consider a related, but distinct, empirical strategy where we consider home owners and renters separately. This

[12] Entry rates into employer firms are 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 very reasonable.

[13] In 2000, the average multiple was 21.6 using quarterly reports from Case-Shiller and FHFA data.

separation allows us to isolate better the impact of aggregate price changes from the implied increases in home value on entrepreneurship. We outline this approach below.

3.5 Measuring Home Equity Growth

One key part of our analysis is to measure the relative impact of home equity growth compared to the initial financial position of respondents. Our baseline metric takes the form

$$\frac{\text{Home equity growth}_i^{00-04}}{\text{Financial position}_i^{00}} = \frac{\text{Home value}_i^{00} \cdot \text{Home price growth}_z^{00-04}}{\text{Household income}_i^{00} + \text{Estimated home equity}_i^{00}} \tag{1}$$

where i indexes individuals and z indexes the zip code in which the individual i resides. A second variant uses CBSA-level price growth but keeps the other elements of (1) the same. It is helpful to walk through each part of this calculation in detail and provide representative values. First, the numerator considers home price growth x initial home value. The average home value in our home owner sample is \$188,764, and the mean zip code price growth for home owners is 42.73% in Table 1. Multiplying these together yields an expected home equity increase for the mean US home of \$80,659. It is important to note that the added equity is orthogonal to the level of initial home equity. All else being equal, the expected nominal gain of \$80,659 is the same whether the individual's 2000 equity in the home is \$10,000 or \$150,000.

The denominator estimates the financial position of individuals in 2000 through their household income and estimated home equity. The former is taken directly from the Census responses and averages \$88,753 for home owners. The latter is estimated based upon time since home purchase, home price growth from time of purchase to 2000, and similar data. Specifically, we collect from Freddie Mac the average value, interest rate, and number of points on 30-year fixed rate loans for the years in which home owners in our sample moved into their homes. Using a mortgage calculator, we then quantify the expected equity levels by year of move-in for that cohort in 2000 against the original loan amount and price levels. Owners are assumed to have as further equity all additional price growth from the time of their home purchase until 2000. Moreover, if no outstanding mortgage exists, we assign home equity to be 100% of the value of the home. With this approach, the average home owner in our sample is estimated to have about 57% of their home value as equity, which would be \$107,595 in our example using mean values. This would give the total 2000 financial position for the denominator of (1) as \$196,348.

From these data pieces, we would estimate using the sample averages discussed above a relative financial gain of 41.1% = \$80,659 / \$196,348. The actual average gain in our data for home owners is 45.4%, reflective of some minor correlation in these variables with each other at the individual level. This is shown in Row 27 of Table 1, which also gives values when using CBSA prices. Importantly, we have most of these data elements for renters and can thus

calculate the "placebo" like equity increases in Column 3 of Table 1. The one difference in the renter calculation is that the variable indicating no mortgage being outstanding is undefined in the renter case, and thus we calculate our placebo values as if all renters have outstanding balances. Due to the greater price appreciation in their zip codes and lower initial financial positions, the hypothetical shock for renters is higher than for owners and averages 86% using zip code prices.

It is clear that initial financial position can be dictated by more than just the two elements included. Thus, we discuss below many robustness checks on this design. That said, some estimates in the literature suggest that our baseline is reasonable. For example, Gentry and Hubbard (2004) measure a median wealth-to-income ratio of 1.8, and our calculations deliver an implied ratio of 2.2. Related, Gentry and Hubbard (2004) measure equity in primary homes as 41% of wealth portfolio share for wage workers, and this share is 55% in our sample. Similarly, our estimate of 57% home equity is very close to the 52% measure found by Bracke, Hilber, and Silva (2014) with their loan data.

4 Empirical Results

House price changes can link to entrepreneurship through the promotion of new entrants or changes in the behavior of existing entrepreneurs. Likewise, there are multiple strategies running through the literature to separate out local demand-side effects from collateral-based effects, most notably 1) looking at variations in the degree to which industries require external finance (e.g., Rajan and Zingales, 1998), 2) considering variations in homestead exemptions by state (Berkowitz and White, 2000; Cerqueiro and Penas, 2014), 3) using renters as a control or counterfactual (e.g., Schmalz, Sraer, and Thesmar, 2014), and 4) examining price increases believed to be exogenous from demand-side effects due to geography-based housing price elasticities (e.g., Adelino, Schoar, and Severino, 2013) developed by Saiz (2010).

We approach this complicated and multifaceted problem in several steps, by bringing elements of each of these approaches into our analysis. We start with city-level analyses of aggregate transition rates from wage workers to entrepreneurship for owners and renters, which provides a background on the challenges of isolating home equity effects and also an aggregate effect that we seek to somewhat decompose. We then show our central estimations using individual-level transitions, and we spend a substantial amount of time discussing economic magnitudes. We then turn to various robustness checks on these results and discuss extensions to net entry specifications. We devote the last set of analyses to efforts to learn more about whether collateral effects or wealth effects are responsible for the results we observe. This is done through analyses of entrepreneurial mobility across cities, sector choices, SBO tabulations, and sample splits based

upon local lending traits.

4.1 City-Level Estimations

We first document the strong link between city-level growth in house prices and transitions to entrepreneurship. This correlation has been observed in a variety of settings, and we observe it for the United States during the 2000-2004 period. We start by collapsing our individual-level sample described in Table 1 to the CBSA level. We focus on 145 CBSAs for which we observe both owners and renters in 2000 and for which a housing price elasticity from Saiz (2010) is available. We measure for each CBSA the counts of owners and renters employed in wage work in 2000 and the rate at which each group transitioned into entrepreneurship by 2004.[14]

The first three columns of Table 2 report OLS regressions for rates of entrepreneurial transitions by city. These specifications take the form

$$y_c^{04} = \beta \ln\left(\frac{HP_c^{04}}{HP_c^{00}}\right) + \phi_r + \epsilon_c, \tag{2}$$

where y_c^{04} is the share of wage workers by home ownership type who are transitioning. The regressions include fixed effects for four Census regions. The β coefficient captures the percentage increase in the dependent variable for a unit change in house prices HP. We weight the sample for each column by the raw count of LEHD individuals that underlie the calculated transition metric (e.g., the number of renters by CBSA is used to weight CBSAs in Column 3), and we find very similar results when weighting by the total count for all columns.

These regressions document a statistically significant and economically large relationship between house price growth and entrepreneurship. We use FHFA data for this analysis, and the mean CBSA-level price increase in the sample is 33%. The β coefficient in Column 1 implies the 33% price growth is associated with a 0.4% increase in the transition rate. Measured relative to the unweighted average for CBSAs of 1.55%, this is a 25.4% increase. This increase is robust to many specification variants, including considering log counts of entrants, dropping regional fixed effects, and so on.

This large increase matches prior work, but Columns 2 and 3 show some concern about assigning this effect to home equity channels, much less home collateral effects. The relative

[14] For all of our initial analyses, owners and renters remain assigned to the zip codes and CBSAs in which they are living in 2000, even if they move to another location by 2004. We can observe these moves through the LEHD. We keep individuals assigned to their initial location as the price growth of their starting location is the true treatment and moves are endogenous. We later describe estimations that consider mobility over different priced cities and entrepreneurial transitions. It is important to note for now that our estimates in Table 2 do not include mobility into a city in order to take advantage of a booming economy, and so this construction by itself is a first guard against aggregate demand biases.

response of renters is also present and strong even though they did not own their dwellings in 2000. The comparable economic magnitudes of the response by home owners and renters highlight that these city-level specifications are not isolating home equity channels from other mechanisms through which house prices can drive entrepreneurship or other correlated omitted factors.

In Columns 4-6, we test whether using geography-based housing price elasticities developed by Saiz (2010) to instrument for the house price increases can correct this situation. The geographic features of cities are exogenous and clearly have a powerful link to home price growth during this period, as shown by the F-statistics for the first stages. The IV coefficients are more than double those of OLS, but they also further obscure any differences between owners and renters. Thus, while city topology is exogenous, it will not serve our need to separate out home equity channels from other factors correlated with home price growth that impact renter entry decisions (e.g., constrained land supply may indicate coastal locations that are becoming more attractive as home cities, driving up demand for entrepreneurship over and above the link through house prices in areas). To provide a more granular analysis, we next turn to individual-level estimations.

4.2 Core Individual-Level Estimations

We conduct individual-level estimations using a simple extension of specification (2) that takes the form

$$y_i^{04} = \beta \ln\left(\frac{HP_c^{04}}{HP_c^{00}}\right) + \gamma \frac{\text{Home equity growth}_i^{00-04}}{\text{Financial position}_i^{00}} + \theta \mathbf{X}_i^{00} + \phi_r + \epsilon_i, \tag{3}$$

where y_i^{04} is an indicator variable that takes a value of one if individual i has become an entrepreneur in 2004.

While equation (3) is similar to equation (2) in that the propensity to engage in entrepreneurship is related to house price increases, there are some key differences. First, we have left in equation (3) the use of CBSA-level prices and regional fixed effects, but the individual-level data allow us to consider more fine-grained dimensions for both. Second, and related, much of our attention now shifts towards the added metric of home equity growth compared to initial financial position, which is defined earlier in (1). The γ coefficient is always measured in the upcoming analyses, while the β coefficient is measured only when using regional fixed effects. Third, we can now introduce a vector of individual-level covariates $\mathbf{X}_i^{00}$ to capture other factors like income levels and demographics that impact entry decisions. As a small change, we also no longer restrict the sample to CBSAs where topology instruments are available.

Quite importantly, the vector of individual-level covariates $\mathbf{X}_i^{00}$ includes log house value in 2000 and log household income in 2000, which we will report in our core analyses. Further, we include unreported fixed effects for the following traits of individuals, with category counts

in parentheses: age (9 groups), education (6 groups), gender (male/female), race (4 groups), immigration status (yes/no), marital status (married/not), LEHD earnings in 2000 (10 deciles), accumulated LEHD earnings to 2000 (10 deciles), date of move-in to residency (6 groups), and own home with no mortgage (yes/no). Accumulated earnings are measured relative to the respondent's state due to different durations of states in the LEHD sample.

Table 3 reports our core estimates, with Panel A continuing to focus on CBSA-level prices. Column 1 is very similar in spirit to Table 2's city-level analysis for home owners, where we use only CBSA-level house price growth and regional fixed effects. Column 4 is similarly comparable to Table 2 for renters. These specifications do not yet include the home equity change variable, and thus we anticipate the β coefficients to be close to their city-level counterparts so long as the individual covariates do not over-turn the relationship. We do indeed find very comparable outcomes despite the specification differences. This common baseline allows us to shed light on the composition of the aggregate effect, using the granular individual-level data.

The third row in Table 3 shows a strong positive association between log home value in 2000 and transitions to entrepreneurship in 2004 for home owners. As home values reflect individual wealth, even in the presence of our fixed effects for accumulated LEHD earnings, this relationship is quite intuitive—wealthier people in 2000 are more likely to become entrepreneurs by 2004 independent of local price changes. A similar relationship is also observed for household income in the fourth row. An important finding, however, is that all of these relationships are again observed for renters in Column 4. This comparability remains even though the implied home value for renters is derived through their rental payments and does not reflect ownership of the dwelling. Nevertheless, wealthier people select higher rental properties on average. Reflecting Hurst and Lusardi (2004) and related work, wealthier and higher-income individuals are more likely to enter into entrepreneurship over the ensuing four years independent of house price changes in their local area due to factors like better resources, higher risk tolerance, consumption effects, and so on.

Column 2 adds the individual-level measure of increase in home equity relative to initial financial position. The γ coefficient is statistically significant and of important economic magnitude that we further discuss below. This augmented specification also leads to a significant attenuation of the overall price change effect β, although the main effect remains statistically significant. The combination of these two effects is similar to the overall effect, which is not surprising, but they do not have to add up. Column 5 does a similar introduction for the renter specification. Here there is a critical difference. The γ coefficient in Column 5 is very small and statistically insignificant, suggesting that we have now isolated something important for home owners that is also specific to home owners. In continued contrast, the overall price change effect β is very stable to renters. This difference that now emerges between renters and owners

is encouraging, as it suggests that our two measures are able to better parse out the response to house prices that are driven by an individual's own home equity gains from broader price effects.

Columns 3 and 6 take this isolation one step further and include fixed effects ϕ_z for the 5,909 zip codes of our respondents rather than the four regional fixed effects. These fixed effects control for the main effect of house price increases, the general rate of entrepreneurial transitions in the zip code, and related local economic conditions. While these fixed effects absorb the main effect of the price change from 2000-2004, we can still identify the γ coefficient on home equity changes relative to initial financial positions through differences across individuals within zip codes in home values relative to initial financial wealth. The reported coefficients are quite stable for both owners and renters in the more-stringent specifications, which is comforting.

Panel B of Table 3 repeats this battery of specifications using zip code prices rather than CBSA-level prices. These results are even sharper, providing a precisely-estimated null effect of pseudo home equity change for renters, in contrast to a clear link for home owners. The overall levels of the β and γ coefficients are lower in Panel B than Panel A. We prefer estimates using zip code price changes because 1) they are more likely to accurately reflect actual price growth for individuals in large cities and 2) they are less likely to be contaminated by aggregate demand effects. An example of a concern that zip code estimates help correct would be entry by an individual with stagnant home prices to respond to demand effects coming from other booming parts of the city (e.g., the opening of a maid business to serve clientele in richer neighborhoods across the city). These localized price changes are an important advantage of these data. A comparison of Columns 2 and 3 suggests that zip code prices and individual-level measures of changes in home equity relative to initial financial position adequately account for aggregate demand effects.[15] The primary focus of our analysis is on wage transitions to entrepreneurship, but rising home values can also impact the persistence of existing entrepreneurs. Appendix Table 1 shows that we find similar results to Table 3 when considering net entry impacts that include survival effects for existing businesses. These estimations include all respondents in the sample and add a control variable for whether someone is already an entrepreneur in 2000. The relative magnitudes are slightly smaller than those estimated directly with wage work. In general, the counts of existing entrepreneurs are too small to use this group in isolation with the most-stringent parts of the estimating framework that we focus on in this paper.

[15]It is important to note, however, that this logic could hit limits at ever finer levels of data. For example, while we do not observe in our data actual home value changes, it is not clear that we would want to use such information if we had it. It could be that very industrious individuals both found businesses and also work around their house in ways to improve its value. Or, it could be that loans are taken out to remodel homes, boosting individual home values, but discouraging entry. Either way, due to these types of endogeneity concerns, localized price changes at the zip code level may be something close to the optimal.

4.3 Discussion of Coefficient Magnitudes

We now discuss the coefficients more broadly. At the bottom of each panel in Table 3, we provide an estimate of the mean effects in our sample relative to overall transition rate to entrepreneurship observed. The row titled "Mean estimated price growth effect" is calculated by multiplying the log average price ratio by the β coefficient for each column and then dividing by the mean of the dependent variable. The log average price ratios are taken from Rows 3 and 5 of Table 1 and are specific to owners and renters and each panel. The row titled "Mean estimated financial position effect" is similarly calculated by multiplying the average home equity increases given in Rows 27-28 of Table 1 by the γ coefficients and then dividing by the mean of the dependent variable.

For owners, these calculations show the large home price effects associated with the 2000-2004 run-up connect to a relative financial position effect that is between 8.6% and 14.3% depending upon the price level used and fixed effect strategy employed. For renters, these effects are basically zero, as noted above. After estimating this component, the broader house price effects continue to speak to an additional relationship between prices and entry. For owners, this relative effect is about 8%, while for renters it is about 14%.

Panels A-D of Table 4 lay out these calculations in detail for the case of zip code prices. For clarity in what follows, we set the renter effect due to relative financial gain exactly to zero, but calculations in Rows D1 and D2 of Table 4 otherwise exactly match those reported in Table 3. Row D3 then adds these effects and provides our estimate of the share of the effects due to relative financial gains. Our approach estimates that about 55% of the overall impact for entry from home owners comes through these relative financial gains. With CBSA-level prices, this share is estimated at 60% for owners (calculated from Panel A of Table 3).

Panel E of Table 4 then combines the effects estimated in Panel D with a population-average split of 70% home owners and 30% renters. This approach estimates an aggregate entry response of 15% that is reassuringly close to our direct estimate in Table 2. It then estimates that about 40% of this overall effect can be traced to the relative financial gains of home owners, whereas the rest we cannot assign to home equity effects for owners or are due to renters. With CBSA-level prices this fraction comes to 45.4%. Thus, our analysis highlights that estimations of price impacts directly on entry rates are liable to overstate the role that can be assigned to home equity channels and possibly collateral impacts.[16]

[16]It is worth emphasizing that our CBSA-level results are comparable to estimates in much prior work, although studies taken from different settings can be subject to different owner-renter effects than those we measure. For example, Black, de Meza and Jeffreys (1996) estimate the elasticity of entrepreneurship with respect to house prices as 0.6, implying a 27% increase in entry for the average price growth in our setting. Schmalz, Sraer and Thesmar (2014) estimate an 11% increase in entry for home owners relative to renters for a 16% point increase in house prices, implying a 31% increase in entrepreneurship in our setting. Similarly, Corradin and Popov (2015) estimate a 10% increase in prices lead to a 7% increase in entrepreneurship, implying a 31.5% increase in our

Before moving to robustness checks, Table 5 relates these entry results to job creation and the "quality" of the increased entry due to these home equity channels. Column 1 replicates the estimation from Column 3 of Table 3, Panel B. Columns 2 and 3 compare entry of small vs. large businesses as measured in the LEHD in 2004.[17] These two coefficients and the means of the dependent variables sum to the full effects in Column 1, and their relative effects are similar. Columns 4 and 5 similarly break out this entry into start-ups that survive until 2008 from those failing before 2008. As can be seen from Columns 3 and 4, two-thirds of the increased entry that we connect to the home equity channel is churning entry, composed of start-ups that did not survive until 2008. Moreover, we cannot reject the hypothesis that there was no increase in longer-term entry. Similar to Kerr and Nanda (2009), Anderson and Nielsen (2012) and Jensen, Leth-Petersen and Nanda (2014), this suggests that the marginal entrant benefiting from the increased prices was somewhat weaker and hence more likely to fail.

4.4 Robustness Checks and Extensions

4.4.1 Alternative Specifications

It is reassuring to note that the regressions in Table 3 using the sample of renters show no impact of changes in pseudo home equity value on entry. More generally, however, we want to be careful to not push the renter comparison too far. Theoretically, the model of Bracke, Hilber, and Silva (2014) shows the ambiguity of the renter comparison when viewing home ownership and business ownership as part of a portfolio of risky assets. Empirically, even after controlling for aggregate demand, rising home prices in a local area can affect renters and their incentives towards entrepreneurship. Some renters may be discouraged from seeking to establish firms due to the fear of losing savings when the price of homes they want to buy is escalating. They may also suffer from reduced cash flow for entrepreneurship due to higher rent rates if parity to home values is maintained. On the other hand, some renters may be irrationally encouraged to entry if they believe themselves wealthier due to rising home prices around them, even if they do not directly participate. Renters may also benefit from "cheap credit" to the extent that large price appreciation fosters broader adjustments in lending standards (e.g., Glaeser and Nathanson, 2014). The renter comparison helps ground our core specification and the belief that it connects to home equity growth, but the bigger message is the general size of the coefficients present.

Having noted these issues, we examine in Table 6 the results from stacked specifications of

setting.

[17] LEHD employment here is measured differently from other settings in that we capture all employees who work for a firm through the full year, part or full time. This contrasts with many administrative datasets that measure employment at one date and often through full-time employees.

the form

$$\begin{aligned} y_i^{04} &= \alpha D_i + \beta_1 \ln\left(\frac{HP_c^{04}}{HP_c^{00}}\right) + \beta_2 \cdot D_i \cdot \ln\left(\frac{HP_c^{04}}{HP_c^{00}}\right) \\ &\quad + \gamma_1 \frac{\text{Home equity growth}_i^{00-04}}{\text{Financial position}_i^{00}} + \gamma_2 \cdot D_i \cdot \frac{\text{Home equity growth}_i^{00-04}}{\text{Financial position}_i^{00}} \\ &\quad + \theta \mathbf{X}_i^{00} + \phi_r + \epsilon_i, \end{aligned} \tag{4}$$

where D_i is an indicator variable that takes the value of one for owners and the other variables are as defined above. These regressions use renters as a baseline against which to compare the response of owners, closely following the innovative methodology of Schmalz, Sraer, and Thesmar (2014). In subsequent specifications, we also interact the full set of covariates $\mathbf{X}_i^{00}$ with the owner dummy or with house price changes as well.

Table 6 provides very consistent results with those documented in Table 3. Column 1 begins without the home equity change variables. We do not find a statistical difference between owners and renters in how they respond to price changes overall. In the calculations at the bottom of each panel, we continue to use the owner- and renter-specific average price changes and baseline means for the transition rates; as renters generally lived in areas with greater price appreciation, they record an overall greater entry effect at the mean. These mean effects are quite comparable to those in Table 3, with the main difference being that the stacked specification delivers a larger point estimate of the mean effect for renters compared to owners. There are some interesting parallels and differences to the French experience in these regards, perhaps related to different mortgage lending conditions over countries.[18]

Column 2 adds in the home equity change relative to initial financial position and its interaction, and Column 3 adds in zip code fixed effects. Columns 4-6 repeat the triplet of specifications with all of the covariates also interacted with the owner dummy. With these covariate interactions added, the only difference from Table 3's separate regressions is the common regional or zip code fixed effects.

These results again mirror the earlier work. The mean estimated financial position effect of owners ranges 11-13% with CBSA prices, compared to 13-15% in Table 3. With zip code prices, both approaches deliver entry effects of about 8% in relative terms. In all cases, renters do not show statistically significant or economically important financial position effects, which is reassuring given their placebo nature, and the entry behavior of renters instead loads onto the aggregate home price effects. Looking across these specifications, we again see similar to Tables 2 and 3 an overall similar response of owners and renters to house price growth, but that they

[18] For example, only outright owners with no mortgage outstanding were able to borrow against their home to finance entrepreneurship over the time period studied by Schmalz, Sraer and Thesmar (2014).

have different origins. Similar to the prior work, we also see that the localized zip code prices reduces the effects by a third or a little less in Panel B compared to Panel A's CBSA price series.

In addition to the owner interactions, estimations available from the authors repeat this triplet with every covariate interacted with local price growth. We do not tabulate these, as calculating the total and relative effects that we focus on requires a lengthy evaluation of price change effects across all interacted covariates. What is direct to note, however, is that this approach continues to stress the importance of the relative financial position effects for owners compared to renters: the equivalent coefficient for Column 3 of Panel A for renters is $\gamma_2 = 0.0043$ (0.0020); for Panel B, we observe $\gamma_2 = 0.0027$ (0.0013). In both cases, the main effect γ_1 for renters is slightly negative and far from statistically significant.

Table 7a reports additional tests. We include many controls in our baseline estimates, but more are feasible. Column 2 reports a specification that controls for the log estimated initial home equity for home owners rather than the value, finding similar results. Column 3 reports an augmented specification that adds additional fixed effects for the following traits of individuals in 2000, with category counts in parentheses: occupation (511), industry (211), time period of immigration (8), and number of children (4). Our results persist with this approach, with the slightly diminished coefficient from the baseline approach only further reinforcing that the assessment that home equity effects are relatively modest for entry. Columns 4 and 5 control linearly and via fixed effects, respectively, for monthly mortgage payment levels, reaching similar conclusions. Column 6 shows similar results when interacting local price growth with household incomes, showing the link through home value growth is robust. Columns 7 and 8 show that the results hold when excluding either the youngest or oldest members of the sample. Further tests show robustness to excluding individuals who own their homes without mortgage or to weighting the data such that each CBSA receives the same importance.

Our estimations focus on 2000-2004, but our data continue through 2008. We choose the shorter time period to establish a better event study given the extensive changes that can occur over eight years. Examining net changes in entrepreneurship from 2000-2008, we find almost identical relative effects for home owners in Column 9. Looking back at Figure 1, this is not surprising as the majority of the home price adjustments occur during the initial years after 2000. Likewise, work similar to Decker et al. (2014) does not reveal abnormal trends in entrepreneurship for the periods considered.

Table 7b considers variations on the denominator used in our relative financial gain variable. Column 1 considers using LEHD earnings instead of household income for the denominator of (1), while Columns 2-5 adjust up or down the relative contributions of household income vs. estimated home equity. The estimates and relative entry elasticities are consistent across this range of approaches.

Up until this point, we have assigned individuals to their original location in 2000, regardless of whether they moved. This non-mobility is a first step towards isolating differences from aggregate demand due to migration to growing cities vs. the substantive role of the home equity channel. In Table 8, we explicitly check that the majority of entry stems from those who do not move between MSAs during 2000-2004. We find a negligible role is played by those who are moving across cities at the same time that they start their business. Interestingly, however, people moving and entering firms are more likely to move to substantially cheaper cities, potentially to lock in the wealth change experienced through the house price appreciation in their MSA. Panels B and C show that this seems isolated to individuals who start less capital-intensive businesses, suggesting that the move was perhaps not driven by a need to unlock substantial capital that could not be raised through other financing channels. Together with the earlier results, this paints a relatively favorable picture of the ability of firms to access capital.

Unreported estimations find that much of the heightened transitions into entrepreneurship by wage workers are associated with employees of companies founded over the prior five years. This connects to findings like Gompers, Lerner, and Scharfstein (2005) on entrepreneurial transitions being more likely out of small and young businesses. Likewise, educated workers and immigrants seem particularly sensitive to opening businesses following appreciation in their home values.

4.4.2 Survey of Business Owners Estimations

The LEHD-based analysis provides a number of results that yield a consistent picture of the important, but limited, role that home equity plays in the financing of new businesses. However, as with most other studies in this domain, our base data do not contain direct measures of home equity financing by new entrepreneurs and business owners, and as a consequence inference must come through empirical connections between home prices and entrepreneurship without this missing link. Our data allow us a new and stronger approach to discerning these effects, but the arguments remain somewhat indirect as in prior work. We now provide some validating evidence for our main findings using a separate database from the 2007 Survey of Business Owners (SBO). The 2007 SBO has direct measures regarding home equity financing by entrepreneurs that allow us to shed new light on the empirical relationship of home price growth to entrepreneurship; moreover, some of the basic data facts are important in their own right.

We use the publicly available micro data released by the Census Bureau for the 2007 SBO.[19] The file contains over two million observations on employer and non-employer firms, and the

[19]Data and descriptions are available at: https://www.census.gov/econ/sbo/pums.html. This is the first-ever SBO Public Use Microdata Sample and it allows researchers to create their own tabulations and analyses on entrepreneurial activity, including the relationships between firm characteristics such as sources of capital, number of owners, firm size, and firm age.

data contain detailed information about the firm and its owners. Each firm has a recorded state and industry; information on 2007 sales and receipts, employment, and payroll; information on the year the business was established; and the sources of financing for start-up capital and for expansion capital. For each business owner, the SBO tells the owner's age in 2007, the highest level of education they completed, the number of hours per week spent working in the business, the owner's primary functions in the business, and when and how each owner acquired or started the business. Interestingly, the SBO data also tell whether the business provided the owner's primary source of personal income, with 81% of primary respondents for employer firms saying yes.

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

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

The use of home equity for start-up capital shows a bulge during our sample period consistent with some form of home price growth effect. Caution must be exercised with the statistics we

[20] The total value of start-up financing is not split by source, but interesting differences emerge among the firms depending on which sources they report having used. Those relying on credit cards and personal savings report the smallest totals on average ($135,959 and $125,591, respectively), followed by home equity loans at $224,867. Thus home equity appears to be a source that can be accessed by smaller businesses. Firms that use home equity loans as part of their start-up capital also tend to utilize a mixture of other financing sources. Personal savings (65%), credit cards (38%), bank loans (27%), and other personal assets (26%) are the most frequently cited additional sources, while grants (0.2%) or venture capital (1%) are rarely used by those firms.

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

provide next because we only have a 2007 cross-section, and we are thus unable to separate age from cohort effects. For firms founded in 2000-2002 that are alive in 2007, 10.4% report using home equity in start-up financing. This share grows to 13%-14% from 2003-2006, before falling back down to 12.5% in 2007. This reversion signals to us that cohort effects associated with the price run-ups may have played a role here, whereas a monotonic relationship would have been much harder to argue for over age and survival effects. A similar, but much weaker bulge, is evident for use of home equity in expansion capital. This bulge is interesting in its own right as it provides something of an upper bound on how large the home equity loan effects could be during this period of price expansion.[21]

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

Panel A of Table 9 considers the share of firms entering during 2000-2007 indicating reported financing, which implicitly focuses attention on the composition of start-up financing. Columns 1-3 divide the sample into the individuals who do not raise external finance, those that raise finance that does not include home equity, and those who raise capital that includes home equity. These categories are collectively exhaustive and mutually exclusive, such that the coefficients sum to zero, and the means of the dependent variables sum to one (state-level averages): 8% of respondents did not raise external finance, 79% raised external finance that did not include home equity loans, and 13% raised finance that included home equity loans. We regress these outcome variables on log home price levels in 2000, log home price changes during 2000-2007, and unreported covariate controls for the log count of pre-2000 entrants by state and the share

[21] Adelino, Schoar, and Severino (2013) demonstrate rising home prices connect to greater refinancing and use of home equity lines of credit in cities. The important difference in our estimations is that we are isolating the use of home equity loans for start-up capital specifically.

of older firms in each state that used the forms of financing listed in Columns 2-8 (7 regressors in total). These unreported regressors are held constant over specifications to provide a consistent baseline estimation and control for long-standing financing behavior in the state. We weight states by their count of pre-2000 respondents.

The main coefficient of interest is the one for log house price growth during 2000-2007, which shows a strong positive association with use of home equity for start-up financing. This suggests an intuitive substitution towards home equity financing as it becomes available, and it is very important for the literature focusing on home prices and entrepreneurship to observe this connection. Yet, these effects again appear modest. The average state home price gain through 2007 is 59%, but we use a 45% increase to provide easier comparison to our LEHD-based results. This level of price growth is associated with a 1.4% increase in the share of firms using home equity financing, or an 11% relative increase in home equity financing off of the 2000 baseline.

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

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

Although the magnitudes of Table 9 are not directly comparable to our LEHD work, given that the earlier work focuses on transitions rather than financing choices among an entrant pool, both approaches provide a consistent picture that house price increases play a statistically significant but quantitatively modest role in driving entrepreneurship through the home equity channel.

4.5 Do Home Equity Effects Operate via the Collateral Channel?

Our primary focus has been on isolating likely effects through home equity channels from other ways that housing prices could impact entry decisions from renters and owners. We have yet to

assess, however, whether the home equity effects that we do identify are likely to be connected to the use of home equity for collateral with banks. This is rather challenging overall given that rising home values can generate an increased demand for entrepreneurship independent of the credit channel. Real estate values are often linked to financial credit channels (e.g., Chaney, Sraer and Thesmar, 2012), and most studies of house prices and entrepreneurship have assumed that all of the impact is flowing through collateral effects that are unlocked by increased willingness of banks to lend, a supply-side argument.

Yet, as discussed in the prior section, rising wealth connected to home price changes may lead to entrepreneurial transitions where bank loans are not involved. Despite the huge price run-ups, less than one-fifth of recent entrants in the 2007 SBO can be linked to bank loans connected to home collateral. Moreover, and conceptually quite important if home price effects are to be used to study financing constraints for entrepreneurship, the presence of a mortgage-backed loan for a new entrant following big house price increases is not conclusive evidence that a prior financing constraint on the supply side has been alleviated. The low interest rates often available with home equity loans make them an attractive way to finance small businesses. Thus, an individual induced into entrepreneurship due to wealth effects only following house price changes—i.e., financing constraints never existed, and the bank was always willing to lend to the individual—may choose to take a home equity loan out as a cheap source of capital.

To assess these issues, we use sample splits along state and industry dimensions to look for asymmetric responses that would be consistent with a strong collateral channel. Table 8 already considers a common approach, dating back to Rajan and Zingales (1998), for looking for these effects using industry-level differences. Following Hurst and Lusardi (2004), we use the Survey of Small Business Finances to segment businesses based on their starting capital requirement, and we code businesses in retail and wholesale trade and manufacturing as capital intensive, and businesses in services and construction as less capital intensive. The relative effect is modestly larger for capital-intensive sectors at 13.9% vs. 8.7%, which does suggest a substantive role for the collateral channel. Weighing against this, however, is that entry into low capital-intensity sectors occurs at 3.6 times the rate of high capital-intensity sectors (comparing the means of the dependent variables), and thus the 8.7% response is more responsible for the aggregate entry outcomes we measure.[22] Unreported estimations also find the entry effects stronger in tradable sectors.

Table 10 next considers variations in local lending conditions. Columns 2 and 3 first compare

[22] While the literature since Rajan and Zingales (1998) typically takes stronger effects in capital-intensive sectors to be evidence for a financing effect, Adelino, Schoar, and Severino (2013) argue the opposite in their analysis of home prices and small businesses. The argument for stronger effects occurring in sectors with less capital intensity would be that the marginal gain in collateral would not be sufficient for tipping the scale on lending decisions for capital-intensive sectors given the large amounts of money involved. Either way, the overall comparability of our estimates in Table 8 across sectors suggests limited impacts in this regard.

entrepreneurial transitions in states with high personal bankruptcy exemptions to those with low exemptions. Despite home equity loans or lines of credit being collateralized loans, Berger, Cerqueiro and Penas (2009) document how the challenges that banks face in foreclosing on such transactions in high-exemption states makes banks less willing to lend against personal property. If collateral is critical, their work suggests that we should find a stronger impact in low-exemption states, where the value of collateral is more protected and hence banks are more willing to lend when collateral potential is unlocked. And at the other end, this logic suggests home owners in states with unlimited exemptions may be unable to unlock loans no matter how high their house prices soar due to the inability of banks to use these properties for collateral.

We split our sample by whether states have unlimited homestead exemptions or not. We benefit in this analysis by the fortuitous fact that our big states are evenly divided along this dimension—e.g., Florida and Texas have unlimited exemptions, while California and Illinois both have homestead limits of $75,000 or less during our sample period. We next use the SBO data to verify that these homestead legal differences connect to meaningful differences in home equity lending practices. The average share of 2000-2007 start-ups in the 2007 SBO that report using home equity is 15.0% in states with limited exemptions, versus 8.9% in states with unlimited exemptions. Similar differentials hold using all states and when looking at home equity lending for expansion capital. Columns 2 and 3 of Table 10 split our LEHD sample along this same dimension and find, however, that the entrepreneurial reaction is higher in states with unlimited homestead exemptions. This would not be consistent with a mechanism like collateral that links home ownership to entrepreneurship through the willingness of banks to lend more.

Columns 4-7 examine different attributes of the local lending environment. Columns 4 and 5 compare counties with a high share of commercial banks specializing in mortgage lending (as reported to the Federal Deposit Insurance Corporation) to those with relatively few specialist mortgage banks. We find that entrepreneurship is slightly higher in counties with lower-than-median share of commercial banks specializing in mortgage lending. Columns 6 and 7 similarly compare counties with high bank concentration to those with greater banking competition. The literature on bank competition suggests that more-competitive banking markets are likely to be ones where banks are more responsive to the needs of young and small businesses. Yet, again we find no differential response in counties with low levels of banking concentration.

In summary, our decomposition exercises along industry and state lines find limited evidence of asymmetries that would support a strong collateral channel operating for entrepreneurship; the broad-based and rather homogeneous responses instead appear better aligned with an increased demand for entrepreneurship driven by an increase in home equity. This would be similar to studies of other windfall gains leading workers to be more willing to experiment with starting a new business (e.g., Lindh and Ohlsson, 1996; Anderson and Nielsen, 2012; Manso, 2015). This

is not to suggest that home equity loans and the use of homes for collateral are not important—our SBO tabulations clearly show that about 13% of young businesses rely on them, more than family/friend loans. Comparable levels of using personal real estate as collateral are also recorded in the 1998 Survey of Small Business Finances. But, in general, we do not find evidence that suggests home price appreciations dramatically unlock entrepreneurship via collateral channels.

5 Conclusions

The financing conditions of entrepreneurs is a topic of central importance given the link of young firms to economic growth. The massive recent swings in home prices in the United States and other countries have brought renewed interest to the role of adjustments in home equity in decisions to start new firms. Home equity has the potential to play an important role since it is amenable to pledging against bank loans and because its swings can provide substantial windfalls or losses. Yet, looking at the massive price growth during 2000-2004, we find only modest connections between home price changes and rates of entrepreneurship that we can reasonably link to home equity growth that home owners experience. Once we account for aggregate demand, the magnitudes we estimate are about a third of prior studies. Even when we do connect rising housing equity to entrepreneurship, many of the patterns we observe suggest an increased demand for entrepreneurship due to rising housing wealth that is at least as strong as adjustments in credit supply from banks. In sum, increases in housing collateral due to house price increases appear to play at best a modest role in alleviating credit constraints for entrepreneurs, especially in comparison to the large impact of home price appreciations that have been observed in other settings, like rising consumer debt. These findings suggest either that financing constraints are not binding for the average entrepreneur in the United States (as with Hurst and Lusardi (2004)) or that if they are binding, changes in the value of the owner's housing collateral is unlikely to play a strong role in alleviating them.

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Fig. 1: Average US House Prices

Data Source: Federal Housing Finance Agency

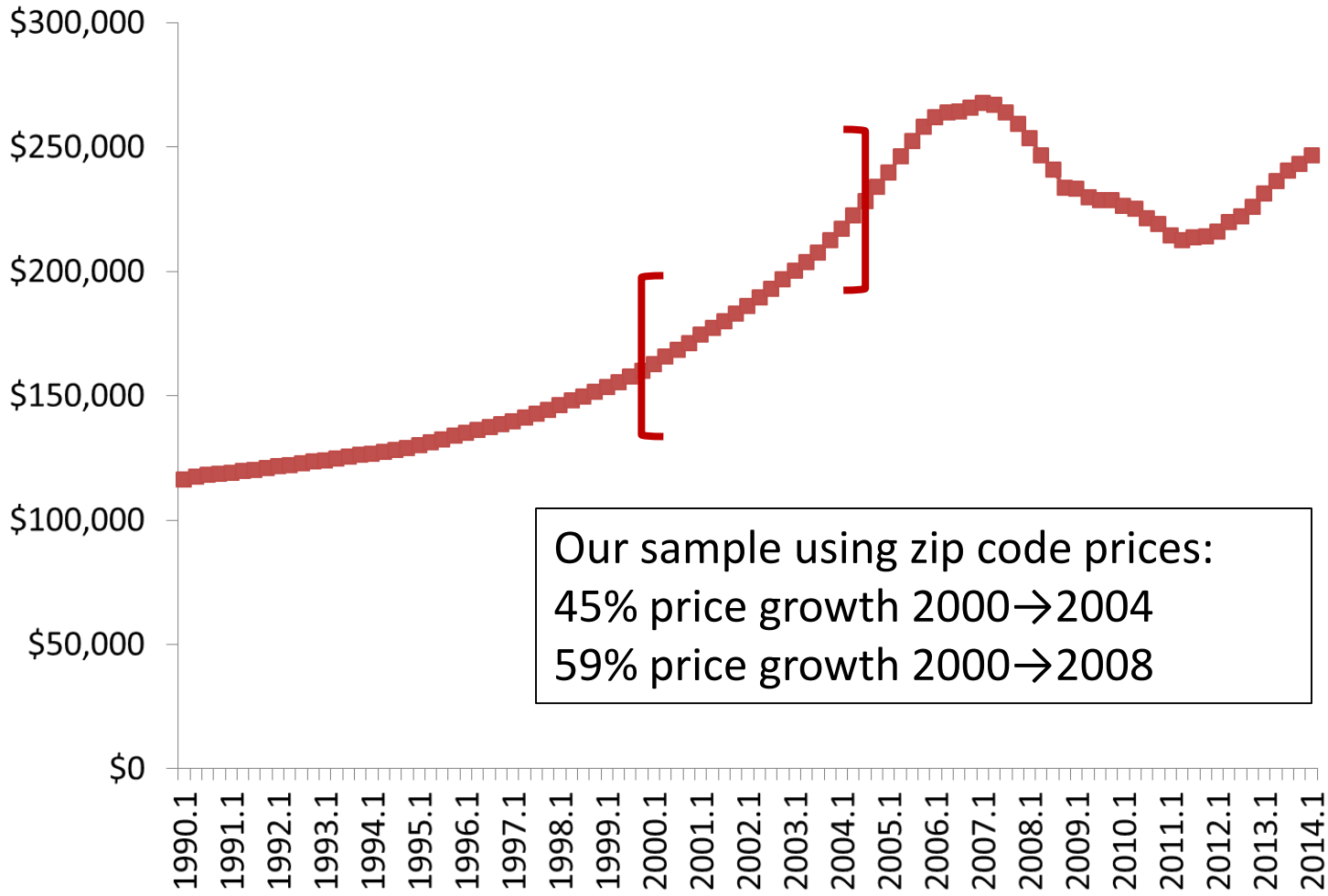

Figure 2: LEHD State Coverage

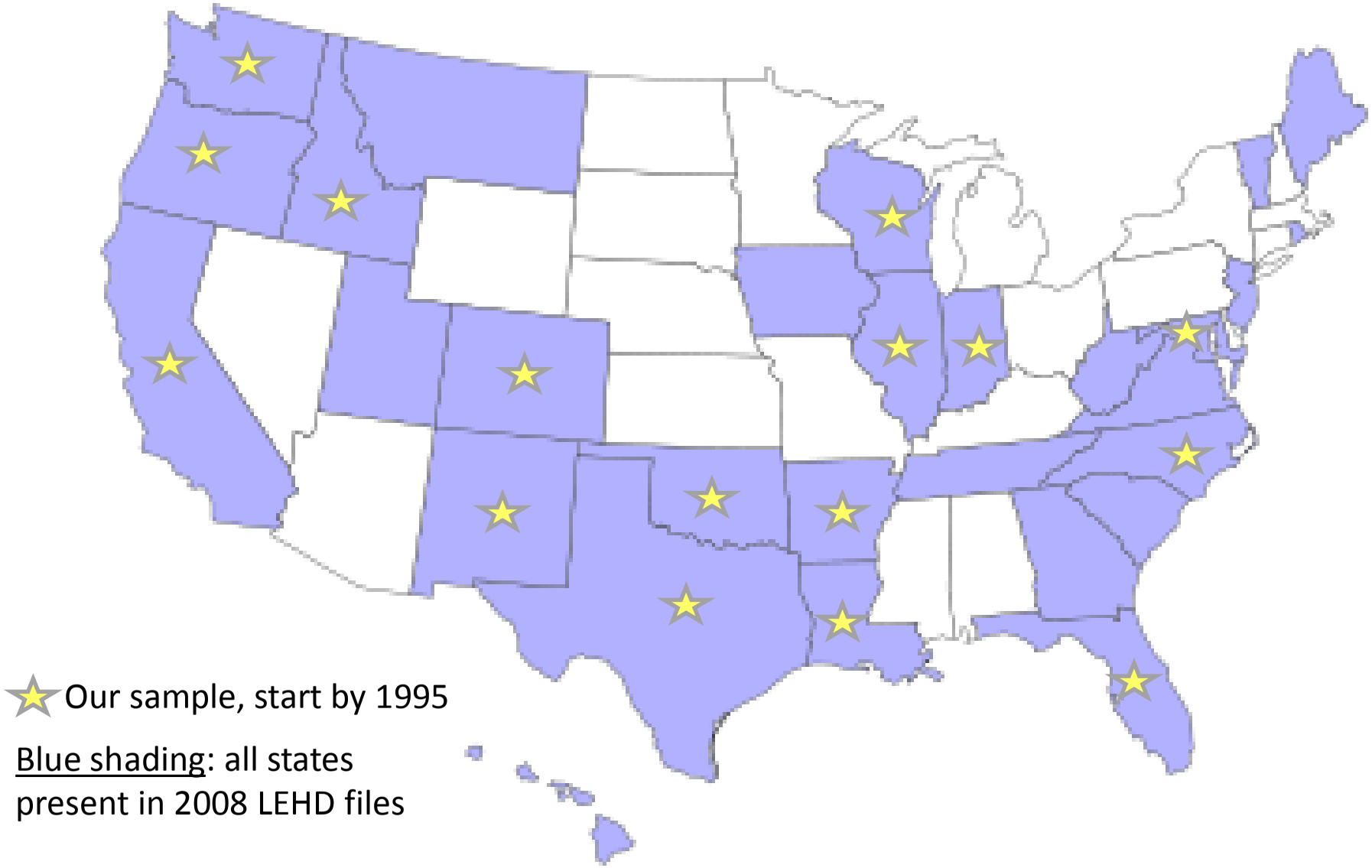

Table 1

Descriptive statistics on LEHD sample

Notes: This table provides descriptive statistics on our sample. Our sample includes working individuals present in 2000, 2004, and 2008 in one of 16 states included in the LEHD by 2000: AR, 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, listed observation counts are rounded.

	Respondent home ownership in 2000	All	Owner	Renter
		(1)	(2)	(3)
(1)	N	807,800	567,500	240,300
(2)	Share	1.00	0.70	0.30
(3)	Zip code house price 2004 / price 2000	1.45	1.43	1.51
(4)	Zip code house price 2008 / price 2000	1.59	1.56	1.66
(5)	CBSA house price 2004 / price 2000	1.33	1.32	1.36
(6)	CBSA house price 2008 / price 2000	1.47	1.46	1.49
(7)	Business owner 2004	0.0169	0.0173	0.0158
(8)	Business owner 2008	0.0238	0.0246	0.0219
(9)	Age	38.10	39.33	35.20
(10)	Male	0.53	0.53	0.52
(11)	Hispanic	0.13	0.11	0.19
(12)	African American	0.07	0.05	0.12
(13)	Asian	0.06	0.05	0.07
(14)	Immigrant	0.17	0.15	0.22
(15)	Married	0.73	0.83	0.49
(16)	Bachelor's education and higher	0.39	0.42	0.31
(17)	Renter	0.30	0.00	1.00
(18)	Own with mortgage	0.67	0.95	0.00
(19)	Own without mortgage	0.03	0.05	0.00
(20)	Home value (max=$1 million)	188,764	188,764	n.a.
(21)	Implied rental value	169,311	n.a.	169,311
(22)	Move-in date	1993.57	1992.50	1996.10
(23)	Household income (max=$2.5 million)	77,539	88,753	51,057
(24)	LEHD earnings 2000	45,234	50,936	31,768
(25)	LEHD earnings 2004	54,904	60,954	40,615
(26)	LEHD earnings 2008	64,544	70,745	49,898
(27)	Equity increase relative to initial financial position, zip prices	0.57	0.45	0.86
(28)	Equity increase relative to initial financial position, CBSA prices	0.42	0.34	0.60

Table 2

Estimations of city-level house price changes and entry rates for wage workers in 2000

Notes: This table reports regressions of aggregate CBSA-level transitions of wage workers in 2000 into entrepreneurship in 2004 with CBSA-level home price appreciations from 2000 to 2004. The sample is restricted to 145 CBSAs for which a house price elasticity from Saiz (2010) is known. The dependent variables are the shares of 2000 wage workers by home ownership type in the CBSA observed to be entrepreneurs in 2004. Regressions include fixed effects for four Census regions. Estimations report robust standard errors. Columns 1-3 report OLS estimations, and Columns 4-6 report estimations that instrument for local house price with the elasticity of housing in the CBSA as measured by Saiz (2010) due to geographic features of the local area. Within each triplet of columns, the first column reports outcomes for all wage workers in 2000, the second column for wage workers who are home owners in 2000, and the third column for wage workers who are renters in 2000. Estimations weight CBSAs by the number of individual observations that are included in the CBSA for the worker type being studied.

	OLS estimations			IV estimations		
	Total worker set in 2000	Home owners in 2000	Renters in 2000	Total worker set in 2000	Home owners in 2000	Renters in 2000
	(1)	(2)	(3)	(4)	(5)	(6)
	DV: Share of CBSA wage workers in 2000 that become entrepreneurs in 2004					
Log CBSA house price growth from 2000-2004	0.0138	0.0156	0.0102	0.0327	0.0344	0.0307
	(0.0041)	(0.0047)	(0.0040)	(0.0067)	(0.0074)	(0.0079)
Number of observations	145	145	145	145	145	145
Mean of dependent variable	0.0155	0.0155	0.0157	0.0155	0.0155	0.0157
Mean price growth effect / mean of DV	0.2539	0.2870	0.1853	0.6016	0.6329	0.5576
F-statistic in first stage				44.47	50.48	37.66

Table 3

Variations on house price levels and geographic fixed effects

Notes: This table reports regressions of individual-level transitions of wage workers in 2000 into entrepreneurship in 2004 with house price appreciations from 2000 to 2004. Columns 1-3 consider home owners, using 2000 house values and local price changes. Columns 4-6 consider renters, using value of rented dwellings and local price changes (a pseudo placebo). Home equity change relative to financial position is measured as (home value in 2000 * home price growth 2000-2004) / (estimated home equity in 2000 + household income in 2000). This calculation is done for renters as if they owned their dwelling, based upon its value and their move-in date. Columns 1-2 and 4-5 include unreported fixed effects for four Census regions. Columns 3 and 6 include fixed effects for 5909 zip codes. Where appropriate, the main effect for local price changes is reported. Regressions include unreported fixed effects for the following traits of individuals, with category counts in parentheses: 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), date of move-in to residency (6), and owning home without mortgage (1). Accumulated earnings are measured relative to the respondent's state due to different durations of states in the LEHD sample. Standard errors are clustered at the zip code level. Mean estimated price growth effect is calculated as the average log price change 2000-2004 multiplied by its coefficient and divided by mean of dependent variable. Mean estimated financial position effect is similarly defined. The appendix repeats these estimations in a net entry format that includes entrepreneurs in 2000.

Home owner status	Home Owners in 2000			Renters in 2000		
Geographic fixed effect level	Region	Region	Zip	Region	Region	Zip
	(1)	(2)	(3)	(4)	(5)	(6)
			A. CBSA house price index			
Log price change 2000-2004	0.0173	0.0062		0.0119	0.0099	
	(0.0022)	(0.0036)		(0.0029)	(0.0054)	
Home equity change relative to		0.0077	0.0065		0.0006	0.0000
financial position		(0.0022)	(0.0022)		(0.0020)	(0.0021)
Log home value 2000	0.0061	0.0050	0.0048	0.0037	0.0035	0.0035
	(0.0004)	(0.0005)	(0.0006)	(0.0008)	(0.0009)	(0.0010)
Log household income 2000	0.0046	0.0057	0.0053	0.0022	0.0023	0.0022
	(0.0008)	(0.0006)	(0.0006)	(0.0006)	(0.0007)	(0.0008)
Number of observations	567,500	567,500	567,500	240,300	240,300	240,300
Mean of dependent variable	0.0173	0.0173	0.0173	0.0158	0.0158	0.0158
Mean estimated price growth effect	0.2768	0.0992		0.2290	0.1905	
Mean estimated financial position effect		0.1504	0.1269		0.0227	0.0000
			B. Zip code house price index			
Log price change 2000-2004	0.0089	0.0035		0.0047	0.0050	
	(0.0012)	(0.0022)		(0.0016)	(0.0030)	
Home equity change relative to		0.0033	0.0034		-0.0002	0.0000
financial position		(0.0013)	(0.0013)		(0.0010)	(0.0011)
Log home value 2000	0.0062	0.0056	0.0050	0.0038	0.0038	0.0035
	(0.0004)	(0.0004)	(0.0005)	(0.0008)	(0.0008)	(0.0010)
Log household income 2000	0.0046	0.0053	0.0050	0.0022	0.0021	0.0021
	(0.0005)	(0.0005)	(0.0005)	(0.0006)	(0.0007)	(0.0007)
Number of observations	567,500	567,500	567,500	240,300	240,300	240,300
Mean of dependent variable	0.0173	0.0173	0.0173	0.0158	0.0158	0.0158
Mean estimated price growth effect	0.1830	0.0720		0.1228	0.1307	
Mean estimated financial position effect		0.0866	0.0892		-0.0109	0.0000

Table 4

Example calculation of entry decomposition due to house price growth

Notes: This table presents a representative calculation of house price growth effects and entry rates. Panel A provides base traits for our sample taken from Table 1 for the LEHD sample. Panel B provides beta coefficients from Table 3 (Columns 2 and 4) for local price relationships to entry using zip code prices. The renter coefficient for relative price increase is set to zero, with its true coefficient being -0.0002 (0.0010). Panel C provides calculations of the estimated entry impact related to 1) home equity change relative to financial position and 2) response associated with broader house price changes. The total entry response is the sum of these two. Panel E combines these for a representative population of 70% home owners and 30% renters. The last row provides the share of the total entry effect associated with house price gains that is related to changes in relative financial positions.

		Owner	Renter	Calculation
A. Base traits from Table 1				
A1	Zip code price ratio	1.4273	1.5113	
A2	Estimated financial gain	0.4539	0.8598	
A3	Mean of dependent variable	0.0173	0.0158	
B. Representative beta coefficients from Table 3				
B1	Beta: entry due to relative increase	0.0033	0.0000	Table 3 Panel B
B2	Beta: entry due to area-wide prices	0.0035	0.0050	Table 3 Panel B
C. Magnitude of response				
C1	Estimated entry response for relative financial gain	0.0015	0.0000	A2*B1
C2	Estimated entry response with broader house price changes	0.0012	0.0021	ln(A1)*B2
D. Elasticity relative to baseline entry rate				
D1	Elasticity of relative financial gain	8.66%	0.00%	C1/A3
D2	Elasticity of broader house price changes	7.20%	13.07%	C2/A3
D3	Total elasticity	15.86%	13.07%	D1+D2
D4	Share due to relative financial gain	54.6%	0.0%	D1/D3
E. Estimated aggregate response using 70% home ownership rate				
E1	Estimated aggregate elasticity for relative financial gain		6.06%	0.7* owner D1+0.3* renter D1
E2	Estimated aggregate elasticity with broader house price changes		8.96%	0.7* owner D2+0.3* renter D2
E3	Total aggregate entry elasticity		15.02%	E1+E2
E4	Share of aggregate entry due to relative financial gain		**40.35%**	E1/E3

Table 5

Variations across entrant employment levels and longevity

Notes: See Table 3.

	Baseline estimation for being entrepreneur in 2004	Considering entry of businesses with five or fewer employees in 2004	Considering entry of businesses with more than five employees in 2004	Considering short-term entry measured as 2004 entrant that closes by 2008	Considering long-term entry measured as 2004 entrant that is in operation in 2008
	(1)	(2)	(3)	(4)	(5)
Home equity change relative to financial position	0.0034	0.0007	0.0026	0.0022	0.0011
	(0.0013)	(0.0006)	(0.0011)	(0.0008)	(0.0010)
Number of observations	567,500	567,500	567,500	567,500	567,500
Mean of dependent variable	0.0173	0.0038	0.0135	0.0069	0.0104
Mean estimated financial position effect	0.0892	0.0836	0.0874	0.1447	0.0480

Table 6

Stacked specification

Notes: See Table 3. Regressions pool owners and renters and contain 807,800 observations.

	Baseline that estimates uniform covariate effects			Interacting individual covariates with ownership		
Geographic fixed effect level	Region	Region	Zip	Region	Region	Zip
	(1)	(2)	(3)	(4)	(5)	(6)
			A. CBSA house price index			
Home owner in 2000	0.0033	0.0028	0.0031	0.0034	0.0044	0.0050
	(0.0008)	(0.0009)	(0.0009)	(0.0062)	(0.0063)	(0.0063)
Log price change 2000-2004	0.0171	0.0140		0.0176	0.0161	
	(0.0024)	(0.0041)		(0.0025)	(0.0052)	
Owner x Log price change 2000-2004	-0.0019	-0.0084	-0.0073	-0.0026	-0.0118	-0.0111
	(0.0025)	(0.0041)	(0.0042)	(0.0027)	(0.0060)	(0.0061)
Home equity change relative to		0.0014	0.0010		0.0006	0.0001
financial position		(0.0014)	(0.0015)		(0.0020)	(0.0020)
Owner x Home equity change relative to		0.0052	0.0045		0.0068	0.0064
financial position		(0.0019)	(0.0019)		(0.0029)	(0.0030)
Log home value 2000	0.0051	0.0043	0.0039	0.0041	0.0039	0.0038
	(0.0004)	(0.0004)	(0.0005)	(0.0008)	(0.0009)	(0.0009)
Log household income 2000	0.0037	0.0044	0.0042	0.0022	0.0023	0.0022
	(0.0004)	(0.0004)	(0.0005)	(0.0006)	(0.0007)	(0.0007)
Mean of dependent variable - owner	0.0173	0.0173	0.0173	0.0173	0.0173	0.0173
Mean of dependent variable - renter	0.0158	0.0158	0.0158	0.0158	0.0158	0.0158
Mean est. price growth effect - owner	0.2432	0.0896		0.2400	0.0688	
Mean est. price growth effect - renter	0.3290	0.2694		0.3387	0.3098	
Mean est. financial position effect - owner		0.1289	0.1074		0.1445	0.1269
Mean est. financial position effect - renter		0.0529	0.0378		0.0227	0.0038
			B. Zip code house price index			
Home owner in 2000	0.0028	0.0010	0.0014	0.0027	0.0017	0.0024
	(0.0004)	(0.0008)	(0.0008)	(0.0062)	(0.0062)	(0.0062)
Log price change 2000-2004	0.0077	0.0077		0.0082	0.0083	
	(0.0014)	(0.0025)		(0.0014)	(0.0030)	
Owner x Log price change 2000-2004	-0.0004	-0.0050	-0.0044	-0.0008	-0.0060	-0.0054
	(0.0015)	(0.0028)	(0.0028)	(0.0016)	(0.0035)	(0.0036)
Home equity change relative to		0.0001	0.0004		-0.0001	0.0002
financial position		(0.0008)	(0.0008)		(0.0010)	(0.0010)
Owner x Home equity change		0.0028	0.0026		0.0032	0.0030
relative to financial position		(0.0012)	(0.0012)		(0.0016)	(0.0016)
Log home value 2000	0.0052	0.0048	0.0041	0.0043	0.0043	0.0038
	(0.0004)	(0.0004)	(0.0004)	(0.0008)	(0.0008)	(0.0009)
Log household income 2000	0.0037	0.0041	0.0040	0.0022	0.0022	0.0022
	(0.0004)	(0.0004)	(0.0004)	(0.0006)	(0.0007)	(0.0007)
Mean of dependent variable - owner	0.0173	0.0173	0.0173	0.0173	0.0173	0.0173
Mean of dependent variable - renter	0.0158	0.0158	0.0158	0.0158	0.0158	0.0158
Mean est. price growth effect - owner	0.1501	0.0555		0.1522	0.0473	
Mean est. price growth effect - renter	0.2013	0.2013		0.2143	0.2169	
Mean est. financial position effect - owner		0.0761	0.0787		0.0813	0.0840
Mean est. financial position effect - renter		0.0054	0.0218		-0.0054	0.0109

Table 7a

Robustness checks on specification design

Notes: See Table 3. Estimations consider robustness checks on Panel B and Column 3 of Table 3, which considers for home owners estimated equity increases using price changes at the zip code level and zip code fixed effects. Column 3's extended fixed effects include occupation (511), industry (211), time period of immigration (8), and number of children (4).

	Baseline estimation for being entrepreneur in 2004	Substituting control for log estimated initial home equity instead of log home value	Including fixed effects for additional attributes	Including log control for monthly mortgage payment	Including fixed effects for deciles of monthly mortgage payment	Including additional regressor for interaction of price changes and 2000 household income	Excluding individuals less than 30 years old	Excluding individuals greater than 45 years old	Considering entry rate to 2008
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Home equity change relative to financial position	0.0034	0.0038	0.0028	0.0030	0.0026	0.0039	0.0034	0.0042	0.0049
	(0.0013)	(0.0013)	(0.0013)	(0.0013)	(0.0013)	(0.0014)	(0.0014)	(0.0015)	(0.0015)
Number of observations	567,500	567,500	567,500	567,500	567,500	567,500	518,100	446,700	567,500
Mean of dependent variable	0.0173	0.0173	0.0173	0.0173	0.0173	0.0173	0.0168	0.0186	0.0246
Mean estimated financial position effect	0.0892	0.0997	0.0735	0.0787	0.0682	0.1023	0.0919	0.1025	0.0904

Table 7b

Robustness checks on relative financial gain metric

Notes: See Table 3. Estimations consider variations in the denominator used to calculate relative financial gain.

	Using LEHD earnings in 2000 instead of household income	Setting home equity at 50% of estimate	Setting home equity at 200% of estimate	Setting household income at 50% of estimate	Setting household income at 200% of estimate
	(1)	(2)	(3)	(4)	(5)
Home equity change relative to financial position	0.0023	0.0032	0.0037	0.0018	0.0064
	(0.0008)	(0.0009)	(0.0018)	(0.0009)	(0.0019)
Number of observations	567,500	567,500	567,500	567,500	567,500
Mean of dependent variable	0.0173	0.0173	0.0173	0.0173	0.0173
Mean of new metric for financial gain	0.6000	0.6195	0.3021	0.6042	0.3098
Mean estimated financial position effect	0.0798	0.1146	0.0646	0.0629	0.1146

Table 8

Estimations of sector choice and mobility by transitioning wage workers

Notes: See Table 3. This table reports regressions that identify the relationship between entry and city moves for transitioning wage workers. Coefficient values for Columns 2 and 3 add up to the baseline effect, and coefficient values for Columns 4-6 add up to the coefficient in Column 3. Sample excludes individuals in rural areas or unknown MSAs in 2000 or 2004.

Dependent variable	Entrepreneur in 2004	Entrepreneur in 2004 and no MSA move	Entrepreneur in 2004 and MSA move	New MSA has home prices: >20% more expensive	Similar price range	>20% cheaper
	(1)	(2)	(3)	(4)	(5)	(6)
			A. All entry			
Home equity change relative to financial position	0.0034	0.0032	0.0005	-0.0002	0.0001	0.0006
	(0.0013)	(0.0012)	(0.0005)	(0.0002)	(0.0003)	(0.0003)
Number of observations	542,200	542,200	542,200	542,200	542,200	542,200
Mean of dependent variable	0.0166	0.0133	0.0033	0.0006	0.0018	0.0008
Mean estimated financial position effect	0.0930	0.1092	0.0688	-0.1513	0.0252	0.3404
			B. Entering low capital-intensity sectors			
Home equity change relative to financial position	0.0025	0.0020	0.0005	-0.0002	0.0000	0.0007
	(0.0011)	(0.0010)	(0.0005)	(0.0002)	(0.0003)	(0.0003)
Number of observations	542,200	542,200	542,200	542,200	542,200	542,200
Mean of dependent variable	0.0131	0.0104	0.0026	0.0005	0.0015	0.0006
Mean estimated financial position effect	0.0866	0.0873	0.0873	-0.1816	0.0000	0.5296
			C. Entering high capital-intensity sectors			
Home equity change relative to financial position	0.0011	0.0012	0.0000	0.0000	0.0001	-0.0001
	(0.0006)	(0.0006)	(0.0002)	(0.0001)	(0.0002)	(0.0001)
Number of observations	542,200	542,200	542,200	542,200	542,200	542,200
Mean of dependent variable	0.0036	0.0029	0.0007	0.0001	0.0004	0.0002
Mean estimated financial position effect	0.1387	0.1878	0.0000	0.0000	0.1135	-0.2270

Table 9

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

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

	Sample breakdown			Additional examples of financing employed				
	No start-up capital raised	Capital used does not include home equity loans	Capital used includes home equity loans	Capital used includes personal savings	Capital used includes personal assets	Capital used includes credit cards	Capital used includes business loan from a bank	Capital used includes business loan from family or friends
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	A. Dependent variable is share of firms entering during 2000-2007 indicating reported financing							
Log house price levels in 2000	0.0226	-0.0344	0.0119	-0.0080	0.0013	0.0101	-0.0296	-0.0145
	(0.0153)	(0.0200)	(0.0165)	(0.0365)	(0.0141)	(0.0174)	(0.0379)	(0.0130)
Log house price growth from 2000-2007	0.0043	-0.0429	0.0386	-0.0078	0.0168	0.0054	-0.0244	-0.0118
	(0.0119)	(0.0160)	(0.0158)	(0.0281)	(0.0114)	(0.0153)	(0.0354)	(0.0070)
Mean of dependent variable	0.0804	0.7875	0.1321	0.7267	0.1307	0.0822	0.2291	0.0523
Mean price growth effect	0.0016	-0.0160	0.0143	-0.0029	0.0063	0.0020	-0.0091	-0.0044
Growth effect / mean of DV	0.0201	-0.0203	0.1086	-0.0040	0.0479	0.0243	-0.0396	-0.0840
	B. Dependent variable is log count of firms entering during 2000-2007 indicating reported financing							
Log house price levels in 2000	0.6473	0.3955	0.5022	0.4157	0.4374	0.4947	0.1288	0.1769
	(0.3356)	(0.2385)	(0.1946)	(0.2504)	(0.2085)	(0.2307)	(0.2199)	(0.2234)
Log house price growth from 2000-2007	0.3665	0.2025	0.5165	0.2569	0.3727	0.3682	-0.0601	0.0382
	(0.2680)	(0.2098)	(0.1900)	(0.2167)	(0.2146)	(0.2370)	(0.1561)	(0.1771)

Table 10

Estimations with partitions based upon local lending conditions

Notes: See Table 3. This table splits the sample by local lending traits. Columns 2 and 3 split states by whether they have unlimited homestead exemptions in bankruptcy laws. Columns 4-5 split counties by whether they are above or below the median share of commercial banks specialized in mortgage lending in terms of local bank composition. Columns 6-7 split counties by whether they are above or below the median concentration levels of banks in terms of market shares as measure of local banking competition.

	Full sample	Homestead exemption		County mortgage lending		County bank HHI	
		Unlimited	Limited	Low	High	Low	High
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Home equity change relative to	0.0034	0.0062	0.0025	0.0035	0.0029	0.0033	0.0032
financial position	(0.0013)	(0.0036)	(0.0014)	(0.0028)	(0.0016)	(0.0016)	(0.0022)
Number of observations	567,500	148,600	418,900	275,600	291,900	299,400	268,100
Mean of dependent variable	0.0173	0.0202	0.0163	0.0174	0.0172	0.0177	0.0169
Mean estimated financial position effect	0.0892	0.1393	0.0696	0.0913	0.0765	0.0846	0.0859

Appendix Table 1

Table 3 examining net entry rates

Notes: This table repeats Table 3 using all individuals in 2000 to model net entrepreneurship responses. Estimations add a fixed effect for being an entrepreneur in 2000.

Home owner status	Home Owners in 2000			Renters in 2000		
Geographic fixed effect level	Region	Region	Zip	Region	Region	Zip
	(1)	(2)	(3)	(4)	(5)	(6)
			A. CBSA house price index			
Entrepreneur 2000	0.6651	0.6651	0.6634	0.4891	0.4891	0.4881
	(0.0041)	(0.0041)	(0.0041)	(0.0078)	(0.0078)	(0.0079)
Log price change 2000-2004	0.0194	0.0064		0.0138	0.0149	
	(0.0025)	(0.0039)		(0.0033)	(0.0061)	
Home equity change relative to		0.0090	0.0068		-0.0005	-0.0013
financial position		(0.0024)	(0.0024)		(0.0022)	(0.0023)
Log home value 2000	0.0077	0.0065	0.0073	0.0038	0.0039	0.0042
	(0.0005)	(0.0005)	(0.0006)	(0.0009)	(0.0010)	(0.0011)
Log household income 2000	0.0052	0.0066	0.0061	0.0025	0.0024	0.0021
	(0.0006)	(0.0006)	(0.0007)	(0.0006)	(0.0008)	(0.0008)
Number of observations	581,900	581,900	581,900	244,600	244,600	244,600
Mean of dependent variable	0.0338	0.0338	0.0338	0.0245	0.0245	0.0245
			B. Zip code house price index			
Entrepreneur 2000	0.6652	0.6646	0.6634	0.4891	0.4891	0.4881
	(0.0041)	(0.0039)	(0.0041)	(0.0078)	(0.0078)	(0.0079)
Log price change 2000-2004	0.0101	0.0033		0.0066	0.0090	
	(0.0014)	(0.0024)		(0.0017)	(0.0034)	
Home equity change relative to		0.0042	0.0037		-0.0009	-0.0007
financial position		(0.0013)	(0.0013)		(0.0011)	(0.0012)
Log home value 2000	0.0078	0.0071	0.0075	0.0039	0.0042	0.0042
	(0.0005)	(0.0005)	(0.0006)	(0.0009)	(0.0009)	(0.0011)
Log household income 2000	0.0053	0.0061	0.0058	0.0025	0.0021	0.0022
	(0.0006)	(0.0006)	(0.0006)	(0.0006)	(0.0007)	(0.0008)
Number of observations	581,900	581,900	581,900	244,600	244,600	244,600
Mean of dependent variable	0.0338	0.0338	0.0338	0.0245	0.0245	0.0245