House Prices, Home Equity Borrowing, and Entrepreneurship

Abstract

This paper shows that housing wealth helps alleviate credit constraints for potential entrepreneurs by enabling home owners to extract equity from their property and invest it in their business. Using a large US individual-level survey dataset over the $1996 - 2006$ period, we find that a 10% increase in home equity raises the share of individuals who transition into self-employment each year from 1% to 1.07%. Our results persist when we use proxies for aggregate housing demand shocks and for the topological elasticity of housing supply to generate variation in home equity that is orthogonal to entrepreneurial choice.

JEL classification: G21, L26.

Keywords: Credit constraints; home equity borrowing; new business creation.

1 Introduction

In this paper, we identify the effect of housing wealth on new business creation by exploiting the exogenous variation in home equity induced by the US housing boom of the late 1990s and early-to-mid 2000s. Using a uniquely suited individual-level dataset of US home owners and renters, we investigate how changes in home equity affect the probability of becoming an entrepreneur. This allows us to study whether nascent entrepreneurs are deterred by credit constraints, and whether the ability to extract housing wealth by increasing their mortgage helps them overcome these constraints.

A number of influential papers have suggested that potential entrepreneurs can be discouraged from starting a business if borrowing constraints prevent them from raising sufficient capital.[1] Black and Strahan (2002), Cetorelli and Strahan (2006), and Kerr and Nanda (2009a) document a strong impact of positive shocks to access to external finance following banking deregulation in the US, on the rates of new business creation. A house price boom can provide another source of exogenous shocks to credit constraints whereby start-ups can extract the additional home equity in their property and invest it in their business. The effect is potentially significant given that residential property represent 60% of all personal wealth in the US (US Census, 2010), and that prior research has already documented the households' propensity to extract equity from their home, to various ends. For example, Hurst and Stafford (2004) highlight home equity borrowing as a mechanism whereby households smooth their consumption over time. Mian and Sufi (2011) empirically investigate how existing homeowners responded to the rising value of their home equity between 2002 and 2006. They provide evidence that this home equity-based borrowing channel, which may have been fueled by increasing availability of mortgage credit, was an important cause for the rapid rise in household leverage in the run-up to the financial crisis of 2008-09.

The magnitude of the US house price boom provides for an ideal identification of the home equity borrowing channel of entrepreneurship. Nationally, real home prices rose by 86% between the fourth quarter of 1996 and the first quarter of 2006 (Shiller, 2007), but there were large regional

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[1] For important contributions, see Evans and Jovanovic (1989), Evans and Leighton (1989), Holtz-Eakin, Joulfain, and Rosen (1994), Blanchflower and Oswald (1998), and Wang, Wang, and Yang (2012), among others. See Kerr and Nanda (2009b) for a thorough review of the literature.

differences. For example, over this period home prices almost tripled in Miami, but declined by 10% in Detroit. Figure 1 plots the change in establishments births between 2003 and 2006 (the peak of the housing boom) against the change in the state-level Federal Housing Finance Agency house price indices over the same period, inflation-adjusted, for the 50 US states plus the District of Columbia. A positive relationship is readily available, suggesting higher entrepreneurial activity in states with a house price boom.

We investigate the link between housing and new business creation using micro-data on home equity and business ownership from the Survey of Income and Program Participation (SIPP) of the US Census Bureau, from 1997 to 2006. In each survey year, the respondents are asked whether they run and/or operate a business and what the value of their business equity is. They are also asked questions about their residential property. We construct an empirical proxy for home equity as the difference between the value of the household's property and the size of the household's mortgage. The survey also contains household-level data on a variety of other relevant characteristics, such as the household's non-housing wealth and labor income and the head's age, race, education, and marital status. We control for housing debt, too, to account for the possibility that more levered households may harbor higher entrepreneurial tendencies. We control for MSA × year fixed effects in order to identify variation across households residing in the same MSA at the same point in time. The three SIPP panels put together contain information on $78,793$ unique households interviewed during the years $1996 - 2000$, $2001 - 2003$, and $2004 - 2006$, for a total of $217,014$ possible observations.

The central part of the paper deals with the identification of the collateral channel. There are non-trivial endogeneity concerns related to the impact of home equity on the transition into entrepreneurship. Individuals who ultimately become entrepreneurs can be different from the rest in ways which matter for entrepreneurship. For example, they may disproportionately reside in areas with booming local economies where the propensity to start a business is higher. In fact, it is highly likely that the areas which experienced the largest house price booms during the early-to-mid 2000s were also intrinsically entrepreneurial areas (such as large coastal cities). Alternatively, an outward shift in the supply of credit which accelerated house price growth (see Mian and Sufi, 2009)

may have also relaxed constraints on business loans, leading to higher levels of self-employment. And even in the absence of such omitted variable bias, rising house prices can feed back into local demand booms, raising the return to entrepreneurship.

We implement a number of empirical strategies to differentiate exogenous shocks to housing wealth from local economic effects (such as demand booms) which may be correlated with changes in house prices and in small business creation. First, we employ a version of the identification strategy suggested by Chetty and Szeidl (2010). Namely, we use the change in average *US-wide* house prices between the year when the house was bought and the current year, divided by the *local* (MSA-level) topological elasticity of housing supply from Saiz (2010), as an instrument for home equity. The idea behind this approach is that an increase in the economy-wide demand for housing will increase house prices, and this effect should be stronger in MSAs with less elastic housing supply where the adjustment in response to aggregate demand shocks takes place on the price margin. Second, we repeat our analysis only on the sub-sample of individuals who live in the MSAs with the most elastic housing supply. By doing so, we address the concern that the propensity to start a business can be positively correlated with the local price response to economy-wide changes in housing demand. Third, we seek to alleviate concerns that the house price boom is driving entrepreneurship directly, by excluding from the analysis business start-ups in construction, finance, and real estate. We also exclude business start-ups in health and education to account for the fact that the collateral channel we identify may be contaminated by a housing boom-driven increase in the demand for services with high income elasticities. Fourth, we compare home owners to renters, hypothesizing that the same increase in house prices should affect entrepreneurial propensity relatively more for home owners as renters lack entirely the collateral channel. Finally, we compare the change in mortgage debt of new business owners and of non-business owners around the same point in time in the same geographic locality. If the home equity borrowing channel is active, mortgage debt should increase more for new business owners, year-on-year, as these are expected to draw down their home equity in order to increase their business investment.

We find that the probability of starting a new business is strongly positively correlated with the value of the home equity. A 10% increase in home equity raises the probability that a non-business

owning household will switch to entrepreneurship in the next period by up to 7%. This effect translates into an increase in the share of households in the sample who switch to self-employment from around 1% to 1.07%, from one year to the other. The results remain statistically robust to model specification and to accounting for a number of data features and alternative explanations. In particular, the positive effect of lagged home equity on the probability of starting a business is robust to controlling for a wide range of demographic and income characteristics, for the local business cycle, and for the bankruptcy code, and it is not driven by the propensity of individuals to start a new business when more levered. It is positive and significant regardless of whether we define business ownership in terms of owning and operating a business, in terms of holding non-zero business equity, or in terms of either. It is still present in the data when we correct for potential incidental variables problem and when we account for the fact that the SIPP oversamples low-income areas. Crucially, it survives when we use global housing demand shocks and the local elasticity of housing supply to extract the exogenous element of the change in housing wealth; when we look at areas where the propensity to start a business is unlikely to be correlated with changes in house prices; when we exclude new businesses likely driven by local demand booms; and when we compare owners to renters. We also find a strong positive correlation between new business ownership and the change in mortgage debt. This implies that once they switch away from fixed income to entrepreneurship, individuals tend to draw down their home equity in order to finance their business investment, confirming that one's house can serve as efficient collateral in business financing.

Our empirical results differ from Hurst and Lusardi (2004), who use micro-level data from the Panel Study on Income Dynamics (PSID) to argue that liquidity constraints do not matter for entrepreneurship for most of the wealth distribution. Furthermore, they find that households that lived in regions in which house prices appreciated strongly were no more likely to start a business than households in other regions. Their analysis is mainly conducted on data from the $1989 - 1994$ period when house prices in the US were relatively flat. Conversely, we are able to exploit the effect of the large increase in house prices during the early-to-mid 2000s, when in some states (such as California) house prices doubled over the span of five years.

Our reduced form estimates imply potentially important linkages between housing and real economic activity. For example, our results suggest that the housing boom before the Great Recession may have resulted both in higher rates of new business creation and in higher investment. This conjecture is corroborated in aggregate industry-level data by Adelino, Schoar, and Severino (2014) who document that areas with a bigger increase in house prices between 2002 and 2007 experienced a strong increase in small business employment relative to large business employment. Our findings also inform the work of Loutskina and Strahan (2015) who find that positive shocks to local house prices exert a strong positive effect on local economic growth. Related to our work, Chaney, Sraer, and Thesmar (2012) examine listed US firms over the $1993-2007$ period and provide evidence that when the value of a firm's real estate appreciates by 1\$, its investment increases approximately by \$0.06. Our results also have important potential implications for economic activity during downturns, suggesting that high levels of mortgage debt after 2006 may have depressed self-employment, denting the positive effect on new business creation of higher unemployment rates. Our results thus relate to the evidence in Midrigan and Philippon (2011) who find that both output and employment declined more after 2007 in regions where household leverage increased more between 2001 and 2007.

The paper closest to ours is the one by Schmalz, Sraer, and Thesmar (2013) who compare French homeowners and renters and find that home owners are more likely to start a business in areas where house prices appreciated more because higher collateral values increase borrowing capacity. Our paper is different in two important ways. First, we observe the actual housing wealth that home owners have in their property. Therefore, we can estimate the effect of a change in home equity on the probability of transition into entrepreneurship *within the sample of home owners*, in addition to comparing owners and renters, and so we do not have to deal with the concern that home owners may harbor higher latent entrepreneurial tendencies than renters. Second, because Schmalz, Sraer, and Thesmar (2013) neither observe bank lending nor levels of home equity, they do not know whether the collateral channel operates by allowing home owners to secure a larger business loan against the rising value of their property, or by enabling them to extract the additional home equity, thus bypassing the project screening function of the banking sector. Because we observe changes

in mortgage levels, we find that nascent US entrepreneurs indeed extract housing wealth from their residential property, by increasing their mortgage debt. Our paper thus identifies directly the *home equity borrowing channel* of entrepreneurship.

The rest of the paper is organized as follows. Section 2 presents the data. Section 3 describes the empirical strategy. Section 4 reports the main empirical estimates alongside a battery of robustness tests. Section 5 concludes.

2   Data

We estimate the effect of changes in housing wealth on the propensity to start a business using household level survey data from the Survey of Income and Program Participation (SIPP) of the US Census Bureau from 1996 to 2006. In each survey year, the respondents are asked questions related to business ownership. The survey also contains questions on the value of the house and on the size of the mortgage, which allows us to construct a proxy for home equity by taking the difference of the two.

The survey contains household-level data on a variety of additional individual characteristics. In particular, it has a detailed inventory of the household's financial assets, in addition to demographic characteristics which are theoretically related to entrepreneurial choice and business equity ownership, such as age, gender, race, education, and marital status. At each moment, SIPP tracks approximately $30,000$ households. During the period considered, information was collected from three consecutive groups of households that were interviewed during the years $1996 - 2000$ (four times), $2001 - 2003$ (three times), and $2004 - 2006$ (two times), respectively. The three SIPP panels put together contain information on $78,793$ unique households, for a total of $217,014$ possible observations.[2]

During its active period, each panel is interviewed every year, while panels of households do not overlap across periods. The longitudinal nature of the survey enables us to analyze dynamic characteristics, such as changes in employment status and income, changes in household and family

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[2] The SIPP over-samples individuals from areas with high poverty concentrations. We perform robustness checks to make sure that our main results are not affected by this feature of the survey.

composition, or housing dynamics. The survey's cross-sectional features allow us to keep track of housing wealth. We focus on the identification that arises when the value of the property, and consequently of the home equity, changes.

Theory provides little guidance on how to classify "entrepreneurs" (see Hurst and Lusardi, 2004). The SIPP allows us to distinguish between direct ownership of business and ownership of business equity, which may or may not be ownership of equity in the household's own business. Specifically, we utilize responses in the survey to the question "Did the household own and operate a business in the previous year?" to define business ownership, and responses to the question "What is the value in dollars of the household's total business equity?" to define ownership of business equity. This strategy is somewhat richer that previous studies utilizing household data on entrepreneurship. For example, Hurst and Lusardi (2004) define entrepreneurship from a question in the PSID which asks household whether they "[...] own a business [...] or have a financial interest in any business enterprise", so they are unable to distinguish between direct and indirect ownership.

In terms of the household's assets, we calculate net wealth as total wealth minus total debt. Total debt includes any mortgage on the household's current home. We later distinguish between mortgage and non-mortgage debt. Total net wealth excludes the value of equity in the house.

To examine the role of home equity on the transition into entrepreneurship, we create a pooled sample of non-business owners from the three survey waves. A household is defined to enter entrepreneurship if the household head or the spouse owns and operates a business in the very next period of the same survey wave. In robustness checks, we define entrepreneurship as ownership and operation of a business in any of the subsequent periods of the same survey wave. Consistent with Hurst and Lusardi (2004), we eliminate households in which the head is still in school or is close to retirement and focus on non-retired household heads between the ages of 22 and 60.

In addition to household information, we include data on Gross State Product (GSP) growth, state unemployment, and a proxy for homestead exemptions. The economic rationale for including the former two is that a more vibrant economy and/or a more depressed local labor market can raise the returns to self-employment (see Fairlie, 2013). Regarding the latter, the homestead exemption enables a filer for bankruptcy to retain home equity in her primary residence up to the exempted

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amount. A higher exemption may thus increase the rates of new business creation by imposing a lower cost on a potential business exit. At the same time, because the debts of the firm are personal liabilities of the firm's owner, lending to the firm is legally equivalent to lending to its owner. Higher homestead exemptions can thus endogenously generate tighter financial conditions. For example, Berkowitz and White (2004) show that small firms located in states with unlimited homestead exemptions are more likely to be denied credit. In our sample, the homestead exemption ranges from $0 in Maryland to an unlimited amount in 8 US states in 2006.

Table 1 presents summary statistics of the main variables in the data. There are a total of 58,127 households observed during the first year of each survey wave. There are 46,679 households who answered the question "Did the household own and operate a business in the previous year?" 453 of those households answered "yes", implying that about 1% of non-entrepreneurs become business owners each year. 59% of household heads are aged between 31 and 50 years; 57% of households have at least some college education; 14% are African-American; 51% are female; 53% are married; and 3% are unemployed. In terms of financials, average labor income is around $49,000, and average non-housing wealth (i.e., total wealth excluding home equity) is around $74,000. The average property is worth $87,659, roughly equal size mortgage and home equity. Finally, average state-level unemployment over the period was 5.1%, average GSP growth was 5.7%, and on average $211,000 worth of home property value could be exempted from bankruptcy procedures.[3]

Table 2 reports descriptive statistics on the subsample of household that transitioned into entrepreneurship in the very next period. We compare those to descriptive statistics on the subsample of household that remained non-business owners. The differences between the two samples are in most cases statistically significant, and in some cases economically large. For example, those transitioning into entrepreneurship are on average more educated and are more likely to be white, male, and married. They are also more likely to have a higher labor income and higher non-housing wealth. Importantly, those transitioning into entrepreneurship have more home equity, as well as a more valuable property and higher mortgage debt. This implies that when estimating the effect of home equity on the transition into entrepreneurship, we need to pay attention to differences in

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[3]We have assigned a value of $1,000,000 to the home exemption in states where the home exemption is unlimited.

mortgage debt as otherwise our estimates can be contaminated by the independent effect of leverage on the probability of starting a business. Finally, Table 2 implies that individuals are more likely to transition into entrepreneurship if they live in a state with (marginally) lower unemployment and a higher homestead exemption.[4]

Table 3 summarizes the data on new business owners, that is, on individuals who transitioned into ownership and operation of a business between the previous and the current period. The average business equity of new business owners is $27,875. While it is considerably higher than the average business equity of non-business owners ($3,379), its relatively low level implies that the entrepreneurs in the sample are on average not owners of large businesses or important job creators. This is confirmed by the sectoral break-up of new businesses reported in the table: most of the new business owners are in professional services, followed by sectors such as construction; arts, entertainment, recreation, accommodation, and food services; education, health, and social services; and retail trade. Only 3.1% of the new entrepreneurs are in manufacturing. These stylized facts caution against deriving implications in terms of job creation from observations on transition into self-employment.

3   Empirical methodology and identification

The main hypothesis that we test is that an increase in house prices will increase the probability that an individual will transition into entrepreneurship. The intuition for this result is that if household leverage remains the same (i.e., keeping the mortgage balance constant), a higher value of the property will increase the home equity, raising the value of potential business investment and reducing the effective cost to the agent of switching from fixed income to variable income.[5]

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[4] All of these state-level variables are time-varying.

[5] Corradin and Popov (2013) formulate a simple model of career choice with home ownership in the presence of borrowing constraints to motivate this hypothesis. In their model, agents start out as fixed-wage workers and can choose to become entrepreneurs in each following period. Their value function in each period depends on own wealth (as in Quadrini, 2000; Cagetti and De Nardi, 2006, and Buera, 2009), but also on house prices through two channels. The first one is that the current level of house prices affects the equity value they can extract from their home, increasing their mortgage balance. The housing stock thus has a collateral value component, beyond the value derived from the direct consumption of housing services, due to prospects of limits on the amount of borrowing. The second channel results from the interaction between the first channel and the cost of external financing available to the potential entrepreneur. As in Quadrini (2000), the entrepreneur can take external financing through a business

We test this prediction using the following non-linear probability model:

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\begin{aligned}
\text{Prob(new business}_{ijt+1} &= 1|Z_{ijt}) = \varphi(Z_{ijt}) = \\
&\varphi\left(\beta_1 + \beta_2 \cdot \ln(1 + \text{home equity}_{ijt}) + \beta_3 \cdot X_{ijt} + \beta_4 \cdot \Phi_{jt} + \varepsilon_{ijt}\right),
\end{aligned}
\tag{1}
$$

where 'new business' is a dummy equal to 1 if household i in MSA j does not own or operate a business during the period when first interviewed (t), but does so in the next period $(t+1)$. 'home equity$_{ijt}$' denotes the difference between the value of the household's property and the size of the household's mortgage debt at time t. Because the main explanatory variable is defined as 'ln(1+home equity$_{ijt}$)', we include in the sample those with 0 home equity, too (i.e., renters and homeowners whose mortgage equals 100%). However, we also run our regressions after excluding renters, in order to exploit further the richness of our sample, which allows us to compare the extensive margin of entrepreneurship within the sample of home owners. Consistent with the hypothesis, we expect that $\beta_2 > 0$.

X_{ijt} denotes a vector of demographic and income proxies. These include age, education, race, gender, marital status, and employment status, for each household i in state j at time t. Variables related to liquidity constraints are also included in X_{ijt}, in particular, the household's current labor income and net wealth. Not accounting for wealth may bias our results upward because wealthier individuals may be simultaneously more likely to own a more expensive house and to become entrepreneurs. Theory predicts that the inability to acquire the capital necessary to start a business is one of the main theoretical obstacles faced by would-be entrepreneurs. A large literature has documented a positive relationship between initial wealth and subsequent business entry (e.g., Evans and Jovanovic, 1989; Evans and Leighton, 1989; Fairlie, 1999; and Quadrini, 1999). However, Hurst and Lusardi (2004) challenge this view. Using detailed survey data, they show that personal wealth is important only for the richest households, and that once these are excluded

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loan up to an amount that corresponds to the difference between the maximum permitted level of capital investment and total net wealth. The model thus predicts that agents are more likely to become entrepreneurs when the value of their home equity is high. It also predicts that on average, new entrepreneurs increase their mortgage balance and rely more on external financing.

from the sample, there is no statistical relationship between wealth and entrepreneurial choices. If the positive relationship between wealth and entrepreneurship is confined to the top of the wealth distribution, then self-employment contains a "luxury good" component; namely, as households become wealthier, they are more likely to purchase the benefits associated with owning a business, such as prestige, power over decision-making, a flexible time schedule, etc.[6] We take these considerations into account by including an up to fifth degree polynomial of household net wealth in our tests.[7]

Finally, Φ_{jt} is a matrix of MSA $\times$ year fixed effects. These control for any remaining time-varying factors that are common to all households in an MSA. Consequently, the estimate of β_2 is driven off comparisons of households in the same MSA-year who have access to different levels of housing wealth.

While this empirical model allows us to evaluate the association between current home equity and future small business ownership, there are a number ways in which the OLS estimates could be biased. The most obvious one is related to omitted variable bias. For example, credit standards were gradually relaxed throughout the US in the wake of the dot-com bust. Easy credit may have simultaneously generated an increase in house values by raising local demand for housing, and a decrease in borrowing limits for new firms. In other words, credit standards may have declined relatively more in areas with rising house prices, a possibility corroborated by the evidence in Mian and Sufi (2011) and Duca, Muellbauer, and Murphy (2011). Alternatively, individuals who ultimately become entrepreneurs may disproportionately reside in areas with local economies where the propensity to start a business is naturally higher. If the areas which experienced the largest house price booms during the early-to-mid 2000s happen to be latently entrepreneurial, too (such as California, Massachusetts, and New York), then a positive association between home equity and new business creation may again be largely driven by an omitted variable bias. And even if changes in home equity are uncorrelated with credit standards or with unobservable entrepreneurial tendencies,

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[6] In the same vein, Hamilton (2000) shows that most entrepreneurs enter and persist in business although they have both lower initial earnings and lower income growth than paid employees. Moskowitz and Vissing-Jorgensen (2002) show that the returns on private equity are no higher than the returns on public equity, even though entrepreneurial investment is poorly diversified. Both papers thus suggest that there are important non-pecuniary benefits of entrepreneurship.

[7] Results available upon request.

rising house prices can feed back into local demand booms, raising the return to entrepreneurship and, subsequently, the rate of new business creation. In this case home equity will be related to entrepreneurship though a different channel than the home equity borrowing channel we seek to identify.

In order to isolate a clear causal effect of housing wealth on entrepreneurship, we need to identify exogenous shocks to home equity which are unrelated to local entrepreneurial propensity or economic conditions. To achieve this, we use an instrumental variable procedure to generate exogenous variation in home equity. Building on the research design in Chetty and Szeidl (2010), we first calculate, for each home owner in the sample, the change in *national* (US-wide) house prices between the year when the house was bought and the current year. We also use information on the local topological elasticity of housing supply from Saiz (2010). The rationale is that local adjustment in response to changes in the demand for housing is more likely to take place on the quantity margin in places with highly elastic housing supply, and on the price margin in areas with inelastic housing supply.[8] We calculate this elasticity both at the state and at the MSA level.[9] The second approach is preferred as it yields a higher variation in the local elasticity of housing supply, however, for anonymity purposes the MSA is not reported for 37% of households, and so in these cases, we apply the state-level elasticity.[10] We then divide the change in national house prices between the year when the house was bought and the current year by the local elasticity of housing supply. The resulting ratio is our instrument for home equity. The idea is that following a positive aggregate US-wide demand shock for housing, house prices will appreciate (and consequently home equity will increase, keeping the mortgage balance constant) considerably more in local areas with less elastic housing supply due to topological reasons, where adjustment in response to such shocks takes place on the price margin. It is therefore reasonable to expect that this instrument will help identify the variation in home equity that is unrelated to changes in local business conditions.

In addition to constructing an instrument for home equity, we implement a number of other

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[8]Other recent papers to pursue identification of changes in collateral values using the local topological elasticity of housing supply include Chaney, Sraer, and Thesmar (2012), Adelino, Schoar, and Severino (2014), and Cvijanovic (2014), among others.

[9]The original data in Saiz (2010) is at the MSA level. We calculate state-level elasticities by averaging the MSA-level elasticities for all MSAs in the state, weighted by the MSA's population.

[10]The SIPP stopped reporting the MSA field starting with the 2004-2006 wave.

strategies aimed at identifying the effect. First, we repeat our analysis only on the sub-sample of individuals who live in the MSAs with the most elastic housing supply, such as the ones in the Great Plains. In those, the propensity to start a business is less likely to be correlated with the local price response to economy-wide changes in housing demand. Second, we seek to alleviate concerns that the house price boom is driving entrepreneurship through a demand channel rather than through a home equity borrowing channel by excluding from the analysis business start-ups in industries such as construction, finance, and real estate. Finally, we compare the change in mortgage debt of new business owners and of non-business owners around the same point in time in the same geographic locality. If new business owners can indeed efficiently tap into housing wealth, one should observe a higher increase in mortgage debt, from one period to another, for new business owners relative to the rest.

4   Empirical results

We now present different sets of empirical estimates of Model (1). In Section 4.1, we present the OLS evidence on the association between housing wealth and new business creation, alongside a batter of robustness checks. In Section 4.2, we present the headline results in the paper where we account for various sources of endogeneity in order to be able to interpret the positive effect of housing wealth on new business creation as a causal one.

4.1   Preliminary results: OLS estimation

4.1.1   Main OLS result

In Table 4, we report the results from the base OLS estimation of Model (1). We start with all households who do not own or operate a business in the first period when they were interviewed (columns (1) and (2)), and then we repeat the tests on the sub-sample of home owners who do not own or operate a business in the first period when they were interviewed (columns (3) and (4)). We control for the demographic characteristics of the household (age, education, race, gender, marital status, labor income, employment status). To clearly separate the effect of housing wealth from the

effect of the rest of the household's financials, we report specifications without (columns (1) and (3)) and with (columns (2) and (4)) non-housing wealth and the size of the household's mortgage.

The estimates suggest that higher housing wealth significantly increases the probability that a household makes the transition to business ownership in the next period. Neither the coefficients nor their significance appears to be sensitive to the inclusion of non-housing wealth and of mortgage debt. The intuition for the observed effect is that when house prices increase and raise the value of the property, holding the mortgage fixed, individuals can now extract more housing wealth from the house to buy working capital if they are to switch from employment to self-employment. In all cases, the null hypothesis that current home equity has no effect on future business ownership is rejected with $p < 0.01$. The effect is of a sizeable magnitude. Take the specification with individual and financial controls and MSA $\times$ year fixed effects in the case of home owners (column (4)). Going from the 25th to the 75th percentile of past house price increases (corresponding to a 17.70% increase) implies that the average house in the sample (valued at $87,659$) appreciated by $15,516$, or a 35% increase in home equity, holding the mortgage constant. The point estimate implies that for a household with the sample mean demographic and income characteristics, an 35% increase in home equity raises the probability that the household head will transition into entrepreneurship in the future by 0.039 percentage points. Given a mean share of households who transition into entrepreneurship in the next period of 1.0%, this is equivalent to a 3.9% increase in the probability that the household will transition into entrepreneurship in the next period.

We also find that individuals are more likely to become entrepreneurs if they have at least a college degree and if they are white, male, and married, which is consistent with the results in Hurst and Lusardi (2004). The effect of non-housing wealth is positive and significant, implying that other types of wealth that can be used to finance a business also increase the probability of transition into entrepreneurship. The point estimate implies that variations in home equity have a twice bigger effect on entrepreneurship than variations in non-housing wealth, which may partially be due to the fact that non-housing wealth includes the value of durables, such as vehicles and non-home real estate. Finally, the effect of mortgage debt is positive but insignificant, implying that controlling for housing and non-housing wealth, households with additional leverage are no

more likely to start a business.

4.1.2 Robustness

We next perform, in Table 5, a battery of alternative tests to evaluate the robustness of the statistical association between housing wealth and new business creation, for the full sample of owners and renters. We start by recognizing that in parametric panel data models with fixed effects where the independent variable is a dummy variable, the estimates will in general be inconsistent if the time dimension is small (Neyman and Scott, 1948). As a solution to this "incidental variables" problem, we re-evaluate Model (1) using a linear probability model instead of a non-linear probability one. As column (1) of Table 5 reports, the significant positive association between current home equity and future transition into entrepreneurship remains robust to this alternative specification.

In column (2) of Table 5, we address another possible concern related to our methodology, namely, the fact that our data may not be derived from a representative survey. The SIPP intentionally oversamples low-income households in order to maximize the coverage of households who get public services. Indeed, median labor income in the sample is $38,400$ compared to mean labor income of $48,998$, and median non-housing wealth is five times smaller than the mean one, implying that the income and wealth distribution in our dataset is positively skewed. We address this issue by performing a version of the empirical test in column (1) where we have used the reported survey weights to re-weight our observations. As reported in column (2), this alternative methodology does not yield results which are qualitatively or quantitatively very different from our baseline estimates.

Another concern is that the positive association between housing wealth and entrepreneurship can be driven by our choice of proxy for entrepreneurship. We have defined an entrepreneur as an individual who owns and operates a business. While accurate, this definition of entrepreneurship by construction does not account for indirect business ownership. We now replicate our preferred specification after employing alternative definitions of business ownership that have been used in the literature. We first define transition into business ownership as a dummy variable equal to one if the household declares zero business equity in the current period but positive business equity

in the next period. This definition accounts for the fact that individuals may become business owners not only by starting a business themselves, but also by investing in other agents' (such as family members') business. Column (3) of Table 5 reports the estimates from this test. The null hypothesis that current home equity has no effect on future business equity is rejected at the 1% statistical level. In column (4) we employ the definition of entrepreneurship used in Hurst and Lusardi (2004), namely, we define business owners as households who are either running and operating their own business or own business equity. We find that the positive association between home equity and the probability of transition into business ownership continues to be statistically strong ($p < 0.01$) for this broadest possible definition of entrepreneurship. We conclude that our results so far are not driven by our choice of proxy for new business creation.

A fourth concern is related to the *timing* of transition into entrepreneurship. In our main empirical tests we have focused on the moment when non-business owning households were interviewed for the first time, and we have then looked at the probability that they would start a business *in the next period*. Given that in two of the three SIPP waves there are more than two observations per household, this leaves out a potentially substantial number of start-ups. We now address this issue in two ways. First, we look at the probability of transitioning into entrepreneurship in the next period *at all times*, not just the first time when households were interviewed. This allows us to include multiple observations of the same household. The estimates reported in column (5) of Table 5 suggest that our results so far have not been affected materially by the exclusion of a number of later start-ups. In column (6), we address the same issue differently by defining entrepreneurship as the probability of a non-business owner becoming an entrepreneur *at any point in the future*. There are 678 such households, compared with 453 who transition in the next period. This approach suffers from a purely mechanical problem in that different waves of the SIPP include a different number of years, and so households's entrepreneurial choices are observed over different durations in each panel. At the same time, it allows us to capture a larger number of start-ups without including multiple times the same household in the regression. The results remain qualitatively unchanged: the strong positive association between home equity and transition to entrepreneurship survives this alternative definition of the switching horizon. Again, the null hypothesis that current

home equity has no effect on future business ownership is rejected with $p < 0.01$. Quantitatively, the probit estimate increases to 0.0236 (from 0.0210 in Table 4, column (2)). This is expected given that the probability of transitioning into entrepreneurship is higher over a longer horizon.

Importantly, all results in Table 5 are recorded after including our exhaustive set of variables which proxy for demographic characteristics, non-housing wealth, and mortgage debt. We conclude that the positive association between home equity and new business creation is not due to the high correlation between home equity and net wealth, disposable income, changes in the return to entrepreneurship, or to the potential impact of home ownership on the propensity for business ownership through the channel of higher leverage.

Our main results seem at odds with Hurst and Lusardi (2004), who use micro-level data from the PSID to argue that liquidity constraints do not matter for entrepreneurship for most of the wealth distribution. Furthermore, they find that households that live in regions in which house prices appreciated strongly are no more likely to start a business than households in other regions. We believe that a number of factors can explain the difference between their work and ours. First, their sample consists of around $8,000$ individuals (compared to around $79,000$ in our sample), so they are not able to exploit as rich a regional variation in house price changes as we are. Second, their analysis is conducted on data from the $1989 - 1994$ period when house prices in the US were relatively flat. Conversely, we are able to exploit the effect of the large increase in house prices during the early-to-mid 2000s, when in some states (such as California) house prices doubled over the span of five years.

4.1.3 Interaction effects

Our results suggest that credit constraints serve as a barrier to new business creation, and that a credit expansion based on an increase in home equity borrowing can help nascent entrepreneurs overcome this barrier. This raises a number of additional questions related to the link between house prices, the business cycle, and credit expansion. First, is the home equity borrowing channel of housing more potent for individuals that are more credit constrained? If households have sufficient non-housing wealth, such as savings they can tap in or durable non-housing goods they can liquidate,

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then the effect of additional home equity should not have a material effect on the propensity to start a business, and so the association we uncover might be spurious. Second, does the effect of an increase in housing wealth vary along the business cycle? In particular, the early-to-mid 2000s saw an unprecedented expansion in credit supply in general and in home equity borrowing in particular (Mian and Sufi, 2009), while home equity borrowing may not have been so prevalent in earlier decades. In fact, Hurst and Lusardi (2004) analyze the early 1990s, a period notable for a sharp credit crunch, which many hold accountable for the 1991 recession (e.g. Bernanke and Lown, 1991). Finally, what role do characteristics of the local business environment, such as the local business cycle or legal treatment of housing assets, play in the association between housing wealth and new business creation? Because our specifications include MSA × year fixed effects, our tests cannot say anything on the level effect of those, but we could still study how they interact with housing wealth.

In Table 6, we address these questions by including in our main model interactions of home equity with demographic, financial, and state-specific variables, as well as with year dummies. We observe three sets of facts. First, the coefficient on the interaction of home equity with non-housing wealth is positive and significant, while the coefficient on the interaction of home equity with labor income is negative and significant. The evidence to whether higher housing wealth stimulates new business creation relatively more for credit constrained households is ambiguous. Second, we find that the same level of housing wealth has a similar effect on new business creation in the 1990s and 2000s, as the coefficient on the interaction of home equity with the 2002 dummy and the 2005 dummy is insignificant.[11] Finally, we also find that the interactions of state-level unemployment and of the level of the homestead exemption with home equity is positive. The first piece of evidence confirms the intuition that for the same level of housing wealth, individuals are more likely to transition into entrepreneurship when job opportunities are scarce. The second piece of evidence suggests that for home owners with higher housing wealth, the direct effect of higher homestead exemptions in the case of personal bankruptcy through reduced business risk dominates the indirect effect through endogenously tighter credit constraints.

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[11] The omitted year category is the 1997 dummy.

4.2 Headline results: Instrumental Variables estimation

4.2.1 Ruling out omitted variable bias

While our OLS estimates establish a robust positive association between current home equity and future new business creation, there are a number of ways in which the OLS estimates could be biased. The most obvious one is related to omitted variable bias. For example, credit standards were gradually relaxed throughout the US in the wake of the dot-com bust. Easy credit may have simultaneously generated an increase in house values by raising local demand for housing, and a decrease in borrowing limits for new firms. Mian and Sufi (2011) and Duca, Muellbauer, and Murphy (2011) document a larger decline in credit standards in local areas with a house price boom. Along the same lines, Corradin (2014) suggests that if mortgage lenders had optimistic views on house price dynamics in terms of low house price volatility and/or high expected house price growth rate, they may have loosened underwriting standards and offered low down payments contracts. Alternatively, individuals who ultimately become entrepreneurs may disproportionately reside in areas where the propensity to start a business is naturally higher. If the areas which experienced the largest house price booms during the early-to-mid 2000s happen to be latently entrepreneurial, too (such as California, Massachusetts, and New York), then a positive association between home equity and new business creation may again be largely driven by an omitted variable bias. And even if changes in home equity are uncorrelated with credit standards or with unobservable entrepreneurial tendencies, rising house prices can feed back into local demand booms, raising the return to entrepreneurship and, subsequently, the rate of new business creation. In this case home equity will be related to entrepreneurship through a different channel than the collateral channel we seek to identify.

In order to isolate a clear causal effect of home equity on entrepreneurship through the collateral channel, we need to identify exogenous shocks to home equity which are unrelated to local entrepreneurial propensity or economic conditions. To achieve this, we use an instrumental variable procedure to generate exogenous variation in home equity. Building on the research design in Chetty and Szeidl (2010), we first calculate, for each home owner in the sample, the change

in *national* (US-wide) house prices between the year when the house was bought and the current year.[12] Next, we use information on the local topological elasticity of housing supply from Saiz (2010). The idea is that local adjustment in response to changes in the demand for housing is more likely to take place on the quantity margin in places with a highly elastic housing supply (i.e., flat areas such as Kansas) and on the price margin in areas with inelastic housing supply (i.e., coastal cities such as Boston or San Francisco). We calculate this elasticity both at the state and at the MSA level. The second approach is preferred as it yields a higher variation in the local elasticity of housing supply (there are 96 reported MSAs). The downside is that for about a third of the households in SIPP, the MSA is not reported for confidentiality reasons, and so we assign to these households the state-level value. We then divide, by the topological elasticity of housing supply, the change in national house prices between the year when the house was bought and the current year. The resulting ratio is our instrument for home equity. The main idea is that when there is an aggregate demand shock for housing at the national level, house prices will appreciate (and consequently home equity will increase) considerably more in MSAs with less elastic housing supply due to topological reasons, where adjustment in response to such shocks takes place on the price margin. It is therefore reasonable to expect that this instrument will help identify a variation in home equity that is unrelated to local business conditions. Furthermore, this instrument takes on different values for different individuals in the same MSA and year, and as a result, the housing wealth coefficient is driven solely off the comparison of people in the same MSA-year who have experienced different housing price appreciation based solely on differences in the year in which they purchased to home.

In Table 7, we report the estimates from Model (1) where we use the instrumental variable just described to extract the exogenous component of home equity. We first report the estimates from the first stage regression of the natural logarithm of home equity on the instrumental variable. We do so for the full sample (column (1)) and for the sub-sample of home owners only (column (2)). The reported coefficients imply that the change in national house prices between the year of purchase and the current year, divided by the local elasticity of housing supply, predicts a large

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[12]This variable takes on a value of 0 for renters.

share of the variation in individual housing wealth. The value of the first-stage Wald Statistics, reported as "Wald F-statistics", is strictly higher than the critical value for the IV regression to have no more than 10% of the bias of the OLS estimate (see Stock and Yogo, 2005).

We next report the estimates from the second stage regression, and once again we perform the tests separately on the sample of owners and renters and on the sample of owners only. We also note that both non-housing wealth and the size of the mortgage are endogenous variables: individuals planning to start businesses in the future may save more today, thus paying down mortgage debt and amassing more financial assets. Because we do not have enough instruments for all endogenous variables, we report two versions of each regression, one that does not control for non-housing wealth and for the size of the mortgage, and one that does.

The estimates in columns (3)-(6) strongly suggest that the null hypothesis that current housing wealth has no effect on future business ownership is rejected. In the full sample, the effect is significant at least at the 5% statistical level, and with $p < 0.01$ in column (3) where we do not control for non-housing wealth and for the home mortgage. For the sub sample of home owners, the effect is still significant at the 10% statistical level, and is numerically larger. Once again, the effect is of a sizeable magnitude. Take the specification with individual and financial controls and MSA $\times$ year fixed effects in the case of home owners (column (6)). Going from the 25th to the 75th percentile of past house price increases (corresponding to a 17.70% increase in property values) implies that the average house in the sample (valued at $87,659$) appreciated by $15,516$. Given an average home equity in the sample of $44,111$, this corresponds to a 35% increase in home equity, holding the mortgage constant. The point estimate implies that for a household with the sample mean demographic and income characteristics, a 35% increase in home equity raises the probability that the household head will transition into entrepreneurship in the next period by 0.24 percentage points. Given a mean share of households who transition into entrepreneurship in the next period of 1.0%, this is equivalent to a 24% increase in the probability that the household will transition into entrepreneurship in the next period.[13]

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[13]This effect is directly comparable to Schmaltz et al. (2013) who find that going from the 25th to the 75th percentile of past house price growth increases the probability of firm creation by homeowners, relative to renters, by up to 13%.

For an alternative interpretation, consider the following back-of-the-envelope calculation. The average difference in business equity between a new business owner and a non-business owner is $24,500$ (see Table 3), which corresponds to 55% of average home equity in the sample. Our estimate in column (6) of Table 7 implies that the 55% increase in home equity necessary to generate the average difference in business equity between business owners and non-business owners in the sample increases the probability of switching to self-employment by 38.5%. There were roughly 110 mln. households in the US in 2006, around 1% of whom (or 1.1 mln. households) switch to self-employment each year. Therefore, the 55% increase in home equity required to generate the average difference in business equity between business owners and non-business owners results in an additional $423,500$ households who switch from fixed income to self-employment, year-on-year.

One concern related to our Instrumental Variables strategy is that the exclusion restriction may not be satisfied. That is, the instrument may be explaining variation in entrepreneurship through channels other than the channel of increased home equity. This would be the case if areas with lower elasticity of housing supply were also areas with intrinsically higher rates of small business creation. While we cannot directly test for this, we seek to assuage these concerns by comparing across MSAs, for home owners who do not currently own or operate a business, the average probability of transitioning into entrepreneurship in the future. When we compare the top half to the bottom half of the MSAs, we find that this probability is 1.01% in the former and 0.94% in the latter, and that the difference between the two is not significant. We find the same when we compare the top tertile to the bottom tertile. We conclude that it is unlikely that the exclusion restriction is systematically violated in our sample.

4.2.2 Ruling out local demand booms and feedback effects

Our identification strategy addresses head-on the concern that the positive association between home equity and entrepreneurship may be driven by local economic conditions which simultaneously raise house prices and increase new business formation. Nevertheless, one concern with identification still remains, namely, that (even exogenous) changes in home prices can feed back into local demand booms. Mian, Rao, and Sufi (2013) document that households consume a large

share of any additional home equity. If the demand for entrepreneurial services (or a subset of these) goes up relatively more in areas with the highest increase in home prices, then our estimates of the size of the home equity borrowing channel can still be biased upwards.

We have so far partially dealt with this possibility by comparing owners and renters, whereby the latter lack entirely access to home equity borrowing, and by employing lagged explanatory variables whereby we map home equity at time t into the probability of transition into entrepreneurship at time $t + 1$. In Table 8, we address this concern in two additional ways. First, we repeat our tests on a subsample of MSAs with the highest elasticity of housing supply. In these, adjustment in the housing supply is relatively quick, and so it is unlikely that an aggregate demand shock would raise prices enough to generate an empirically substantial local demand boom. Second, we exclude from the sample those entrepreneurs that enter businesses which are directly linked to the housing boom. Two obvious such businesses are construction firms and mortgage brokerages. If all new small businesses in the sample are related to the building or selling of real estate property, then it will be hard to argue for a home equity borrowing channel of housing. This strategy is somewhat related to Adelino, Schoar, and Severino (2014) who separate the effect of housing on small business creation for tradeables and non-tradeables, and show that the effect is there for tradeables, too, alleviating concerns that the effect is driven by local demand booms. However, our sample contains too few manufacturing start-ups for this strategy to be implemented.

In the first two columns of Table 8, we report OLS (column (1)) and IV (columns (2)) estimates of Model (1) where we focus on the subsample of households living in the top half of the MSAs in SIPP, in terms of local elasticity of housing supply. Our main result continues to hold, and in both cases the effect of an increase in housing wealth on new business creation is significant at the 1% statistical level. The size of the numerical effect, however, declines relative to the full sample, suggesting that part of the increase in entrepreneurship in response to a boom in house prices may be due to a wealth effect that operates independently of from the home equity borrowing channel.

In columns (3) and (4), we drop all entrepreneurs who start businesses the demand for which may have increased in the wake of a housing boom. We exclude the following sectors: Sector 3 (Construction); Sector 9 (Finance, insurance, real estate, and rental and leasing); and Sector 11

(Education, health, and social services). We exclude the first two because entry in those may be driven directly by an aggregate housing demand shock. As for education, health, and social services, these are traditionally the sectors with the highest income elasticity of demand. For example, if a housing boom makes people richer through a wealth effect and this raises their demand for health services, then a doctor's decision to leave her job in a hospital and start a private practice cannot be directly linked to the home equity borrowing channel of housing. Our results survive the exclusion of these businesses, and the main effect is still significant at the 1% statistical level, suggesting that even though such effects are plausible, they are not the main driver of our results in the aggregate.

Finally, the main result of the paper still obtains in the data when we combine both strategies, i.e., when we exclude households living MSAs with a very inelastic housing supply and drop businesses which are driven by the housing boom (columns (5) and (6)).

4.2.3 Changes in mortgage debt after transition into entrepreneurship

Why does higher housing wealth induce entrepreneurship? While we have argued for a home equity borrowing channel, whereby home owners extract equity from their residential property to finance their business, they could also simply be collateralizing their property in order to obtain business loans. One direct way to evaluate whether housing wealth indeed drives new business creation through a home equity borrowing channel is to observe changes in mortgage debt after the household's transition into entrepreneurship. If one's house is indeed an efficient source of wealth, a new entrepreneur will partially convert her home equity into business investment by increasing her mortgage. If not, it would be difficult to argue for the existence of a home equity borrowing channel. Our data actually allow us to observe the behavior of new business owners, in terms of changes in total and in particular in mortgage debt.

We now proceed to explicitly test for this. In practice, we estimate the following equation:

$$
\begin{aligned}
\Delta \ln(1+\text{mortgage debt}_{ijt+1}) = \ &\beta_1 + \beta_2 \cdot \text{new business owner}_{ijt} + \beta_3 \cdot \ln(1+\text{mortgage debt}_{ijt}) \\
&+ \beta_4 \cdot X_{ijt} + \beta_5 \cdot \Phi_{jt} + \varepsilon_{ijt}
\end{aligned}
$$

$$(2)$$

where the dependent variable is the logarithm change in mortgage debt between period t and period $t+1$ for household i in MSA. A new business owner is defined as a household head who owns or operates a business or owns business equity at time $t+1$, but did not do so at time t. Consistent with the home equity borrowing channel hypothesis, we expect that $\beta_2 > 0$. To account for natural convergence, we include last period's stock of mortgage debt, too. Because we now include all individuals in the tests, and potentially more than once, the sample increases to a maximum of $117,828$ observations.

Table 9 reports the estimates from the regression of the change in mortgage debt on the new business owner dummy, controlling for the same demographic characteristics and time-varying state characteristics as in Table 4, as well as for state and year fixed effects. We observe smaller increases in mortgage debt for individuals whose mortgage debt is higher to begin with. Importantly, the estimate of β_2 in Model (2) implies that new business owners accumulate substantially more mortgage debt than otherwise identical individuals who did not become entrepreneurs over the same period. This is the case both in the full sample (column (1)) and for the sub-sample of home owners only (column (2)). Taking the latter case, a new entrepreneur tends to increase her mortgage by around 0.6 of a standard deviation more than an otherwise identical individuals who did not become a business owner. Our results thus broadly confirm the conjecture that financing of the business is facilitated by access to housing wealth, in that business owners can - and do - use their house as a source of equity.

5 Conclusion

In this paper, we evaluate the importance of credit constraints for new business creation using the exogenous variation in home equity for a large sample of US home owners over the period $1996 - 2006$. We find that households with higher home equity today are significantly more likely to own and operate a business in the future. We record this result after implementing a number of strategies aimed at isolating a variation in home equity that is orthogonal to local economic effects. Numerically, a 10% increase in home equity increases the probability that a non-business owning

household will switch to entrepreneurship in the future by around 7%. This effect is robust to controlling for a wide range of demographic and income characteristics and for MSA × year fixed effects. Finally, we find a strong positive correlation between transition into entrepreneurship and the increase in mortgage debt. The intuition is that once individuals switch from a fixed-income job to entrepreneurship, they draw down their home equity to finance their business investment, confirming that real estate is indeed efficient source of funds.

Our reduced form estimates imply potentially important linkages between housing and real economic activity. For example, our results suggest that the housing boom before the Great Recession may have resulted in higher rates of new business creation, while increasing levels of mortgage debt since 2006 may have depressed self-employment, denting the positive effect on new business creation of higher unemployment. There can be important economic spillovers from entrepreneurship, too, such as higher growth, lower crime, or higher rates of job creation. Regarding the latter, recent work has established that employment disproportionately expands in industries and areas most sensitive to changes in home prices (Adelino, Schoar, and Severino, 2014). In future work, it would also be instructive to incorporate an analysis of the implications for entrepreneurship of reducing transaction costs in the housing market and of various exemptions related to housing in the case of personal bankruptcy.

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Figure 1. Changes in rates of new business creation and changes in house prices
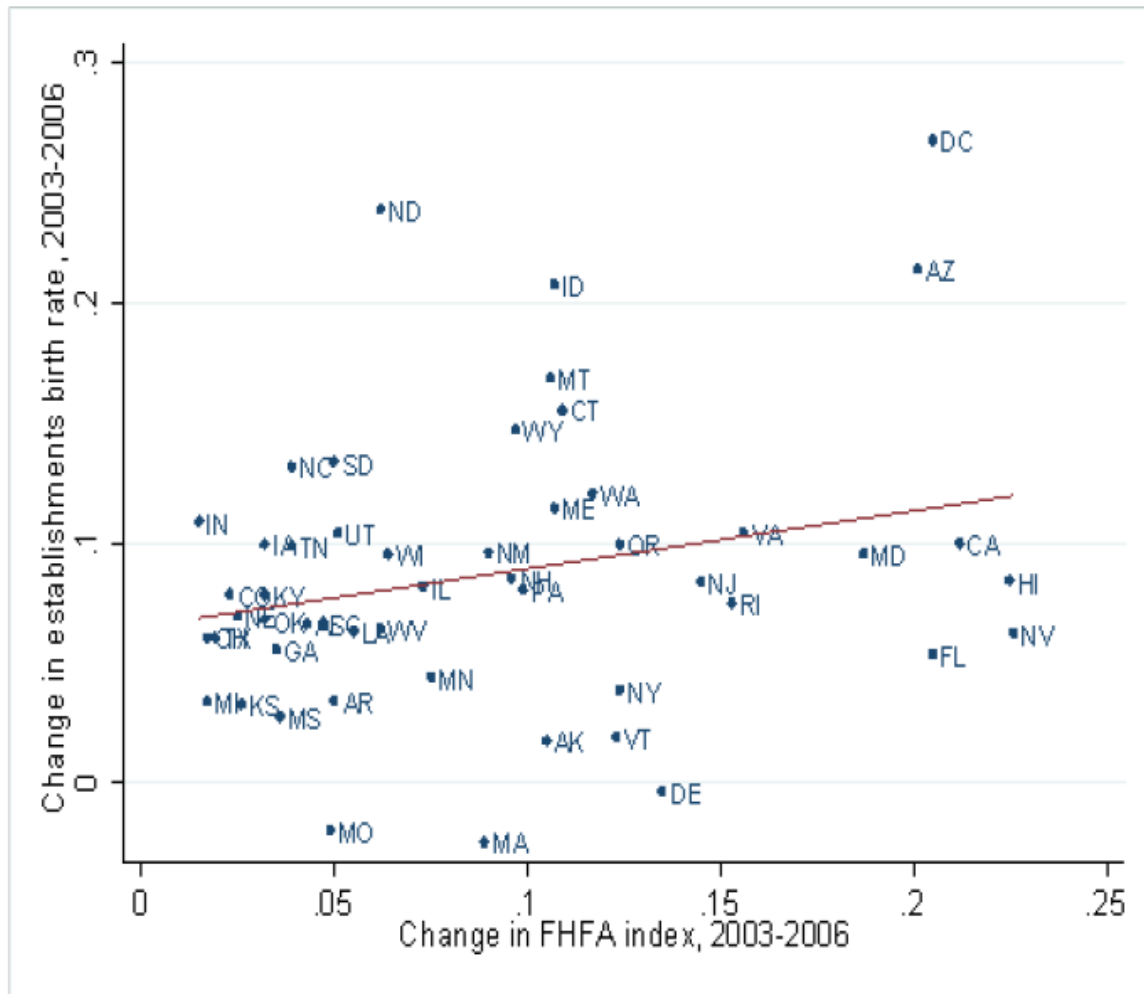
Notes: This figure plots the change in establishments births between 2003 and 2006 (the peak of the U.S. housing boom) against the change in the state-level Federal Housing Finance Agency house price indices over the same period, for the 50 states plus the District of Columbia. House price data are inflation-adjusted.

Table 1. Variables summary statistics

Variable	No. observations	Mean	St. dev	Min.	Max.
Business owner next period	46,679	0.01	0.10	0	1
Age					
Age 31-40	58,127	0.29	0.46	0	1
Age 41-50	58,127	0.30	0.42	0	1
Age 51-60	58,127	0.22	0.43	0	1
Education dummy					
High school	58,127	0.25	0.43	0	1
Some college	58,127	0.32	0.47	0	1
College or more	58,127	0.25	0.43	0	1
Dummy: African American	58,127	0.14	0.35	0	1
Dummy: Female	58,127	0.51	0.50	0	1
Dummy: Married	58,127	0.53	0.50	0	1
Labor income	58,127	$48,998.01	$52,144.90	$0	$1,212,060
Dummy: Unemployed	58,127	0.03	0.17	0	1
Household non-housing wealth	54,626	$74,008.71	$1,063,061	$-1,013,580	$22,047,280
Home equity	58,127	$44,111.26	$80,412.79	$-299,446	$546,000
Home mortgage	58,127	$43,548.18	$67,443.40	$0	$330,002
Home property value	58,127	$87,659.44	$122,718.70	$0	$850,000
State unemployment	58,127	5.13	0.94	2.28	7.81
GSP growth	58,127	5.71	2.30	0.08	14.85
Homestead exemption/100,000	58,127	$2.11	$3.60	$0	unlimited

Notes: The sample includes all households in SIPP for the 1996-2000, 2001-2003, and 2004-2006 waves, between the age of 22 and 60 that did not own a business the first time they were interviewed. 'Business owner next period' is a dummy variable equal to 1 if the household owns or operates a business in the next period. 'Age 31-40' is a dummy variable equal to 1 if the household head's age is between 31 and 40 years. 'Age 41-50' is a dummy variable equal to 1 if the household head's age is between 41 and 50 years. 'Age 51-60' is a dummy variable equal to 1 if the household head's age is between 51 and 60 years. 'High school' is a dummy variable equal to 1 if the household head has finished at most high school. 'Some college' is a dummy variable equal to 1 if the household head is a college drop-out. 'College or more' is a dummy variable equal to 1 if the household head has at least a college degree. 'African American' is a dummy variable equal to 1 if the household head is African American. 'Female' is a dummy variable equal to 1 if the household head is a female. 'Married' is a dummy variable equal to 1 if the household head is married. 'Labor income' denotes the annual household income from supplied labor. 'Unemployed' is a dummy variable equal to 1 if the household head is currently unemployed. 'Household non-housing wealth' denotes the total wealth of the household net of the amount of home equity. 'Home equity' denotes the difference between the value of the household's property and the value of the household's mortgage. 'Home mortgage' denotes the value of the household's mortgage. 'Home property value' denotes the value of the household's property. 'State unemployment' denotes the current rate of unemployment in the household's state. 'GSP growth' denotes the current rate of Gross State Product growth in the household's state. 'Homestead exemption' denotes the property value that can be exempted in bankruptcy procedures; we have assigned a value of $1,000,000 in states with unlimited homestead exemption. Omitted category in age is 'Age 22-30'. Omitted category in education is 'High school drop-out'.

Table 2. Descriptive statistics of new business owners and non-business owners

Variable	Non-business owner next period	Business owner next period	*p*-value of difference
Age			
Age 31-40	0.288	0.322	0.07
Age 41-50	0.303	0.325	0.03
Age 51-60	0.234	0.216	0.08
Education dummy			
High school	0.254	0.210	<0.01
Some college	0.325	0.318	0.50
College or more	0.255	0.358	<0.01
Dummy: African American	0.137	0.064	<0.01
Dummy: Female	0.517	0.444	<0.01
Dummy: Married	0.539	0.673	<0.01
Labor income	$49,368	$64,928	<0.01
Dummy: Unemployed	0.027	0.031	0.17
Household non-housing wealth	$76,455	$160,363	0.02
Home equity	$45,736	$78,232	<0.01
Home mortgage	$45,064	$76,567	<0.01
Home property value	$90,800	$154,798	<0.01
State unemployment	0.051	0.052	0.34
GSP growth	0.057	0.059	0.40
Homestead exemption/100,000	$2.106	$2.378	0.01

Notes: The sample includes all households in SIPP for the 1996-2000, 2001-2003, and 2004-2006 waves, between the age of 22 and 60 that did not own a business the first time they were interviewed. All statistics are means. For variable definitions, see Table 1. The unweighted percentage of households that became business owners in the next period after they were interviewed for the first time is 0.010.

Table 3. Characterizing new business owners

Variable	Mean
Business equity new business owners	$27,874.97
Business equity non-business owners	$3,378.97
Industry	
Agriculture, forestry, fishing, and hunting	0.023
Mining	0.000
Construction	0.155
Manufacturing	0.031
Wholesale trade	0.008
Retail trade	0.085
Transportation, warehousing, and utilities	0.070
Information	0.008
Finance, insurance, real estate, and rental and leasing	0.047
Professional, scientific, management, administrative, and waste management	0.264
Education, health, and social services	0.109
Arts, entertainment, recreation, accommodation, and food services	0.124
Other services (except public administration)	0.070
Public administration	0.008
Active military duty	0.000

Notes: The sample includes all households in SIPP for the 1996-2000, 2001-2003, and 2004-2006 waves, between the age of 22 and 60. The share of each industry is determined based on the new business owners who reported the NAICS code of their business.

Table 4. Business ownership and home equity: OLS results

	Business owner next period			
	Owners and renters		Owners	
	(1)	(2)	(3)	(4)
Log (1 + Home equity)	0.0212***	0.0210***	0.0287***	0.0295***
	(0.0039)	(0.0051)	(0.0089)	(0.0116)
Age 31-40	0.0493	0.0414	0.1011	0.1205
	(0.0725)	(0.0822)	(0.0747)	(0.0849)
Age 41-50	0.0123	-0.0069	0.0672	0.0777
	(0.0757)	(0.0838)	(0.0834)	(0.0930)
Age 51-60	-0.0713	-0.0787	-0.0258	-0.0077
	(0.0738)	(0.0883)	(0.0901)	(0.1011)
High school	0.0299	0.0783	0.0408	0.0455
	(0.0545)	(0.0663)	(0.0787)	(0.0869)
Some college	0.0531	0.1045	-0.0090	-0.0074
	(0.0721)	(0.0815)	(0.0942)	(0.0977)
College or more	0.1504*	0.1976**	0.1108	0.0912
	(0.0779)	(0.0879)	(0.1025)	(0.1073)
African American	-0.1758**	-0.1411*	-0.1910*	-0.1578
	(0.0793)	(0.0801)	(0.1135)	(0.1087)
Female	-0.0784*	-0.0849**	-0.0458	-0.0512
	(0.0421)	(0.0421)	(0.0553)	(0.0540)
Married	0.0982***	0.0971**	0.1051**	0.1140**
	(0.0336)	(0.0380)	(0.0440)	(0.0483)
Labor income	0.4151	0.3393	-0.0945	-0.3728
	(0.3856)	(0.3846)	(0.4925)	(0.5084)
Unemployed	0.1080	0.0576	-0.0331	-0.0192
	(0.1151)	(0.1344)	(0.1165)	(0.1162)
Household non-housing wealth		0.0018*		0.0167***
		(0.0011)		(0.0044)
Log (1 + Home mortgage)		0.0031		0.0081
		(0.0053)		(0.0059)
MSA × year fixed effects	Yes	Yes	Yes	Yes
Marginal effect of increasing home equity	0.0006	0.0006	0.0010	0.0011
Observations	38,421	36,473	23,123	22,301
Pseudo R-squared	0.05	0.05	0.04	0.05

Notes: The table reports probit estimates of transition into business ownership in the next period. The sample is composed of all households in SIPP for the 1996-2000, 2001-2003, and 2004-2006 waves, between the age of 22 and 60 that did not operate a business the first time they were interviewed (columns (1) and (2)), and of all households that owned a home and did not own and operate a business the first time they were interviewed (columns (3)-(4)). 'Home equity' denotes the difference between the value of the household's property and the value of the household's mortgage. 'Age 31-40' is a dummy variable equal to 1 if the household head's age is between 31 and 40 years. 'Age 41-50' is a dummy variable equal to 1 if the household head's age is between 41 and 50 years. 'Age 51-60' is a dummy variable equal to 1 if the household head's age is between 51 and 60 years. 'High school' is a dummy variable equal to 1 if the household head has finished at most high school. 'Some college' is a dummy variable equal to 1 if the household head is a college drop-out. 'College or more' is a dummy variable equal to 1 if the household head has at least a college degree. 'African American' is a dummy variable equal to 1 if the household head is African American. 'Female' is a dummy variable equal to 1 if the household head is a female. 'Married' is a

dummy variable equal to 1 if the household head is married. 'Labor income' denotes the annual household income from supplied labor. 'Unemployed' is a dummy variable equal to 1 if the household head is currently unemployed. 'Household non-housing wealth' denotes the total wealth of the household net of the amount of home equity. 'Home mortgage' denotes the value of the household's mortgage. Omitted category in age is 'Age 22-30'. Omitted category in education is 'High school drop-out'. Standard errors clustered by state are reported in parentheses, where *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table 5. Business ownership and home equity: Robustness

	Business owner next period, OLS	Business owner next period, OLS + sample weights	Business equity next period	Business owner or business equity next period	Business owner next period, all years	Business owner in the future
	(1)	(2)	(3)	(4)	(5)	(6)
Log (1 + Home equity)	0.0004***	0.0005***	0.0138***	0.0181***	0.0186***	0.0236***
	(0.0001)	(0.0002)	(0.0036)	(0.0039)	(0.0047)	(0.0044)
Individual controls	Yes	Yes	Yes	Yes	Yes	Yes
MSA × year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Marginal effect of increasing home equity			0.0010	0.0015	0.0005	0.0007
Observations	42,492	42,492	50,888	51,523	46,939	37,992
(Pseudo) R-squared	0.01	0.01	0.04	0.04	0.05	0.05

Notes: The table reports OLS estimates (columns (1) and (2)) and probit estimates (columns (3)-(6)) of transition into business ownership. The independent variable is a dummy equal to 1 if the household head owns and operates a business next period (columns (1)-(2) and (5)) or in any future period (column (6)), a dummy equal to 1 if the households owns business equity next period (column (3)), or a dummy equal to 1 if the household owns and operates a business or owns business equity next period (column (4)). The sample is composed of all households in SIPP for the 1996-2000, 2001-2003, and 2004-2006 waves, between the age of 22 and 60 that owned a home and did not own and operate a business (columns (1)-(2) and (5)-(6)), did not own business equity (column (3)) or did not own business equity or own and operate a business (column (4)) the first time they were interviewed. In column (5), all observations during each wave for each non-business owning household are included. 'Home equity' denotes the difference between the value of the household's property and the value of the household's mortgage. All individual controls from Table 4 are included. In column (2), the survey-provided household weights are used to account for the fact that SIPP oversamples low-income households. Standard errors clustered by state are reported in parentheses, where *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table 6. Business ownership and home equity: Interaction with individual and state characteristics

	Business owner next period
Age 31-40 × Log (1 + Home equity)	0.0193
	(0.0127)
Age 41-50 × Log (1 + Home equity)	0.0236**
	(0.0105)
Age 51-60 × Log (1 + Home equity)	0.0362**
	(0.0172)
High school × Log (1 + Home equity)	0.0191
	(0.0157)
Some college × Log (1 + Home equity)	-0.0177
	(0.0117)
College or more × Log (1 + Home equity)	-0.0078
	(0.0167)
African American × Log (1 + Home equity)	-0.0015
	(0.0145)
Female × Log (1 + Home equity)	0.0118
	(0.0093)
Married × Log (1 + Home equity)	0.0019
	(0.0068)
Labor income × Log (1 + Home equity)	-0.2589***
	(0.0828)
Unemployed × Log (1 + Home equity)	-0.0206
	(0.0235)
Household non-housing wealth × Log (1 + Home equity)	0.0013***
	(0.0004)
Log (1 + Home mortgage) × Log (1 + Home equity)	0.0023
	(0.0026)
State unemployment × Log (1 + Home equity)	0.0067*
	(0.0039)
GSP growth × Log (1 + Home equity)	-0.0024
	(0.0021)
Homestead exemption × Log (1 + Home equity)	0.0019*
	(0.0011)
Dummy 2002 × Log (1 + Home equity)	-0.0168
	(0.0147)
Dummy 2005 × Log (1 + Home equity)	-0.0034
	(0.0106)
Individual controls	Yes
MSA × year fixed effects	Yes
Observations	36,473
Pseudo R-squared	0.06

Notes: The table reports probit estimates of becoming a business owner in the next period. The sample is composed of all households in SIPP for the 1996-2000, 2001-2003, and 2004-2006 waves, between the age of 22 and 60 that did not own and operate a business the first time they were interviewed. 'Home equity' denotes the difference between the value of the household's property and the value of the household's mortgage. 'Age 31-40' is a dummy variable equal to 1 if the household head's age is between 31 and 40 years. 'Age 41-50' is a dummy variable equal to 1 if the household head's age is between 41 and 50 years. 'Age 51-60' is a dummy variable equal to 1 if the household head's age is between 51 and 60 years. 'High school' is a dummy variable equal to 1 if the household head has finished at most high school. 'Some college' is a dummy variable equal to 1 if the household head is a college drop-out. 'College or more' is a dummy variable equal to 1 if the household head has at least a college degree. 'African American' is a dummy variable equal to 1 if the household head is African American. 'Female' is a dummy variable equal to 1 if the household head is a female. 'Married' is a dummy variable equal to 1 if the household head is married. 'Labor income' denotes the

annual household income from supplied labor. 'Unemployed' is a dummy variable equal to 1 if the household head is currently unemployed. 'Household non-housing wealth' denotes the total wealth of the household net of the amount of home equity. 'Home mortgage' denotes the value of the household's mortgage. 'State unemployment' denotes the current rate of unemployment in the household's state. 'GSP growth' denotes the current rate of Gross State Product growth in the household's state. 'Homestead exemption' denotes the current rate of exemption in bankruptcy of one's property in the household's state. 'Dummy 2002' is a dummy variable equal to 1 if the household was first interviewed in 2002. 'Dummy 2005' is a dummy variable equal to 1 if the household was first interviewed in 2005. Omitted category in age is 'Age 22-30'. Omitted category in education is 'High school drop-out'. Omitted category in year is 1997. All individual controls from Table 4 are included. Standard errors clustered by state are reported in parentheses, where *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table 7. Business ownership and home equity: IV results

	Business owner next period					
	First stage		Second stage			
	Owners and renters	Owners	Owners and renters		Owners	
	(1)	(2)	(3)	(4)	(5)	(6)
House price growth / MSA elasticity	17.882***	2.278***				
	(0.223)	(0.197)				
Log (1 + Home equity)			0.0235***	0.0277**	0.1304*	0.1617*
			(0.0075)	(0.0178)	(0.0886)	(0.1064)
Wald F-statistics	6424.81	134.29				
Individual controls	Yes	Yes	Yes	Yes	Yes	Yes
Non-housing wealth and Log(1 + Home mortgage) included	Yes	Yes	No	Yes	No	Yes
MSA × year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Marginal effect of increasing home equity			0.0007	0.0007	0.0053	0.0068
Observations	38,771	22,946	34,518	33,419	19,353	19,346
Pseudo R-squared	0.72	0.22	0.04	0.04	0.03	0.03

Notes: The table reports probit estimates of the transition into business ownership in the next period (columns (3)-(6)). The sample is composed of all households in SIPP for the 1996-2000, 2001-2003, and 2004-2006 waves, between the age of 22 and 60 that did not operate a business the first time they were interviewed (columns (1) and (3)-(4)), and of all households that owned a home and did not own and operate a business the first time they were interviewed (columns (2) and (5)-(6)). 'Home equity' denotes the difference between the value of the household's property and the value of the household's mortgage. 'House price growth' is the US-wide change in house prices between the year when the property was bought and the current year. For renters, it is equal to 0. 'MSA elasticity' is the MSA's elasticity of housing supply (from Saiz, 2010). In columns (3)-(6), 'Log (1+Home equity)' is instrumented using the US-wide change in house prices between the year when the house was bought and the present year, divided by the MSA's elasticity of housing supply. All individual controls from Table 4 are included. Standard errors clustered by state are reported in parentheses, where *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table 8. Business ownership and home equity: Ruling out demand booms and feedback effects

	High-elasticity MSAs		Excluding housing boom-driven sectors		High-elasticity MSAs and excluding housing boom-driven sectors	
	OLS	IV	OLS	IV	OLS	IV
	(1)	(2)	(3)	(4)	(5)	(6)
Log (1 + Home equity)	0.0302***	0.0486***	0.0215***	0.0328***	0.0317***	0.0580***
	(0.0056)	(0.0140)	(0.0049)	(0.0119)	(0.0050)	(0.0162)
Individual controls	Yes	Yes	Yes	Yes	Yes	Yes
MSA × year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Marginal effect of increasing home equity	0.0009	0.0015	0.0006	0.0009	0.0009	0.0017
Observations	19,302	18,245	36,403	34,874	19,286	18,232
Pseudo R-squared	0.06	0.05	0.05	0.01	0.06	0.05

Notes: The table reports probit estimates of becoming a business owner in the next period. The sample is composed of all households in SIPP for the 1996-2000, 2001-2003, and 2004-2006 waves, between the age of 22 and 60 that did not own and operate a business the first time they were interviewed. 'Home equity' denotes the difference between the value of the household's property and the value of the household's mortgage. In columns (2), (4), and (6), 'Log (1+Home equity)' is instrumented using the US-wide change in house prices between the year when the house was bought and the present year, divided by the MSA's elasticity of housing supply (from Saiz, 2010). In columns (1)-(2) and (5)-(6), only individuals living in the top 50% of the MSAs in terms of elasticity of housing supply are included. In columns (3)-(6), the following sectors are excluded: Construction; Finance, insurance, real estate, and rental and leasing; and Education, health, and social services. All individual controls from Table 4 are included. Standard errors clustered by state are reported in parentheses, where *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table 9. Changes in mortgage finance: Comparing business owners to non-business owners

	Log (1+Home mortgage_t+1) - Log (1+Home mortgage_t)	
	(1)	(2)
New business owner	0.3653***	0.2200**
	(0.0760)	(0.0903)
Log (1 + Home mortgage_t)	-0.3113***	
	(0.0109)	
Log (1 + Non-housing debt_t)		-0.5521***
		(0.0126)
Individual controls	Yes	Yes
MSA × year fixed effects	Yes	Yes
Observations	117,828	77,684
R-squared	0.17	0.35

Notes: The table reports OLS estimates of the log change in mortgage debt from the previous to the current period, for the full sample (column (1)) and for the sub-sample of home owners (column (2)). 'New business owner' is a dummy equal to 1 if the household did not own business equity or operated a business in the previous period, but does in this period, and to 0 if it does not. The sample is composed of all households in SIPP for the 1996-2000, 2001-2003, and 2004-2006 waves, between the age of 22 and 60. 'Home mortgage' denotes the value of the household's mortgage. 'Non-housing debt' denotes the value of the household's total debt, excluding mortgage debt. All individual controls from Table 4 are included. Standard errors clustered by state are reported in parentheses, where *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level.