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Abstract Using a unique survey data of Chinese households, we study the impact of house price growth and house price risk on entrepreneurship. House price risk, measured as the sensitivity of house price growth to local GDP growth, negatively impacts the entrepreneurship of homeowners relative to renters. This finding is concentrated only among sophisticated households and is consistent with the portfolio effect when housing and occupational choices are integral parts of the household portfolio. Moreover, a high past house price growth reduces the entrepreneurship of homeowners relative to renters. This holds for both sophisticated and unsophisticated households. We propose a new economic channel based on extrapolative belief and provide further supportive evidence.

Keywords Entrepreneurship; Housing market; Extrapolative belief

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I. Introduction

Entrepreneurship plays an important role in job creation and economic growth (Andersen and Nielsen, 2012) by generating and taking advantage of business opportunities. Since housing is the most important asset for the majority of households (Yao and Zhang, 2005), business decisions and household decisions are highly linked (Wang, Wang, and Yang, 2012). In recent years, a growing literature studies the effect of house value on business formation, but the results are mixed and there are debates about the underlying mechanisms. Moreover, little is known about the effect of house price risk on entrepreneurship.

China has witnessed remarkable entrepreneurship development since 1992. China's economic reform can largely be attributed to unleashing entrepreneurship by removing or lowering institutional barriers to market entry and private business development (He, Lu, Qian, 2019). Entrepreneurship development in China is entering a golden era. Since 2015, "mass entrepreneurship and innovation" has emerged as the new national economic development strategy, and Chinese central and local governments are devoting tremendous amounts of resources to startups. A recent State Council document requires various ministries to lead or support entrepreneurship and innovation initiatives (State Council of People's Republic of China 2017).

In this paper, we study the effects of both house price growth and house price risk for future entrepreneurship using Chinese data. Over the past two decades, China has experienced a great housing boom (Glaeser, Huang, Ma, and Shleifer, 2017) that is difficult to be reconciled with the fundamentals (Han, Han, and Zhu, 2018). High growth rate of house price has been accused of having a negative externality on the real economy, especially entrepreneurship.[1] The 2018 Report on the Work of the Government explicitly stated that "Houses are for living in and not for speculative investment", which reflected the strong will of the government to fight against housing market speculation. Accordingly, the general upward trend was punctured by episodes of government interventions that are often local. As a result of such interventions, the growth rate of house price varied widely across regions, though the growth rate is still high overall (e.g. Fang, Gu, Xiong, and Zhou, 2016; Zhou, 2016; Chen and Wen, 2017). These regional variations and exogenous shocks

[1] For example, on 27 July 2020, Economic Information Daily comments that high house price growth greatly hurts entrepreneurship (see https://www.sohu.com/a/409890430_120133503?_trans_=000014_bdss_dkmwzacjP3p:CP=). The article mentions that when the profit from real estate investment significantly surpasses the profit from business operation, it will be difficult for entrepreneurs to focus on business investment such as R&D and innovation. Established in 1981, Economic Information Daily is the earliest nationwide newspaper on economic topics.

provide us opportunities for identifying the causal effects of house price growth and house price risk on entrepreneurship.

We employ a unique individual-level dataset that is particularly suited for this purpose. The 2017 wave of China Household Finance Survey provides detailed information about households' housing asset, housing market expectation, entrepreneurial activities, financial literacy, and other household characteristics. Such information enables us to conduct refined test hypotheses for various types of households and differentiate among alternative economic mechanisms.

We classify self-employed individuals as entrepreneurs if they view themselves as having started a business. This is consistent with Lazear (2005) who defines an entrepreneur as someone who responds affirmatively to the question "I am among those who initially established the business."

Our research is executed through several steps. First, we calculate house price growth and house price risk of each sample city. House price risk (*Pro*) is measured as the sensitivity of real house price growth to real local GDP growth, and captures the systematic risk of the local housing market. To the extent that local GDP growth is a proxy for the return to entrepreneurial activities, *Pro* also measures the co-movement between the return to housing investment and the return to entrepreneurial activities. Second, we run panel regressions for individual households' propensity to start a business in a given year to investigate the impact of past house price growth and house price risk. To mitigate the endogeneity concern, we construct instrumental variables for house price growth and house price risk based on land supply constraint. Third, we conduct additional tests both for robustness and also to better understand underlying mechanisms.

We are motivated by Bracke, Hilber, and Silva (2018) who consider a model of housing tenure and occupational choice. Households are assumed to integrate labor income and housing wealth in a household portfolio when deciding between dependent work versus entrepreneurship. They highlight a portfolio effect of housing market on entrepreneurship. They show that a higher covariance between house price and entrepreneurial income increases the overall risk of the portfolio and therefore reduces the likelihood of choosing an entrepreneurial occupation. Further, increased house price raises the weight of housing asset in a household portfolio. As a result, the household's exposure to house price risk rises and its entrepreneurship drops.

This portfolio effect implies that both house price growth and house price risk have a negative impact on entrepreneurship. But there are countervailing forces. For example, incremental house value increases lifetime wealth, which in turn reduces risk aversion and

encourages entrepreneurship. This is the "wealth effect". The literature also emphasizes a positive "collateral effect" as increased housing wealth helps alleviate credit constraints for potential entrepreneurs by enabling homeowners to extract equity from their property and invest it in their business. Regarding the effect of housing price risk on entrepreneurship, a "hedging effect" can lead to a positive relation. In regions with a high house price risk, there would be a high correlation between house price and entrepreneurial income. Thus, entrepreneurship provides a good hedge against future housing costs, making it more attractive as an occupational choice. Overall, the confluence of opposing effects above suggests that it is an empirical question how house price growth and house price risk affect entrepreneurship.

One distinguishing feature of our empirical work is that our test hypotheses focus on the marginal effect of house price growth and house price risk for homeowners relative to renters. We compare entrepreneurial activity of homeowners and renters operating in the same region. In contrast, most previous studies focus on homeowners and do not consider renters.

Our first main finding is that past house price growth negatively affects the entrepreneurship of homeowners relative to renters in China. This is in stark contrast to the generally positive effects found within a developed country context (See Section 2 for a succinct literature review). Our second main finding is that house price risk negatively impacts entrepreneurship for homeowners relative to renters. Both results are consistent with the portfolio effect, because unlike homeowners, renters do not own housing assets and are not influenced by the negative portfolio effect.

Moreover, we find that the negative impact of house price risk is concentrated only among households with high education level and understand the diversification effect (based on their responses to a survey question "Investing in multiple financial assets is less risky than investing in one single financial asset."). This is consistent with the portfolio effect: for the portfolio effect to work, households need to be sophisticated enough to understand the diversification effect. However, we find a significantly negative effect of house price growth on entrepreneurship not just for the sophisticated homeowners but also for homeowners with low level of education and financial literacy (for whom the portfolio effect does not apply). Thus, the portfolio effect itself is not enough to fully explain our results.

We propose an additional behavioral channel for the negative effect of house price growth on entrepreneurship that applies particularly to unsophisticated households. It is based on narrow framing and extrapolation bias. Some homeowners may practice narrow

framing, and consider housing versus starting a business separately, not as integral parts of the household portfolio as in the model of Bracke, Hilber, and Silva (2018). High past housing market returns lead households with extrapolation bias to optimistic belief about future housing market. Such optimism encourages households to invest in housing assets, thus crowding out their entrepreneurial activities. Consistent with this idea, we find that unsophisticated homeowners that are more optimistic about the local housing market have a stronger intention to purchase houses but a weaker intention to start a business. Moreover, we find that a high house price growth in another city would also lower the likelihood of local homeowners to start a business, above and beyond the effect of own city's house price growth. This finding is consistent with the extrapolative belief effect, but it cannot be explained by the portfolio effect. The two effects are complementary, and we find empirical support for both.

Our paper makes several important contributions to the literature. First, we are the first to document a negative effect of house price risk on entrepreneurship. Second, our study highlights important cross-country difference in the impact of housing market on entrepreneurship. We find that high house price growth crowds out investing in a small business in China, which is opposite to the evidence from developed countries in the literature. Our findings have important policy implications. Third, we uncover heterogeneity across households in the effect of housing market on entrepreneurship and multiple underlying economic rationales at work. We propose a new behavioral channel through which house price growth affects entrepreneurship and provide supportive evidence.

The rest of the paper is organized as follows. Section II reviews the literature, and Section III develops the test hypotheses. Section IV describes our data. Section V reports the empirical results including additional analyses aimed at better understanding the economic mechanisms. Section VI concludes.

II. Literature review

Most studies in the literature document a positive effect of property value on entrepreneurship and interpret the finding based on the role of housing equity in alleviating credit constraints faced by entrepreneurs. This is called the collateral effect. For example, Wang (2012) studies a reform in urban China that allowed state employees who were renting state-owned housing to buy their homes at subsidized prices. Wang (2012) finds an increase in self-employment following the reform, which alleviated credit constraints by allowing households to capitalize on the value of the real estate. Adelino, Schoar, and

Severino (2015) show that small businesses in areas with greater increases in house prices have stronger growth in employment than large firms in the same areas. They argue that the collateral lending channel for small business employment is important in the U.S. over the past decade. Corradin and Popov (2015) estimate that a 10% increase in home equity raises the share of individuals who become self-employed from 1% to 1.07% in the U.S each year. They propose that housing wealth helps alleviate credit constraints for potential entrepreneurs by enabling homeowners to extract equity from their property and invest it in their business. Harding and Rosenthal (2017) estimates that a 20% real increase in home value over a two-year period raises the likelihood of entry into self-employment by roughly 1.5 percentage points in the U.S. Schmalz, Sraer, and Thesmar (2017) also find a positive relationship between house price appreciation and business creation, and support the collateral effect interpretation.

However, the housing collateral channel could be confounded with a broader wealth effect that can also increase entrepreneurial activity. Specifically, a rise in housing prices increases the net wealth of homeowners, which may encourage them to take more risk (including starting a business) independently of any change in their borrowing capacity. To address this identification problem, Jensen, Leth-Petersen and Nanda (2014) exploit a natural experiment in which an exogenous mortgage reform in Denmark provided entrepreneurs with greater access to home equity lines of credit, thereby unlocking a home equity source of finance to start a business. They find evidence of a housing collateral channel, although the economic effect of the channel is relatively small. Similarly, Kerr, Kerr and Nanda (2017) find that housing collateral plays a role in business formation, but that wealth effects appear to be more important.

There are also different findings regarding the effect of house price appreciation on entrepreneurship. For instance, Hurst and Lusardi (2004) show that U.S. households living in regions in which housing prices appreciated strongly are no more likely to start a business than households in other regions. Disney and Gathergood (2009) find little evidence of house price shocks unbinding liquidity constraints faced by the would-be self-employed. Wu, Gyourko, and Deng (2015) find no evidence for the impact of real estate collateral value on corporate investment.

Bracke, Hilber, and Silva (2018) theoretically show that the effect of home equity wealth on entrepreneurship is ambiguous because of two conflicting forces. In addition to the positive wealth effect, they point out a negative portfolio effect: a higher house value increases the share of housing wealth in a household's portfolio, leading to more exposure

to the covariance between entrepreneurial profits and house values, thus discouraging entrepreneurship for homeowners.

We find that house price growth negatively affects homeowners' entrepreneurship in China. This is in stark contrast to a significantly positive or insignificant relationship documented by the literature. Our result is consistent with but distinct from Li and Wu (2014). Using data from 2005 Inter-Census Population Survey and 2010 Chinese Family Panel Studies, Li and Wu (2014) find that high housing price in general discourages entrepreneurial activities for urban adults in China. People are less likely to start their own business in cities with a higher housing price. Their main focus is on house price *level*, while we study the effect of house price *growth*. Different from Li and Wu (2014) and other previous studies, we also investigate the impact of house price *risk* on entrepreneurship.

III. Hypotheses

The relationship between past house price growth and entrepreneurship is shaped by several opposing forces. The collateral effect and the wealth effect result in a positive relationship. The portfolio effect leads to a negative relationship. These effects apply to homeowners, not renters.

We propose another channel through which house price growth can negatively impact entrepreneurship. This economic mechanism involves potential household behavioral bias. More specifically, due to narrow framing, households may regard housing asset and starting a small business as competing investments instead of considering them together as integral parts of the overall household portfolio. For households with extrapolative belief, high house price growth in the past would induce optimism about future housing market which encourages housing investment and crowds out entrepreneurial investment. This leads to a negative relationship between house price growth and entrepreneurship. We refer to it as extrapolative belief effect throughout the rest of the paper.

The extrapolative belief effect should have stronger influence on the financially unsophisticated individuals. In contrast, in order for the portfolio effect to apply, households need to be sophisticated enough to understand portfolio diversification. Thus, although both the portfolio effect and the extrapolative belief effect imply a negative relationship between house price growth and entrepreneurship, they can potentially be distinguished by examining the relation separately for sophisticated households and for unsophisticated households.

In China, the negative effects of past house price growth on entrepreneurship are likely to dominate the positive effects. First, owner-occupied houses are protected by the law. If a loan is collateralized by an owner-occupied house, the lender is allowed to freeze but not immediately sell the house in case of a default.[2] This makes banks less willing to accept owner-occupied houses as a collateral, which weakens the positive collateral effect. Moreover, Wu, Gyourko, and Deng (2015) point out that no meaningful collateral channel effects can be expected in China because of the absence of the frictions ('contract incompleteness') that give rise to collateral channel effects in other countries. Second, given the large housing boom in China during our sample period, the extrapolation bias is likely to exert strong influence, causing households to herd into housing investment, crowding out entrepreneurial activities. Housing is traditionally viewed as a viable and popular investment option in China (Chen and Wen, 2017). [3] House purchase is even considered a "priority" for young people and their parents due to intense marriage market competition (Li and Wu, 2014). Therefore, our Hypothesis 1 is as follows:

H1: Past house price growth negatively affects entrepreneurship choice for homeowners relative to renters.

Regarding the impact of house price risk on entrepreneurship, the portfolio effect results in a negative relation. On the other hand, entrepreneurship may provide a good hedge against future housing costs in regions with a high house price risk. This hedging effect results in a positive relation between house price risk and entrepreneurship. The portfolio effect only applies to homeowners, while the hedging effect mainly applies to renters. For homeowners, owner-occupied housing already offers a hedge against future housing costs (Sinai and Souleles, 2005; Han 2008; Han 2010). This weakens the hedging effect of entrepreneurship for homeowners. Therefore, our Hypothesis 2 is as follows:

H2: The impact of house price risk on entrepreneurship is negative for homeowners relative to renters.

Since the portfolio effect mainly applies to sophisticated households, we expect the negative impact of house price risk to be stronger for sophisticated homeowners. This leads to our Hypothesis 2a:

[2] See the legal document (in Chinese) at: http://lylcqfy.hncourt.gov.cn/public/detail.php?id=1369

[3] This is also likely to be the case in Europe, where many households see housing as a "safe haven" asset. While Americans tend to hold more stocks, Europeans tend to hold more real estate, especially in the form of primary residences (Musso, Neri, and Stracca, 2011).

H2a: The negative effect of house price risk on entrepreneurship is more pronounced for sophisticated homeowners.

IV. Data

This section describes our data and key variables in the empirical analyses.

4.1 Micro-level data

Established in 2010, the China Household Finance Survey and Research Center provides micro-level data about household finance (Gan, Yin, Jia, Xu, Ma, and Zheng, 2014). This paper uses the latest 2017 wave of China Household Finance Survey (CHFS), which covers urban households from 158 cities in 29 provinces of China.[4]

The survey includes respondents' household characteristics such as the history and current situation of family business (if any) and housing assets (if any). It also contains respondents' personal characteristics including age, gender, education, "hukou" type (urban/rural), risk aversion level, and health status.[5] Their summary statistics are reported in Table 1. The definitions of the variables used in this paper are described in **Appendix**. The fraction of households currently owning a business is 16%, and it increases to 25% if those who used to own a business are also counted. The probability that a household owns at least one property (house or apartment unit) is 88%, and the average number of properties owned is about 1.1.[6] A median respondent is 54 years old, female, with an education level of junior high school or lower, with urban "hukou", married, not preferring projects with above-average risk and return, and relatively healthy. We focus on the urban respondents in our analyses.

In order to study the effect of local house price growth and house price risk on entrepreneurship, we need to merge the CHFS data with house price indexes. The National Bureau of Statistics constructs house price indexes for 70 large and medium cities. Of the 158 cities covered by 2017 CHFS, 54 cities have house price indexes; of the 27,279 respondents in urban area, 18,487 of them are located in these 54 cities. We further delete the respondents with mistaken records of house location.[7] We also drop an observation if

[4] If we consider both rural and urban respondents, then CHFS covers 169 cities. Two provinces, Xinjiang and Xizang, are not covered by CHFS.

[5] The initial type and registry city of one's "hukou" depend on the "hukou" of one's parents. See Liu (2005) for more details about the "hukou" system in China.

[6] Our estimate of the homeownership rate, 88%, is close to the "90%" estimated by Glaeser, Huang, Ma, and Shleifer (2017).

[7] In the survey questionnaire, Question C1001 asks whether one owns the primary residence. Question C2009a asks whether an owned house is located in one's residence city. Question C2009b asks about the city in which an owned house is located. If the three questions give conflicting answers, we delete the observation.

the respondent claimed to be a homeowner but refused to disclose the location or the purchase year of the house. Our final sample in 2017 consists of 16,215 observations.

To make use of the longitude of the data, we transform the 2017 CHFS data into a panel data that spans from 2013 to 2017. This is achieved by using the information on the purchase year of a house and the starting year of households' most recent business. A household-year combination is dropped if the household owned a small business but it was started in the previous years. We are able to mitigate the survival bias associated with small business because for the households who had no business in 2017 but used to have one in earlier years, we know the starting year and the ending year of the most recent business.

Table 2 Panel A reports the average fraction of households that started a business and owned a house each year from 2013 to 2017. For example, in the year 2017, 1.15% of the households started a business, and about 83% of the households owned a house. The home-ownership rate here is lower than the "88%" in Table 1, because we only consider the 54 large or medium cities with house price indexes. In these cities, home-ownership rate is lower than in small cities.

4.2 House price risk

The macro and regional economic variables in this paper are downloaded from the Wind database and the CSMAR database, both of which are widely used by academics and the financial industry in China. The house price indexes of 70 large and medium cities are constructed by the National Bureau of Statistics of China (NBS). They are monthly indexes. For each city, we calculate the most recent one-year growth rate of its house price index and denote it as *HPIg*.

House price risk, denoted by *Pro* in the rest of the paper, is the sensitivity of real house price growth to real GDP growth, measured by the coefficient of *RGDPg* in regression (1).

$$QRHPIg_{c,p} = c_c + \beta_c RGDPg_p + \varepsilon_{c,p} \quad (1)$$

This regression is estimated using quarterly data starting from September 2006. The dependent variable (*QRHPIg*) is year-on-year quarterly house price growth rate of city *c* in province *p,* deflated by CPI. To compute *QRHPIg*, we first calculate year-on-year growth rate in each month, and then compute the quarterly average of it. The independent variable, *RGDPg*, is the quarterly year-on-year growth rate of GDP in province *p*, also deflated by CPI.

To capture potential time-variation in house price risk, we re-estimate (1) as time goes by including latest available data. The expanding window approach allows us to incorporate the boom and bust of house prices around the 2008 financial crisis. This estimation procedure is motivated by Adelino, Schoar, and Severino (2018). They find that, while house price expectations only correlate with house prices lagged one year, lagged house prices even three years prior to the survey still correlate strongly with perceived riskiness of housing.

Figure 1 plots the values of *Pro* of the 70 cities in December 2016, against the values in December 2012. While the house price risk measure *Pro* is rather stable over time for a given city, it varies a lot cross-sectionally. For example, the *Pro* of Wenzhou, a port and industrial city in Zhejiang Province, is as high as 0.86 in 2012 and 0.94 in 2016. In contrast, the *Pro* of Kunming, capital city of Yunan Province, is as low as -0.33 in 2012 and -0.12 in 2016. House price risk tends to be lower for larger cities and those with high house price growth. During 2012-2016, the correlation between *HPIg* and *Pro* is -0.21. The cross-sectional variation of *Pro* helps us identify the impact of local house price risk on entrepreneurship. The large variation across cities in house price growth and risk can be seen from the summary statistics of *HPIg* and *Pro* reported in Table 2 Panel B.

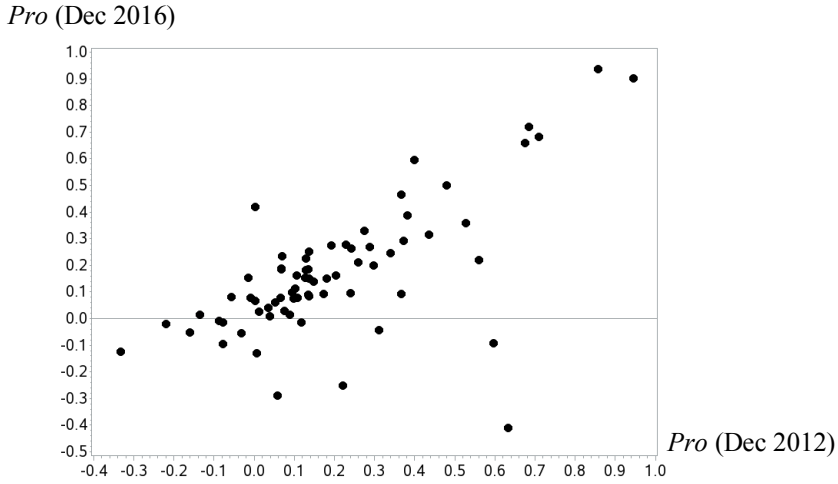

Figure 1 Distribution of *Pro*

Note. The figure plots the value of *Pro* of the 70 large and medium cities in December 2016 against the value in December 2012. *Pro* is the coefficient of *RGDPg* in regression (1), which uses an expanding window that covers from September 2006 to month *t*.

V. Empirical results

We first test the impact of house price growth and house price risk on entrepreneurship at individual household level. We conduct additional analyses for robustness and also to better understand the underlying economic mechanisms.

5.1 Baseline regression

Our baseline regression is specified by Equation (2) and estimated using the panel dataset we have assembled. The dependent variable is the dummy $Start_{i,c,t}$ where i, c, and t refers to household, city, and year, respectively. For a household i of city c in year t, the dummy *Start* equals 1 if the household started a small business in year t, and 0 otherwise. Note that by the construction of our panel dataset, the observations in year t consist of households that either did not own a business or started a business in year *t.*

$$\begin{aligned} Start_{i,c,t} &= c + \beta_1 HPIg_{c,t-1} + \beta_2 Pro_{c,t-1} + \beta_3 Own_{i,t} + \beta_4 Own_{i,t} * HPIg_{c,t-1} \\ &+ \beta_5 Own_{i,t} * Pro_{c,t-1} + \lambda_1 Z_i + \lambda_2 Z_i * HPIg_{c,t-1} + \lambda_3 Z_i * Pro_{c,t-1} + \theta_t + \eta_c + \varepsilon_{i,c,t} \end{aligned} \quad (2)$$

The key independent variables of interest are house price growth *HPIg* in year *t*-1, house price risk *Pro*, and their interaction terms with the dummy *Own,* which equals 1 if the household purchased a house in the city in year *t*-1 or earlier, and 0 otherwise. Our identification comes from city-level variations in house price growth and house price risk. Our results on the coefficients of *HPIg*Own* and *Pro*Own* cannot be explained by aggregate level (e.g., economic, political, regulatory) determinants of entrepreneurship, or personal characteristics that are correlated with occupational choices. We explicitly control for a vector *Z* of the respondents' personal characteristics, including age, gender, education level, "hukou" type, health status, and the level of risk aversion. Following Schmalz, Sraer, and Thesmar (2017), we control for the interactions between *Z* and *HPIg.* We also control for the interactions between *Z* and *Pro*.

Table 3 Column (1) shows the results of the logistic regression. The coefficient of *HPIg* is positive, whereas that of *HPIg*Own* is significantly negative. That is, lagged house price growth *HPIg* has a more negative relationship with the propensity to start a business for homeowners than for renters. Based on the regression coefficients, we compute the marginal effect of *HPIg* on the probability of starting a business, separately for homeowners and renters, holding the household characteristics at their mean values. The

marginal effect is -0.47% for homeowners and 4.7% for renters. The difference is significant, with a p-value of 0.0003. Thus, **H1** is supported.

Moreover, the coefficient of *Pro* is insignificant, and that of *Pro*Own* is significantly negative. In other words, the relationship between past house price risk and entrepreneurship is negative for homeowners, but not for renters. These results are consistent with the portfolio effect which applies only to homeowners. Holding the household characteristics at their mean values, the difference in the marginal effect of *Pro* on the probability of starting a business for homeowners and renters equals -0.72% (p=0.01). Our hypothesis **H2** is supported.

For robustness, we estimate a linear probability model as in Schmalz, Sraer, and Thesmar (2017) using OLS regression. The results, displayed in Table 3 Column (2), are consistent with those from the logistic regression in Column (1). For example, the coefficient of *HPIg*Own* is significantly negative. This supports hypothesis **H1**. For homeowners, an increase of 10% in house price growth is associated with a decrease of 0.85% in the propensity to start a business in the next year. This magnitude is economically significant, given that the unconditional propensity of starting a business in a given year is 1.34% over our sample period.

5.2 Instrumental variable approach

In this section, we address a potential endogeneity concern about the relation between past housing price growth and households' propensity to start a business. Our research design partially deals with this possibility by comparing homeowners' propensity to start a business relative to renters, and by employing lagged explanatory variables whereby we map house price growth in year *t* into the probability of transition into entrepreneurship at year *t*+1. Moreover, it is difficult to reconcile our finding with an omitted variable bias. For example, a local economic boom may stimulate both house price growth and business creation. However, this would suggest a positive relationship between house price growth and entrepreneurship, yet our result is exactly the opposite. Still, we address the potential endogeneity concern in two ways.

First, we take advantage of an exogenous shock in housing market. At the beginning of 2016, the central government and some local governments announced property destocking as a main task in 2016. On February 2, 2016, the People's Bank of China reduced the required down-payment ratio. The policy was followed by abnormally high house price growth in some cities despite lackluster economic prospects. [8] The cross-sectional

[8] For example, the 2016 house price growth in Hefei, the capital of Anhui Province, was as high as 49%.

correlation between city-level house price growth in 2016 and the expected GDP growth announced by each city government is only 0.06 and insignificant. Thus, by focusing on the cross-sectional relationship between house price growth in 2016 and the entrepreneurial activities in 2017, we attenuate the potential endogeneity problem. When we repeat the logistic regression (2) using only the year 2017 observations (instead of the panel data as in Table 3), the coefficient of *HPIg*Own* is -5.18, with a standard error of 1.79. This confirms the results in Table 3 and supports H1.

Second, to further alleviate the potential endogeneity concern, we re-estimate the regression (2) using the instrumental variable (IV) approach. Our IVs for a given city's house price growth (resp. house price risk) are based on interactions between land supply constraint in that city and country-level house price growth (resp. country-level house price risk). The use of land supply constraint is motivated by two papers. Mian and Sufi (2011) use topology-based housing supply elasticity as an instrument for house price growth. Paciorek (2013) find that regulation and geographic constraints play critical and complementary roles in decreasing the responsiveness of housing investment to demand shocks, which in turn amplifies house price volatility. These two points also apply to China, where house price growth has been driven by land values instead of construction cost (Wu, Gyourko, and Deng, 2016), and house price volatility has been significantly affected by land supply (Deng, Girardin, and Joyeux, 2018).

We measure land supply constraint by taking advantage of the 2006-2020 Land Use Plan.[9] In China, the government is the only land supplier. For sake of food security, in 2006, the central government set the bottom line for the size of arable land 296.5 million acres, and the quota was allocated to provinces. This determines the land supply constraint in subsequent years. The Plan proposed two binding constraints for the size of land that can be used for construction. The first is the size of "urban and rural construction land". The second is the size of "urban construction land". Then we calculate two measures of land supply constraint: *ConAll* and *ConUrban*, given by Equations (3a) and (3b). In (3a), $Construct_{2020}$ and $Construct_{2005}$ are the size of planned urban and rural construction area for 2020 and the size of actual urban and rural construction area in 2005, respectively. In (3b), $ConstructUrban_{2020}$ and $ConstructUrban_{2005}$ are the size of planned urban construction area for 2020 and the size of actual urban construction area in 2005, respectively. Among the 70 large and medium cities with house price indexes, *ConAll* and *ConUrban* are available for 69 and 67 cities, respectively.

[9] Each city has a Plan. For example, the Plan of Beijing can be found at:
http://www.beijing.gov.cn/zfxxgk/110014/ztgh32/2017-10/19/content_3e34abc8087d4b4f96483b169e0a3a86.shtml

$$ConAll = \frac{Construct_{2020} - Construct_{2005}}{Construct_{2005}} \tag{3a}$$

$$ConUrban = \frac{ConstructUrban_{2020} - ConstructUrban_{2005}}{ConstructUrban_{2005}} \tag{3b}$$

It is important to note that we do not use the actual land supply as instruments. Our measures of land supply constraint, based on the Land Use Plan, were determined for each city several years prior to the start of our sample period 2013-2017. Therefore, they would not be affected by local economic conditions during our sample period.

We use the interactions between a city's land supply constraint (and its square) with the country-wide house price growth (resp. house price risk) to instrument local house price growth (resp. local house price risk). Assuming a city's land supply constraint is an average of *ConAll* and *ConUrban,* the first stage regressions of our IV approach are given below:

$$\begin{aligned} HPIg_{c,t} &= c + \beta_1 ConAll_c * NHPIg_t + \beta_2 ConUrban_c * NHPIg_t \\ &+ \beta_3 ConAll_c * ConUrban_c * NHPIg_t + \beta_4 ConAll_c^2 * NHPIg_t \\ &+ \beta_5 ConUrban_c^2 * NHPIg_t + \theta_t + \eta_c + \varepsilon_{c,t} \end{aligned} \tag{4a}$$

$$\begin{aligned} Pro_{c,t} &= c + \beta_1 ConAll_c * Npro_t + \beta_2 ConUrban_c * Npro_t \\ &+ \beta_3 ConAll_c * ConUrban_c * Npro_t + \beta_4 ConAll_c^2 * Npro_t \\ &+ \beta_5 ConUrban_c^2 * Npro_t + \theta_t + \eta_c + \varepsilon_{c,t} \end{aligned} \tag{4b}$$

In regression (4a), *NHPIg* is the country-level growth rate of house price, computed from the country-level house price index. Since *ConAll* and *ConUrban* are both time-invariant, the time variation in the predicted value of *HPIg* originates from the national house price growth *NHPIg*. In regression (4b), *Npro* is the country-level house price risk, estimated in the same way as local house price risk using the national counterpart of Equation (1) by regressing country-level house price growth rate on country-level GDP growth rate.

Table 4 Panel 1 reports the results from the first stage regressions. For example, Column (1) shows that for a given level of country-wide house price growth, the local house price growth has an inverse-U relationship with *ConAll*. This is consistent with Nathanson and Zwick (2018), who theoretically show that a house price boom is largest for intermediate values of initial land supply. Results from the F-test indicate that our

instruments for local house price growth and house price risk are valid and significantly correlated with the observed values.

Table 4 Panel 2 reports the results from the second stage of the IV approach where we estimate the baseline regression (2) after replacing *HPIg* and *Pro* by the corresponding predicted values from regressions (4a) and (4b). In both the logistic model and the linear probability model, the coefficients of both *HPIg*Own* and *Pro*Own* are significantly negative. That is, both high past house price growth and high house price risk reduce the likelihood of homeowners to start a small business compared to the renters. Thus, the results under the IV approach support our hypotheses **H1** and **H2**.

5.3 Underlying mechanisms

In Section 5.1 and 5.2, we show that both high house price growth and house price risk discourage the entrepreneurship of homeowners. In this subsection, we conduct additional tests to differentiate alternative explanations of our findings. To test the validity of the portfolio effect, we perform a subsample analysis based on the financial sophistication of the households. Then, to highlight the role of extrapolative belief, we examine the relationship between households' expectation and investment intention. We also investigate the relationship between one's entrepreneurship and the house price growth in another city.

5.3.1 Subsample analysis

As illustrated in Section III, the portfolio effect and the extrapolative belief effect apply to different groups of households. Here, we conduct a subsample analysis in order to differentiate the two channels underlying the negative effect of house price growth on entrepreneurship. To this end, we classify the households in the survey into several groups based on the education level and financial literacy of households. Households with "Low" education level (junior high school or lower) are separated from the "High" education households (senior high school and above). Regarding financial literacy, we make use of CHFS Question H3115, which asks about respondents' view towards the statement "Investing in multiple financial assets is less risky than investing in one single financial asset." If a respondent agrees with it, then the household intuitively understands portfolio diversification benefit and is labeled as "Correct"; otherwise, the household is labeled as "Incorrect". Then we classify households into four groups: High-Correct, High-Incorrect, Low-Correct, and Low-Incorrectly. Such double-sorting helps us mitigate the concern that some respondent correctly answered Question H3115 by chance. The portfolio effect is

expected to influence mainly the financially sophisticated households (i.e., the High-Correct group).

We repeat the baseline regression separately for each of the four groups of households. The results are reported in Table 5. The coefficient of *Pro*Own* is significantly negative for the High-Correct group, but insignificant for the other three groups. This supports **H2a,** and suggests that the portfolio effect plays a key role for the negative effect of house price risk on entrepreneurship, which is significant only in the cases of sophisticated homeowners. This is consistent with the intuition that unsophisticated homeowners do not manage household risk in a portfolio sense and thus are not subject to the portfolio effect in Bracke, Hilber, and Silva (2018).

In contrast, the coefficient of *HPIg*Own* is significantly negative not just for the High-Correct group, but also for the Low-incorrect group. In fact, the estimated coefficient of *HPIg*Own* is the largest for the Low-incorrect group. Since the portfolio effect should not play an important role for these unsophisticated homeowners, we can infer that there are alternative mechanisms underlying the negative impact of housing price growth on entrepreneurship.

In summary, the negative impact of house price risk concentrates among sophisticated homeowners and works through the portfolio effect. But the portfolio effect cannot be the only mechanism underlying the negative relation between past house price growth and entrepreneurship because this relation applies to both sophisticated and unsophisticated homeowners. We explore the extrapolative belief effect in the next subsection and show that it can explain the strong negative impact of past housing price growth on entrepreneurship for unsophisticated homeowners.

5.3.2 Subjective expectations and investment intentions

In this subsection, we conduct several tests using the 2017 Beijing subsample of CHFS to illustrate the importance of extrapolative beliefs about local housing market for households' entrepreneurship decision. By focusing on survey respondents in the same city, we effectively hold fixed house price growth so that variation in households' propensity to start a business documented here cannot be explained by the wealth effect, collateral effect and portfolio effect since these effects work through house price growth. We focus on Beijing because of the availability of a direct measure of Beijing households' subjective belief about the local housing market.

In the 2017 wave of CHFS, there are some city-specific questions. Question C1000bj in the Beijing survey asks the respondents about their expectation for the local house price

growth over the next year. The answer ranges from 1 (very optimistic) to 5 (very pessimistic). We multiple the answer by -1, and denote it as *Optimism*. The variation of *Optimism* reflects people's heterogeneous belief about the local housing market, given that city and time are both fixed. *Optimism* can be viewed as a proxy for extrapolative belief. Since the Beijing house price increased by 37% in 2016, households with extrapolative belief would display high *Optimism* in 2017.

The survey also asks non-entrepreneurs about their intention to start a business. Using the Beijing subsample, we run the following logistic regression to examine the effect of *Optimism* on households' intention to start a business:

$$Willstart_i = c + \beta_1 Own_i + \beta_2 Optimism_i + \beta_3 Own_i * Optimism_i + \lambda Z_i + Z_i * Optimism_i + \varepsilon_i \quad (5)$$

The dependent variable *Willstart* is a dummy that equals 1 if the respondent intends to start a business, and 0 otherwise. The key independent variable of interest is the interaction *Optimism* with *Own*. We control for the same vector *Z* of household characteristics as in regression (2). We also control for the interaction between Z and *Optimism*. Entrepreneurs are excluded from this regression because CHFS only asks non-entrepreneurs about their intention to start a business.

Table 6 Column (1) reports the results of the regression given in Equation (5). The coefficient of *Own*Optimism* is significantly negative. All homeowners in the regression (5) experience the same large house price increase in the previous year, but some of them have extrapolative belief and display high *Optimism*. These extrapolative belief households are less likely to start a business, according to the significantly negative coefficient of *Own*Optimism*. This finding highlights the important influence of extrapolative belief on entrepreneurship, even holding constant past house price growth.

We also perform subsample analyses. We divide the Beijing sample into two groups according to the respondents' answer to question H3115, and run the logistic regression (5) separately for each group. The results are reported in Table 6 Columns (2) and (3). In Columns (4) and (5), we divide the Beijing sample into two groups according to the respondent's education level. We find that *Optimism* is associated with a lower planned entrepreneurship for unsophisticated homeowners (those with low education level and do not understand diversification). This result can explain the finding in Table 5 that house price growth has a significantly negative effect on entrepreneurship for unsophisticated homeowners: a high past house price growth leads to optimism about future housing market

due to the extrapolation belief, and the optimism reduces the probability of starting a business according to the result in Table 6.

Interestingly, Table 6 shows that sophisticated homeowners are able to rein in their optimism about future housing market and do not let it significantly affect the decision of starting a business. This suggests that extrapolative belief has little influence on the entrepreneurship of sophisticated homeowners. Table 5 indicates a significantly negative effect of past house price growth on the propensity to start a business even for sophisticated homeowners. This finding cannot be attributed to the influence of extrapolative belief. It is, however, consistent with the portfolio effect (see Section 5.3.1). Therefore, we conclude that both portfolio effect and extrapolative belief play an important role in explaining the negative relation between entrepreneurship and past local house price growth.

Next, we repeat the logistic regression in Equation (5) but replace *Willstart* with *Willbuy*. Here *Willbuy* is a dummy that equals 1 if a household intends to buy or build a house, and 0 otherwise. The results are shown in Table 6 Column (6). The coefficient of *Optimism* is significantly negative, suggesting that renters who are more optimistic about future local housing market actually tend to have a weaker intention to buy a house. This seemingly surprising result reflects the housing (un)affordability issue. Renters are relatively poor. Because of the high required down-payment ratio,[10] a higher house price would make house purchase more out of reach for the renters and discourage them from entering the housing market. In contrast, the coefficient of *Own*Optimism* is significantly positive, so optimistic homeowners are more likely to purchase additional houses. This suggests that the homeowners in China do not face binding credit constraints (e.g., they can borrow using the existing house as collateral).

To summarize, Table 6 shows that for homeowners, optimism towards the housing market weakens the intention to start a business but enhances the intention to buy more houses. The negative effect of optimism toward housing market on entrepreneurship applies mainly to the unsophisticated households who seem to treat housing investment and small business as competing investments. Because of extrapolative belief, high past house price growth encourages households to invest in housing assets, thus crowding out their entrepreneurial activities.

[10] In Shanghai, for example, the government stipulates that the down-payment ratio is at least 35% for households with no houses in the city.

5.3.3 The effect of house price growth in another city

In this subsection, we differentiate the extrapolative belief effect from alternative effects studied in the literature by examining the influence of house price growth in other cities on entrepreneurship. The wealth effect, the collateral effect, and the portfolio effect have one thing in common: they all work through the value of one's own housing asset, and therefore imply no relation between a homeowner's entrepreneurship and house price growth in another city (to the extent it is uncorrelated with resident city house price growth). In contrast, for someone with extrapolative belief, high house price growth in a different city may increase one's optimism towards the local housing market and thus reduce the probability of starting a business, even if the local house price growth has been low. For example, if two cities are closely linked via friendship or business networks, then residents in one city are likely to hear about the housing market performance of the other city.

We focus on links between cities via high-speed rail (HSR) trains. It has been well documented in the literature that HSR links facilitate communication and interaction of people from different cities (e.g. Dong, Zheng, and Kahn, 2020). For a city *c*, the city that shares the largest number of high-speed rail trains with city *c* is classified as its connected city. [11]

The average correlation of house price growth between each of the 54 sample cities and its connected city is 0.57. To capture house price growth of the connected city that is uncorrelated with own city c in year *t*, we regress the house price growth rate of the connected city on the growth rate of city *c*, using the historical data from 2006 to year *t*. The residual is denoted as $HPIg^M$ and represents the unexpected or abnormal house price growth in city *c*'s connected city that cannot be explained by the house price growth in city *c* based on their historical co-movements.

We run the following regression (6) that expands regression (2) by adding $HPIg^M$ as well as its interaction with homeowner dummy *Own*:

$$\begin{aligned} Start_{i,c,t} &= c + \beta_1 HPIg_{c,t-1} + \beta_2 HPIg^M_{c,t-1} + \beta_3 Pro_{c,t-1} + \beta_4 Own_{i,t} + \beta_5 Own_{i,t} * HPIg_{c,t-1} \\ &+ \beta_6 Own_{i,t} * HPIg^M_{c,t-1} + \beta_7 Own_{i,t} * Pro_{c,t-1} + \lambda_1 Z_i + \lambda_2 Z_i * HPIg_{c,t-1} + \lambda_3 Z_i * Pro_{c,t-1} + \theta_t + \eta_c + \varepsilon_{i,c,t} \end{aligned} \quad (6)$$

Table 7 Column (1) shows that the coefficient of *Own*HPIg* is still significantly negative. Moreover, the coefficient of $Own*HPIg^M$ is also significantly negative, though the magnitude is smaller than that of *Own*HPIg*. That is, after accounting for the negative

[11] We use the timetable in July 2014, the earliest electronic timetable available to us. For cities that were not connected to HSR at that time, we could not assign a connected city. Therefore, we omit observations of survey respondents from these cities (about 11% of the sample) when estimating the regression (6).

effect of own city's house price growth on local entrepreneurship, an unexpected high house price growth in the connected city would also lower the likelihood of local homeowners to start a business. This finding is consistent with the extrapolative belief effect, but it cannot be explained by the wealth effect, the collateral effect, or the portfolio effect studied in the literature.

In Table 7 Columns (2) and (3), we divide the sample into two according to the sign of $HPIg^M$ and re-run the regression (6) separately on each subsample. In the subsample of positive $HPIg^M$ (i.e., when the connected city's house price growth is abnormally high), the coefficient of $Own*HPIg^M$ is significantly negative while the coefficient of $Own*HPIg$ is negative but no longer significant, as shown in Table 7 Column (3). The opposite is true for the subsample of negative $HPIg^M$: in Column (2), the coefficient of $Own*HPIg^M$ is negative but not significantly different from zero, while the coefficient of $Own*HPIg$ is significantly negative. Therefore, the connected city's past house price growth has a negative effect on local entrepreneurship mainly when it is unusually high. Positive performance is more salient and likely communicated more, thereby exerting influences on extrapolators' beliefs. In contrast, people might not be aware of or pay attention to poor housing market in other cities. Their belief about housing market is mainly shaped by own city's experience when the connected city's residual house price growth is negative. Hence, the findings in Table 7 can be explained under extrapolative belief, but they are difficult to reconcile with under alternative explanations.

In an unreported test, we find a similar negative relation between local entrepreneurship and the past house price growth of a geographically neighboring city. The results in this subsection provide further evidence on the important influence of extrapolative belief in the housing market on entrepreneurship.

5.3.4 Homeowners with houses in non-residence cities

In 2017 CHFS, there are 909 homeowners whose houses were all in non-residence cities. We create a panel dataset that include only renters and these homeowners (i.e., we exclude households that own homes in their resident cities), and then rerun the baseline regression (1). The results are displayed in Table 8. This test would further distinguish the extrapolative belief effect from the wealth effect, collateral effect, and portfolio effect. Regarding homeowners whose houses are not in the residence city, the most likely scenario is that one leaves a small-city hometown for a larger city (e.g. more job opportunities). Since houses in small cities are lower priced and have lower appreciations, and since the

correlation in house price growth between the resident city and home city is low,[12] we expect that the wealth effect, collateral effect, and portfolio effect would be weak at best for these homeowners. In contrast, under extrapolative belief, a high house price growth of the resident city would still have a significantly negative effect on households' entrepreneurship decision even if the households have not benefited from the housing appreciation.

Table 8 shows that the coefficient of *Pro*Own* is negative but insignificant in both the logistic and the OLS regression. This suggests that local house price risk does not significantly impact the entrepreneurship decision of households who own houses but not in the resident city. The portfolio effect is insignificant for this subsample of households. On the other hand, the coefficient of *HPIg*Own* is significantly negative in both the logistic and the OLS regression. This provides additional evidence for the extrapolative belief effect.

5.4 Placebo test

As a placebo test, we match each of the 54 sample cities with a randomly selected city from the 70 cities that have house price indexes. To do the matching, we use simulation and sample without replacement. We denote the house price growth and house price risk of the matched city by $HPIg^S$ and Pro^S. We repeat the baseline regression in Equation (2) after replacing *HPIg* and *Pro* with $HPIg^S$ and Pro^S. This exercise is repeated 1,000 times.

Table 9 reports the average coefficient, average standard error, average t-value, and average p-value across the 1000 simulated regressions, for the linear probability model (the results for the logistic are similar and omitted). The average coefficient of $HPIg^S$**Own* is a magnitude lower than that in Table 3 Column (2). The coefficient of Pro^S**Own* is even smaller compared to the actual coefficient we find in the data. The last column of Table 9 shows that in only 5.8% of the 1000 simulated regressions, the entrepreneurship of homeowners in a given city is negatively (significant at 5% level) related to house price growth of a randomly picked city. Further, in only 0.3% of the regressions using simulated data, the coefficient of $HPIg^S$**Own* is significant at 5% level and has a magnitude that is the same or larger than in Table 3 Column (2). Similarly, the odd is low (only about 14%) that a randomly reshuffled data can lead to a significantly negative relation between homeowners' entrepreneurship and local housing market risk. In only 8.4% of the

[12] According to Wind database, from June 2010 to December 2017, the cumulative house price growth in first-tier, second-tier, and third-tier cities was 98%, 47%, and 30%, respectively. We find that the house price correlation between one's residence city and the city where one's houses are located is 0.4.

regressions, the coefficient of Pro^{S}*Own is significant at 5% level and has a magnitude that is the same or larger than in Table 3 Column (2). Therefore, the significantly negative coefficients of *Own*HPIg* and *Pro*Own* documented in Table 3 are unlikely to be statistical fluke.

6 Conclusions

Using data from the 2017 wave of China Household Finance Survey, we show that house price growth and house price risk both significantly and negatively impact the entrepreneurship of homeowners relative to renters. We are the first to empirically document the negative impact of house price risk on local entrepreneurship. This finding can be explained by the portfolio effect (Bracke, Hilber, and Silva, 2018). Consistent with the intuition that unsophisticated homeowners do not manage household risk as an integral portfolio and thus are not subject to influence of the portfolio effect, we find that the negative effect of house price risk on entrepreneurship is significant only for sophisticated homeowners with high education level and financial literacy.

On the other hand, the negative relation between past house price growth and entrepreneurship holds both for sophisticated and unsophisticated homeowners. The portfolio effect is insufficient to fully explain the negative impact of house price growth on entrepreneurship of homeowners. We propose and find support for an additional channel based on extrapolative belief. That is, households regard housing asset and small business as competing investments. When the past house price growth is high, extrapolative households form optimistic expectation about the housing investment which decreases their propensity to start a business.

The negative relation between house price growth and homeowners' entrepreneurship in China is opposite to the generally positive effects found in developed markets. It confirms a negative externality of a hot housing market on the real economy. This together with the negative effect of house price risk on entrepreneurship have important policy implications. In order to promote entrepreneurial activities and economic growth, the government and policy makers should strive to maintain a stable housing market and curb speculative housing bubble.

This paper can be extended in several ways. For example, it is meaningful to investigate the implication of house price growth for the general quality of entrepreneurs. In the past decades, China experienced a persistent housing boom, which makes housing investment highly profitable. In such an environment, some individuals still decided to start a business instead of buying a house. It is possible that such entrepreneurs are sophisticated

and free of extrapolative belief. It is also possible that they have extraordinary business opportunities. Then we can test if entrepreneurs in regions with a more prosperous housing market typically generate better entrepreneurial outcomes. Another possible extension is to examine how firm policies such as innovations and investments depend on local housing market conditions.

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Table 1 Summary statistics of urban respondents

	Mean	Std	Median	Obs
Entre	0.1642	0.3705	0	27278
EntrePast	0.2518	0.4340	0	27279
HaveHouse	0.8790	0.3261	1	27278
NHouse	1.1034	0.6863	1	27242
Age	52.8050	15.9890	54	27277
Male	0.4644	0.4987	0	27278
EduLow	0.5304	0.4991	1	27279
EduMid	0.3448	0.4753	0	27279
RuralHK	0.3342	0.4717	0	27273
Marry	0.8147	0.3885	1	27131
Risky	0.1023	0.3031	0	27269
Unhealthy	0.1457	0.3528	0	27279

Note. Variable values are based on the 2017 China Household Finance Survey. *Entre* is a dummy that equals 1 if a household runs a business, and 0 otherwise. *EntrePast* is a dummy that equals 1 if a household owns or previously owned a business, and 0 otherwise. *HaveHouse* is a dummy that equals 1 if a household has a house, and 0 otherwise. *NHouse* is the number of house that a household has. *Age* is the respondent's age. *Male* is a dummy if the respondent is male, and 0 otherwise. *EduLow* is a dummy that equals 1 if the respondent's educational level is no higher than junior high school, and 0 otherwise. *EduMid* is a dummy that equals 1 if the educational level lies between junior high school (not inclusive) and senior high schooling (inclusive), and 0 otherwise. *RuralHK* is a dummy that equals 1 if a respondent has rural "hukou", and 0 otherwise. *Marry* is a dummy that equals 1 if a respondent is married, and 0 otherwise. *Risky* is a dummy that equals 1 if a respondent prefers projects with above-average risk and return, and 0 otherwise. *Unhealthy* is a dummy that equals 1 if a respondent is not as health as the peers of the same age, and 0 otherwise.

Table 2 Summary statistics of the panel data

	Panel A		Panel B									
	Start	**Own**	**HPIg**					**Pro**				
	Mean	Mean	Mean	P25	P50	P75	Std	Mean	P25	P50	P75	Std
2013	0.0111	0.7486	0.0526	0.0334	0.0480	0.0627	0.0360	0.1680	0.0400	0.1196	0.2658	0.2425
2014	0.0131	0.7711	-0.0392	-0.0510	-0.0410	-0.0257	0.0217	0.1661	0.0428	0.1246	0.2260	0.2457
2015	0.0143	0.7883	0.0112	-0.0179	0.0015	0.0211	0.0644	0.1961	0.0687	0.1573	0.2716	0.2516
2016	0.0171	0.8081	0.0794	0.0120	0.0306	0.1209	0.1101	0.1678	0.0257	0.1439	0.2618	0.2449
2017	0.0115	0.8257	0.0505	0.0292	0.0540	0.0719	0.0293	0.1494	0.0193	0.1331	0.2363	0.2119

Note. Panel A reports the average value of *Start* and *Own* by year. For a year *t*, *Start* equals 1 if a household started a business in year *t*, and 0 otherwise (a household-year combination is deleted from our panel data if the household had a business that was started prior to that year); *Own* equals 1 if the household bought a house in the local city in year *t*-1 or earlier, and 0 otherwise. Panel B reports the cross-sectional mean, the 25th percentile, the median, the 75th percentile, and the standard deviation of *HPIg* and *Pro* in each year.

Table 3 Regression of entrepreneurship on house price growth and risk

	(1) Logistic	(2) OLS
HPIg	3.8105*	0.0544
	(1.9829)	(0.0666)
Pro	-0.0294	0.0003
	(0.6153)	(0.0155)
Own	0.1914	0.0009
	(0.1260)	(0.0024)
HPIg*Own	-4.5423***	-0.0851**
	(1.2080)	(0.0362)
Pro*Own	-0.5899*	-0.0076
	(0.3140)	(0.0074)
Age	-0.0582***	-0.0009***
	(0.0040)	(0.0001)
Male	0.1934	0.0042*
	(0.1295)	(0.0024)
EduLow	0.6542***	0.0106***
	(0.1738)	(0.0034)
EduMid	0.3726*	0.0082**
	(0.1924)	(0.0039)
RuralHK	0.1795	0.0061*
	(0.1485)	(0.0035)
Risky	0.3131*	0.0105**
	(0.1798)	(0.0050)
Unhealthy	-0.1181	-0.0019
	(0.2218)	(0.0023)
Z*HPIg	Y	Y
Z*Pro	Y	Y
City FE	Y	Y
Year FE	Y	Y
Obs	65451	65451

Note. This table reports the results of panel regressions where the dependent variable is the dummy *Start* that takes value 1 if a household started a business in the given year, and 0 otherwise. The independent variables include the previous year house price growth (*HPIg*) and house price risk (*Pro*) for the residence city of each household, as well as their interactions with the home-ownership dummy *Own*, and household characteristics (*Z*). City-fixed effects and year-fixed effects are also included. Given the sampling design of CHFS, the probability of each household being drawn is different. We follow the recommendation by CHFS to weight the observations by the variable "Swgt" provided in the CHFS database. The sample period is 2013-2017. Standard errors are clustered by city-*Own* and reported in parentheses. The symbols *, **, and *** stands for the significance level of 10%, 5%, and 1%, respectively.

Table 4 Effect of house price growth and risk on entrepreneurship: IV approach

Panel 1: First stage				**Panel 2: Second stage**		
	(1) HPIg		(2) Pro		(3) Logistic	(4) OLS
ConUrban*NHPIg	-1.6783	**ConUrban*Npro**	-0.4311*	HPIg	3.1889	0.0293
	(1.1351)		(0.2471)		(6.4231)	(0.1243)
ConAll*NHPIg	8.1078***	**ConAll*Npro**	0.5958	Pro	-11.4474	-0.2185
	(2.5126)		(0.4978)		(10.2877)	(0.2037)
ConUrban*ConAll*NHPIg	-2.0313	**ConUrban*ConAll*Npro**	-1.7618***	Own	0.2206	0.0016
	(2.2737)		(0.469)		(0.1404)	(0.0027)
ConUrban^2*NHPIg	1.0526	**ConUrban^2*Npro**	0.5662***	HPIg*Own	-4.5608***	-0.0710**
	(0.8467)		(0.1814)		(1.3509)	(0.0272)
ConAll^2*NHPIg	-11.9127***	**ConAll^2*Npro**	1.8426**	Pro*Own	-0.8146**	-0.0170*
	(3.7631)		(0.7264)		(0.3512)	(0.0089)
City FE	Y	City FE	Y	Z*HPIg	Y	Y
Year FE	Y	Year FE	Y	Z*Pro	Y	Y
F-value	82.47	F-value	4383.56	City FE	Y	Y
Obs	335	Obs	335	Year FE	Y	Y
R^2	62.52%	R^2	88.69%	Obs	63579	63579

Note. Panel 1 reports the results of the first stage IV regressions given by Equations (4a) and (4b). In Column (1) and Column (2), the dependent variables are *HPIg* and *Pro*, respectively. On the right-hand side, *ConUrban* measures the constraint of urban construction land in a given city; *ConAll* measures the constraint of both urban and rural construction land. *NHPIg* is national house price growth. *Npro* is national house price risk. Standard errors are clustered by city. Panel 2 reports the results of the second stage IV regressions. Standard errors are clustered by city-*Own* and reported in parentheses. The symbols *, **, and *** stands for the significance level of 10%, 5%, and 1%, respectively.

Table 5 Subsample analysis by financial sophistication

	Low-Incorrect	**Low-Correct**	**High-Incorrect**	**High-Correct**
HPIg	14.4783**	-9.7524	3.8455	4.4548
	(7.2796)	(9.2550)	(4.1426)	(2.9714)
Pro	9.1809***	-4.7575***	-0.6444	-0.0422
	(3.2502)	(1.4438)	(1.6315)	(0.8580)
Own	0.4282	0.0444	-0.1031	0.3458*
	(0.3486)	(0.2621)	(0.2201)	(0.1956)
HPIg*Own	-6.6287**	-0.4398	-3.6482**	-5.5887***
	(2.9869)	(3.4871)	(1.7988)	(1.4862)
Pro*Own	-0.4182	1.2589	-0.8781	-1.0113**
	(1.2133)	(1.2300)	(0.7706)	(0.4673)
Z	Y	Y	Y	Y
Z*HPIg	Y	Y	Y	Y
Z*Pro	Y	Y	Y	Y
City FE	Y	Y	Y	Y
Year FE	Y	Y	Y	Y
Obs	17439	15635	12204	20173

Note. We sort households into four groups according to the respondents' education level and the ability to correctly understand diversification benefit. Then we repeat the logistic regression (2) separately for the four groups. Observations are weighted in the way suggested by CHFS. Standard errors are clustered by city-*Own* and reported in parentheses. The symbols *, **, and *** stands for the significance level of 10%, 5%, and 1%, respectively.

Table 6 Optimism towards the housing market and investment intention

	Intention to start a business					Intention to buy a house
	(1) All	**(2) Correct**	**(3) Incorrect**	**(4) High Edu.**	**(5) Low Edu.**	**(6) All**
Own	-0.4535	-0.3062	-3.0401*	-0.0200	-3.9369***	1.6721***
	(0.4461)	(0.3188)	(1.8080)	(0.4162)	(1.4787)	(0.0715)
Optimism	-1.3050**	-0.9201***	-2.5069	-2.2890***	-2.0582	-0.9233***
	(0.6338)	(0.1442)	(4.1376)	(0.5190)	(2.0685)	(0.2487)
Own*Optimism	-0.1608***	-0.1504	-0.9949**	-0.2397	-0.9495**	0.5533***
	(0.0470)	(0.3185)	(0.4719)	(0.2082)	(0.4470)	(0.0297)
Z	Y	Y	Y	Y	Y	Y
Z*Optimism	Y	Y	Y	Y	Y	Y
Obs	935	581	354	577	358	935

Note. This table reports the results of the logistic regression given in Equation (5) estimated using only Beijing households in the 2017 wave of CHFS. In Column (1) to Column (5), the dependent variable is *Willstart*. a dummy variable that equals 1 if a household intends to start a business, and 0 otherwise. Columns (6) report the results of the regression (5) except the dependent variable is replaced by *Willbuy*, a dummy variable that equals 1 if a household intends to buy a house, and 0 otherwise. In Column (2) and Column (3), we classify the households into two groups according the correctness of their answer to question H3115, and conduct a subsample analysis. In Column (4) and Column (5), we classify the households into two groups according their education level, and conduct a subsample analysis. Observations are weighted in the way suggested by CHFS. Standard errors are clustered by homeownership and reported in parentheses. The symbols *, **, and *** stands for the significance level of 10%, 5%, and 1%, respectively.

Table 7 Entrepreneurship and house price growth of the connected city

	(1) All	(2) $HPIg^M \leqslant 0$	(3) $HPIg^M > 0$
HPIg	3.1997	1.5403	4.1562
	(2.2219)	(2.5602)	(3.1579)
$HPIg^M$	0.9587	3.1005	5.1734
	(1.3076)	(5.4721)	(3.7101)
Pro	-0.1878	-2.1326	1.3410
	(0.8749)	(2.0126)	(1.2049)
Own	0.0766	-0.1575	0.4459
	(0.1277)	(0.1696)	(0.2889)
HPIg*Own	-4.3346***	-5.3705***	-2.1580
	(1.2159)	(1.4850)	(1.3162)
$HPIg^M$*Own	-2.3155*	-7.1342	-6.9160**
	(1.3989)	(4.4346)	(3.0813)
Pro*Own	-0.3755	-0.4730	-0.5985
	(0.3427)	(0.6353)	(0.5416)
Z	Y	Y	Y
Z*HPIg	Y	Y	Y
Z*Pro	Y	Y	Y
City FE	Y	Y	Y
Year FE	Y	Y	Y
Obs	57971	29820	28151

Note. This table reports the results of regression (6). For city *c* in year *t*, $HPIg^M$ is the residual from a regression of the house price growth rate of its connected city (i.e., the city that shares the largest number of high-speed rail trains with city *c*) on the house price growth rate of city *c*, using the historical data from 2006 to year *t*. Cities unconnected to HSR are dropped from regression (6). Observations are weighted in the way suggested by CHFS. Standard errors are clustered by city-*Own*. The symbols *, **, and *** stands for the significance level of 10%, 5%, and 1%, respectively.

Table 8 Homeowners with houses in non-residence cities

	(1) Logistic	(2) OLS
HPIg	6.1513***	0.2482**
	(1.9947)	(0.0956)
Pro	1.6015	0.0677
	(1.1088)	(0.0416)
Own	0.7482***	0.0275***
	(0.1789)	(0.0083)
HPIg*Own	-3.6444***	-0.1486**
	(1.3393)	(0.0601)
Pro*Own	-0.6886	-0.0295
	(0.5402)	(0.0217)
Z	Y	Y
Z*HPIg	Y	Y
Z*Pro	Y	Y
City FE	Y	Y
Year FE	Y	Y
Obs	13704	13704

Note. This table reports the results of the baseline regression (2) estimated using the subsample consisting of only renters and homeowners whose houses are not in their residence cities. *HPIg* and *Pro* are the past one-year house price growth and house price risk of the residence city of each household. In Column (1), we use the logistic model. In Column (2), we use the linear probability model. Observations are weighted in the way suggested by CHFS. Standard errors are clustered by city-*Own* and reported in parentheses. The symbols *, **, and *** stands for the significance level of 10%, 5%, and 1%, respectively.

Table 9 Placebo tests: Randomly matched cities

	Coeff.	StdErr	t-value	p-value	Frac. of sig. (5%)	Frac. of sig. & larger
$HPIg^S$	-0.0413	0.0572	-0.7904	0.4345	0.097	0.000
Pro^S	-0.0028	0.0200	-0.1557	0.4965	0.069	0.026
Own	-0.0032	0.0022	-1.4652	0.2421	0.265	0.000
$HPIg^S$*Own	-0.0103	0.0289	-0.3297	0.4644	0.058	0.003
Pro^S*Own	-0.0001	0.0073	-0.0460	0.4267	0.145	0.084

Note. We match each city with another randomly chosen city by simulations. Then we repeat the linear probability model for the baseline regression in Equation (2) after replacing *HPIg* and *Pro* with the values for the matched city $HPIg^S$ and Pro^S. This analysis is repeated 1000 times. The table shows the average values across the 1000 regressions for the estimated coefficients, and the corresponding standard errors, t-values, as well as p-values. The column "Frac. of sig. (5%)" reports the fraction of cases among the 1000 regressions that a coefficient is significant at the 5% level. The last column reports the fraction of cases among the 1000 regressions that a coefficient is significant at 5% level and has the same or larger magnitude than the corresponding coefficient in Table 3 Column (2).

Appendix: List of variables

Variable	Definition
Entre	A dummy that equals 1 if a respondent's household runs a business, and 0 otherwise
HaveHouse	A dummy that equals 1 if a respondent has a house, and 0 otherwise
NHouse	The number of house that a respondent has
Age	Survey respondent's age in years
Male	A dummy that equals 1 if a respondent is male, and 0 otherwise
EduLow	A dummy that equals 1 if a respondent's educational level is no higher than junior high school, and 0 otherwise
EduMid	A dummy that equals 1 if the educational level lies between junior high school (not inclusive) and senior high schooling (inclusive), and 0 otherwise
RuralHK	A dummy that equals 1 if a respondent has rural "hukou", and 0 otherwise
Marry	A dummy that equals 1 if a respondent is married, and 0 otherwise
Risky	A dummy that equals 1 if a respondent prefers projects with above average risk and return, and 0 otherwise
Unhealthy	A dummy that equals 1 if a respondent is not as health as peers of the same age, and 0 otherwise
Start	A dummy that equals 1 if the household starts a business in year *t*, and 0 otherwise
Own	A dummy that equals 1 if the household bought a house in the local city in year *t*-1 or earlier, and 0 otherwise
HPIg	Annual house price growth
QRHPIg	Year-on-year house price growth rate, deflated by CPI
RGDPg	Year-on-year GDP growth rate, deflated by CPI
Pro	A measure of house price risk defined as the sensitivity of a city's house price growth to local GDP growth, obtained as the regression coefficient of *QRHPIg* on *RGDPg*
Optimism	The degree of a Beijing respondent's optimism towards the local housing market over the next year
Willstart	A dummy that equals 1 if the respondent intends to start a business, and 0 otherwise
Willbuy	A dummy that equals 1 if the respondent intends to buy a house, and 0 otherwise