Microfinancing and Home-purchase Restrictions: Evidence from the Online "Peer-to-Peer" Lending in China

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Abstract

This paper uses a quasi-natural experiment to study how houseowners' borrowing costs were affected by the housing value fluctuation in China using a novel micro-level data from an online peer-to-peer (P2P) lending platform. The impacts on other equilibrium loan variables such as borrowing duration and numbers of lenders are also examined. By taking the housing purchase restriction policy shock as an exogenous event, we employ a difference-in-differences (DD) identification strategy. It is found that the equilibrium interest rate decreased, the growth rate of the deal completion time reduced and the number of investors went up for borrowers with house properties from the cities implementing the restriction policy. It echoes from a further triple differences (DDD) when considering city-specific effect based on samples with houseowners and non-houseowners. In addition, we estimate the heterogeneous effect for both household and city-level characteristics. Our dynamic analysis indicates that effects on houseowners' P2P borrowing activities persist for 9 months. The channel of the effect was from the collateral effect rather than the pure wealth effect.

Keywords: P2P, housing price, home-purchase restriction, collateral effect.

JEL Classification Codes: D14, G21, G28, R28

I. Introduction

China has witnessed unprecedented economic growth from past decades and become the second largest economy worldwide. Real estate, as a pillar industry in China, contributes tremendously on the rapid growth of Chinese economy and household consumption. However, along with the development of real estate sector, the soaring housing price has also drawn wide and serious concerns, which leads to a series of home-purchase restriction policies adopted by the Chinese government. Home-purchase restriction, launched in 2010 and 2016 respectively, were implemented under different macroeconomic environments and city coverages in China. Specifically, the earlier policy in 2010 was in the context of the recovery of global financial crisis and a general boost in housing prices so that the government decided to apply a comprehensive housing purchase restriction throughout all the cities. Unlike the 2010's policy, the government adjusted the housing purchase restriction scheme with a focus in China's first- and second-tier cities in 2016 (Du & Zhang, 2015).

The housing purchase restriction policy indicates a strong house wealth increase potential in the cities which announce it. The cities with home-purchase restriction after 2010 have still experienced a roaring housing price as shown in Figure 1. Figure 1 also shows that, for the long run, the growth rate and price index of those cities increases even shaper compared with the cities never implementing home-purchase restriction policies. An empirical study from Li, Cheng, and Cheong (2017) confirms that the home purchase restriction only has long term effects on carrying down housing prices if housing prices monthly growth rate does not exceed 5%, while most of the cities in our sample[1] with home-purchase restriction policies have more than 5% growth rate on a month-to-month basis from 2010 to 2016. Therefore, due to the learning effect of the previous practices, houseowners in the cities which announced the housing purchase

[1] According to the housing price data from Wind, 12 of 16 cities with home-purchase restriction policies have more than 5% growth rate on a month-to-month basis from 2010 to 2016.

restriction policy in 2016 would have a strong expectation of thriving housing prices for their properties.

Housing price fluctuation could cause great wealth variations on household balance sheets (Disney & Gathergood, 2018) since housing value has been widely believed as a major component of household wealth (Banks & Tanner, 2002; Campbell & Cocco, 2007). Tang (2006) and Carroll, Otsuka, and Slacalek (2011) confirm that housing wealth effect is larger than the financial wealth effect by 6 cents on a dollar for marginal propensity to consume (MPC), which will strongly impact household level consumption. Mian, Rao, and Sufi (2013) and Mian et al. (2017) clarifies the significant and unequal consumption decrease in US from 2006 to 2009 based on the role of house loan and varied geographic distribution of negative house price shocks. Schmalz, Sraer, and Thesmar (2013) finds that both the ownership of house and the variation of the housing price will significantly impact the household investment decisions. Besides, other household activities will also be affected by the housing prices swing, including labor decisions, educational selections (Lovenheim 2011; Lovenheim & Reynolds 2013), divorce rates (Farnham et al. 2011), childbirth rates (Lovenheim & Mumford 2013; Dettling & Kearney 2014), and long-term care insurance (Davidoff 2010). As a result, a larger housing wealth would, however, convert to a higher living expense, which discourages household financing and expenditure (Buiter, 2008). The empirical findings from Campbell and Cocco (2007) confirm that growing house wealth could promote consumption by adding households' perceived wealth, or by decreasing borrowing constraints.

In this paper, we attempt to extend the study of house wealth effect and investigate how P2P crowdfunding activities were affected by the home-purchase restrictions in China using a novel micro-level data from an online peer-to-peer lending platform. When contemplating FinTech development in China, the Peer-to-Peer (P2P) lending industry constitutes one vital aspect of it. By December 2018, 6,618 online P2P

platforms have been actively involved in business, with a value of RMB1,794.8 billion transactions in total, according to WDZJ, an authoritative P2P online loan industry portal in China. P2P crowdfunding activities turn out to be a significant financial market for household micro financial activities. For example, Renrendai, one of the largest P2P online lending platforms in China, allows borrowers set loan interests and amount first and investors could make investment decisions based on the borrowers' relevant information.

Recent empirical literature already touched the determinants of P2P borrowing costs and the impact of economic shocks on P2P activities. Age, income, positive financial prospects and housing tenure are found to be significant in determining online borrowing costs in Del and Young (2006)'s research. Michels (2012) finds that volunteer and unverifiable disclosures significantly lessen borrowing costs in p2p lending platform. Li, Liu, and Tian (2018)'s study identify that policy uncertainty negatively affects households' access to small loans in p2p lending platform. Ramcharan and Crowe (2013) further considered housing fluctuations could have a significant influence on P2P lending credit availability. Based on the background of 2008 financial crisis, they found that the declining housing price will make houseowners face lower funding success rates, higher interest rates, greater credit rationing, and quicker loan delinquency.

While our study put efforts to disentangle the mixing Chinese economic forces and target on the unique Chinese housing policies and shed light on the role of home-purchase restriction shocks on household borrowing activities in Chinese P2P platform. We consider the housing restriction policy announced by government as the housing value shock for two reasons. Firstly, the policy is issued mainly due to either the high housing price or the great housing price growth rate, the timing of the policy announcement should be highly correlated with previous measurement. Secondly, as the information asymmetry between the government and individual exist in Chinese

housing market, government own more information than household, the policy announcement can be regarded as the external shock to the housing market.

Based on this exogenous shock, we employ a difference-in-differences (DD) identification strategy to empirically disentangle the effects. We target on within group differences for the houseowners' responses to the home-purchase restrictions. Treating the home-purchase restrictions that were widely implemented in 21 Chinese cities in 2016 as a policy shock, we could control for city-level time invariant confounding factors and nationwide macroeconomics trends that might be correlated with loan level outcomes. As pooled cross-sectional data set is employed, the endogeneity concerns are further alleviated by incorporating bunch of borrowers' characteristics, as homeownership status and credit decisions are likely to be correlated with those individual level features (Ramcharan & Crowe, 2013).

To test the potential heterogeneous effect that shape the results, we explicitly use difference-in-difference-in-differences (DDD) estimation methods. Household-level characteristics, including gender, marriage, education level, job position, SOE jobs, and car, are selected to evaluate the impact of home-purchase restrictions on the house owners. In addition, various information of the local macroeconomic conditions, such as city-level GDP growth rate, wage growth rate, and residential investment growth rate for the last three years (2013-2015), and population growth rate and real estate investment growth rate for the last two years (2014-2015) are used as proxies to directly test the validity of the expectation effect hypothesized above.

Our research results show that home-purchase restriction policies significantly reduce the treated houseowners' P2P borrowing interest rates, slow down their increase of duration of borrowing, and promote the number of lenders who fund this P2P borrowing requests. As to the economic effect, the decrease of interest rate for the treated group is 0.4 bps larger than that of the control group. Duration growth rate for the treated group is 2.6% less than its counterparts. There are five more investors each

borrowing deal for the treated group after the shock compared with the control group. Following the spirit of Cai (2016), We further employ a DDD estimation to confirm the results using the whole sample (houseowners and non-house owners), which could control potential city-specific effects during the sample period. The additional DDD result still holds.

We also test the household-level and city-level heterogeneous effect of the home-purchase restriction policy. The result indicates that male or unmarried houseowners whose city announced the home-purchase restriction policy would like to post a sharper decreasing P2P interest rate, experience a shorter funding duration, and attract more funding investors compared with female or married houseowners in the treated regions. Treated houseowners with high education levels, stable salary payments, state-owned enterprise jobs, or car, could take more advantages in P2P funding activities compared with their counterparts in the treated regions after the housing policy shocks because of their stronger financial position and lower default possibilities. We further consider the city-level economic development in the policy shocks. The results show that the P2P interest rates drop sharper for the treated houseowners who live in the treated regions with higher GDP growth rate, population growth rate, residential wage growth rate, real estate investment growth rate, and residential investment growth rate, while duration of funding also has a slower increase for the treated houseowners higher GDP growth rate. Therefore, economic development of the city could increase the wealth effect of the residents, their household could have a stronger financial position and take more advantages in the P2P borrowing activities. The dynamic effect outcomes show that the effects of the home-purchase restriction on houseowners' P2P borrowing activities persist for 9 months.

After that, we test the channel that makes the previous effect. The effect of the policy is made through the rising house wealth and the related borrowing collateral of the houseowners of the treated regions. It is because the home-purchase restriction policy

implies the rise of the house wealth for the houseowners who tend to have a higher borrowing collateral and lower default risks. As a result, they could obtain a stronger financial position in the financial market. We also consider household loans and age to confirm the borrowing collateral effect. We find that houseowners with borrowing constraints benefit more from the policy effect but their age profile which is generally along with the pure wealth effect does not cause significant correlation.

Our study contributes to two strands of current literatures. Firstly, it explores the housing wealth effect from a new perspective, which demonstrates the household credit access to unsecured small loans. Existing studies have examined the impact of the asset value on household consumption, investment, and borrowing activities by taking the secured loans into their consideration (Mian, Rao, & Sufi, 2013; Schmalz, Sraer, & Thesmar, 2013; Mian & Sufi, 2018). Along with the development of the micro-loan market in China, an increasing number of households choose to borrow from the P2P market and their activities gradually attract more attention from researchers (eg Lin and Viswanathan, 2015; Li, Liu & Tian, 2018). This study complements the effect of housing value fluctuation literatures over the government home-purchase restriction policy shock and try to build the causal relationship between the housing price variations and borrowing activities in the P2P market. Secondly, our study replenishes P2P crowdfunding literatures by standing on the demanding side of the market through the P2P market mechanism in China. We emphasize on how P2P borrowers and investors respond to the new information reflected in the policy shock. Our research echoes the Ramcharan and Crowe (2013)'s study and further confirms the relationship between the house price fluctuation and P2P credit availability, but our identification is different. This study targets on the home-purchase restriction polices from different cities, which is positively related to the housing price and could be considered as external shock because of the information asymmetry between the government and the housing market. Moreover, the market mechanism of the US P2P lending is different

from the one in China. Renrendai P2P lending in China employ the posted-price mechanism instead of auction model used by Prosper.com before 2010. Under posted-price mechanism, the borrowing interest rate and amount are set by borrowers, while investors only voice their opinions by specifying the investment amount and duration. Finally, our study supports the house wealth effect through the borrowing collateral channel in P2P platform and exploit diverse house wealth effects of heterogeneity in household-level and city-level.

The remains of the paper are organized as follows. Section II presents the theoretical foundation of the study. Section III describes the data and summary statistics. Section IV explains the estimation model and results, Section V concludes.

II. Theoretical Foundation

Previous studies generally identify the housing wealth shock by measuring how those shocks affect housing return. For example, Glewwe and Jacoby (2004) believes that local economic growth is an important wealth effect that stimulates residential household level activities. While, other researchers track the effects of government policies on households' behavior, like the important roles that monetary policy play in propagating the shock transmission through the credit channel (Bernanke & Gertler, 1995; Benmelech & Bergman, 2012; Iacoviello, 2005; Kaplan et al., 2018). Tax policy and credit supply expansion policy embrace the similar effects (Sommer & Sullivan, 2018). Empirical evidences are found that households' debt and consumption responded actively to U.S tax policy (Souleles, 1999), and the effects for debt were particularly strong for those who were liquidity unconstrained (Agarwal et al., 2007). Di Maggio & Kermani (2017) studies the heterogenous impact of banking deregulations on different states in the U.S. This exogenous variation of credit supply due to anti-predatory lending contributed to the local house prices and employment rate. Cai (2016) also indicates that the implications of agriculture insurance provision raises household borrowing size while decreases loan interest rates for Chinese rural

households. The intertwined relationships among government housing policies, house prices and household behavior are intriguing. The reason is that among households' balance sheets, housing values are found to have considerable amplification effects in real business cycles via the collateral channel in calibrated DSGE models (Iacoviello, 2005; Iacoviello & Neri, 2010; Liu, Wang & Zha 2013; Guerrieri & Iacoviello, 2017).

The mechanism that drives the bond between the swings of the house value and household consumptions and decisions is widely explained through two major assumptions: pure wealth effect and borrowing collateral effect (Sinai & Souleles, 2005; Cooper, 2013; Berger, 2015, Cloyne et al, 2019). The pure wealth effect considers that the house is one type of financial asset, the rising house prices increase households' nominal housing wealth, households may borrow more and consume more as they feel richer (Campbell & Cocco 2007; Case, Quigley, & Shiller 2013). However, nominal wealth is not real wealth (Sinai & Souleles 2005; Buiter 2010). Because the increase in the housing value may offset by the increase in the future rental cost, the pure wealth effect should be obvious for the one with short horizon. Many studies examine the pure wealth effect through age profile. Old homeowners are regarded as the cohort with short horizon, they may expect to sell the house and exit the housing market in the near future and convert the nominal wealth to real wealth. In contrast, young home owners have the long horizon, the nominal wealth would be offset by future rental cost. As a result, the pure wealth effect can be tested by looking at the heterogeneous effect with respect to age (Campbell & Cocco 2007, Attanasio et al., 2009, Mian & Sufi, 2011). Gan (2010) studies the relationship between house value and credit card spending in Hong Kong, and find that pure wealth effect, which is identified by looking at how the consumption respond to the house value shock across households with different number of houses, can partly explain the relationship. Households without borrowing constraints could benefit from the pure wealth effects captured by their lifetime budget constraints. The canonical certainty-equivalent life-cycle model, on the contrary, suggests an invariant

household behavior after predictable future income fluctuations (Modigliani & Brumberg, 1954; Carroll, 2001: Friedman, 2018).

However, Flavin and Nakagawa (2008) and Buiter (2010) questioned about the pure wealth effect and stated that the effect of housing appreciation or depreciation on the net wealth of the house owners is ambiguous since housing wealth should be treated as both an asset and an expenditure good. A complex mechanism is included behind the housing wealth changes for house owners and non-house owners. For instance, Cho (2011) shows that housing price fluctuation would work in opposite directions for household with house and without house.

Therefore, many research studies the relationship between house prices and economic activities concentrating on the borrowing collateral channel (Guerrieri & Iacoviello, 2017). Housing value makes up the greatest part of the household's portfolio and could be the largest type of collateral. As the relax to credit market would increase the borrow demand (DeFusco 2017), the collateral effect implies that the value of collateral would increase along with the housing price appreciation, so that the increased collateral value would decrease the borrowing cost, especially for households who are experiencing a borrowing constraint (Campbell & Cocco 2007). Aoki et al. (2004) explain the effect of housing value on household consumption via credit market by considering credit frictions in their general equilibrium model. The collateral channel works by amplifying and propagating monetary policy shocks on housing demand and consumption. Iacoviello (2005) distinguish the effect of different type of shocks and theoretically prove that positive demand shock improves the household or firm's debt capacity and increase the consumption and investment. A number of empirical evidences show that the housing wealth impact the borrowing consumption via collateral channel. Cooper (2013) finds the collateral channel, instead of wealth effect channel, could explain the relationship between the non-housing consumption and housing value by looking at the heterogenous effect across groups of households

with different level of borrowing constraints. Cloyne et al (2019) uses a rich dataset to verify the collateral channel by examining the heterogeneous effect of LTV, age, income and income growth on the elasticity of borrowing to housing price. They find the elasticity is strongly respond to high LTV ratio, even controlling for the other 3 factors, suggesting collateral channel can be used to explain their findings of positive relationship between housing value and loan amount. A rise in housing values translates to an increase in collateral values and thus makes households' borrowing constraints non-binding. This encourages leverage and consumption through the classic consumption Euler equation. Later studies confirm that housing wealth helps to alleviate credit constraints for household and even of their potential investments (Schmalz, Sraer, & Thesmar, 2013; Corradin & Popov, 2015). Corradin and Popov (2015) echoes the previous research that housing wealth is able to lessen credit constraints for potential entrepreneurs based on the collateral channel.

These theories allow us to explore the house wealth effect and the heterogeneity of the effect by taking advantages of the quasi-natural experiment of the home-purchase restriction based on the sample of Chinese P2P platform. The effect of the home-purchase restriction on Chinese P2P borrowers' activities could be explored by the identification of the channel of the house wealth effect, including the pure wealth effect and the borrowing collateral effect. The test of the heterogeneity of the effect could further exploit the mechanism that how house-level and city-level characteristics influence the house wealth effect.

III. Data and Summary Statistics

The empirical analysis is based on the household-level data collected from Renrendai, one of the largest P2P online lending platforms in China. Our sample consists of all of P2P funded loans from January 2016 to August 2017, 10 months before and after October 2016, the month with a bunch of announcements of the home-purchase restriction policies. The household residing in the 21 cities (Table 1) which adopted

home-purchase restriction are attributed in the treatment group while others are in the control one. The P2P sample includes funded borrowers' borrowing interests, amount, number of lenders, duration of the funding process, as well as their individual characteristics. To summarize, our sample includes 249,309 households, of which 107,699 household has house and 141,612 has no any house properties. For houseowners, 32,702 of them are in the treatment group where home-purchase restriction policies are adopted while 74,997 of them are in control regions.

Table 2 provides the summary statistics of the key variables for the period January 2016 to September 2016 before the announcement of home-purchase restriction policies. Gender is a dummy variable with one is female and zero is male. Marriage is a dummy variable with one is married and zero otherwise. Age indicates the age of the borrower. Salary is a variable indicating a borrower's monthly income level, where n=0 represents whose wage is no more than 1000 RMB, n=1 means monthly income is between 1000-2000 RMB, n=2 means monthly income is between 2000-5000 RMB); n=3 means monthly income is between 5000-10000RMB; n=4 means monthly income is between 10000-20000RMB; n=5 means monthly income is between 20000-50000 RMB; n=6 means monthly income is above 50000 RMB. Education is a variable indicating the education level of borrowers, where n=0 (if the borrower is high school certificate and below), n=1 (if the borrower is college-degree holder), n=2 (if the borrower is university- degree holder), n=3(if the borrower is with postgraduate degree and above). Work years is a variable showing the working experience of borrowers, where n=0 (if the working experience is no more than 1 year), n=1(if a borrower has 1-3 years' working experience), n=2 (if a borrower has 3-5 years' working experience), n=3 (if a borrower has more than 5 years' working experience). Car is a dummy variable with one has car and zero otherwise. Job position is a dummy variable with one working for salariats and zero otherwise. SOE is a dummy variable with one working for state-

own companies and zero otherwise. Loan is a dummy variable with one having house loan or car loan and zero otherwise.

Based on the characteristics of the P2P borrowers from the sample, the treated houseowners' average borrowing interests (10.26%) are significantly lower than that of the controlled houseowners (10.29%). Meanwhile, the average loan size (98000 RMB), borrowing duration (11.21 hours), and number of lenders (130.1) for the treated borrowers are significantly higher than those of controlled houseowners, which are 87,000 RMB, 9.818 hours, and 113.5, respectively. Also, the treated region borrowers exhibit the differences with more females (0.299 versus 0.311), less marriage (0,756 versus 0.763), younger age (37.51 versus 38.36), and higher education level (1.270 versus 1.392), shorter working experience (2.044 versus 2.161 years), loan percentages (62.4% versus 53.9%), stable salary payment percentages (0.176 versus 0.133), and the average amount of salary (3.941 versus 3.289) compared to the borrowers from the control region. The treated regions have significantly higher GDP growth rate (9.1% versus 8.5%), population growth rate (0.6% versus 0.3%), real estate investment growth rate (12.9% versus 1.7%), and residential investment growth rate (14.5% versus 9.20%), as well as lower wage growth rate (9.4% versus 10.5%) than the control regions.

IV. Estimation Strategies and Results

The progressively implementation of the home-purchase restriction policies introduced variations in house wealth across time periods, cities, and household borrowing activities. According to these variations, we use both DD and DDD estimations in the empirical analysis.

4.1 The Impact of the Home-purchase Restriction on Houseowners

4.11 Common Trend Analysis

To analyze the how home-purchase restriction affect P2P borrowing activities, we first plot the evolution of houseowners in the treatment and control groups. As presented in Figure 2, houseowners were in a similar trend for borrowing interests,

duration (minutes), and number of lenders before the announcement of home-purchase restriction. These borrowing factors shake at a different rate in the treatment group after the first shock, September 26, 2016. We also estimate the common trend assumptions for the pre-policy trend (January-September 2016) in the following regression to examine whether DD is an applicable approach for our study:

(1) $$Interest_{irt} = \beta_0 + \beta_1 Timetrend_t + \beta_2 Treat_{ir} + \beta_3 Timetrend_t * Treat_{ir} + \beta_4 Control_{ir} + \alpha_{irt}$$

(2) $$Number\_lenders_{irt} = \beta_0 + \beta_1 Timetrend_t + \beta_2 Treat_{ir} + \beta_3 Timetrend_t * Treat_{ir} + \beta_4 Control_{ir} + \alpha_{irt}$$

(3) $$Duration\_Min_{irt} = \beta_0 + \beta_1 Timetrend_t + \beta_2 Treat_{ir} + \beta_3 Timetrend_t * Treat_{ir} + \beta_4 Control_{ir} + \alpha_{irt}$$

In the regressions, i, r, t are borrower, city, and month indices, correspondingly. $Interest_{irt}$, $Number\_lenders_{irt}$, $Duration\_Min_{irt}$ are P2P funded interest, numbers of lenders who invest their funds to achieve borrowers' funding goal, and duration of the borrowing activities. $Timetrend_t$ indicates monthly trends during the study. $Treat_{ir}$ is a dummy variable with one for the cities implementing home-purchase restriction while zero otherwise. From Table 3, we could conclude that the common trend assumption is valid since most of the interaction terms, β_3, are insignificant. The only exception is April and June, which already has early home-purchase restriction policy release from Langfang and Shanghai.

4.12 DD Analysis

Based on the common trend assumption, we could further test the effect of home-purchase restriction on the houseowners through the following DD model:

(4) $$Interest_{irt} = \beta_0 + \beta_1 Treatpost_i + \beta_2 Control_{ir} + \alpha_{irt}$$

(5) $$Number\_lenders_{irt} = \beta_0 + \beta_1 Treatpost_i + \beta_2 Control_{ir} + \alpha_{irt}$$

(6) $$Duration\_Min_{irt} = \beta_0 + \beta_1 Treatpost_i + \beta_2 Control_{irt} + \alpha_{irt}$$

where $Treatpost_i$ is an indicator equal to one for treatment regions after the policy shock and zero otherwise. In the model using $Interest_{irt}$ as the independent variable, $Control_{irt}$ indicates various control variables for household characteristics, including gender, married, age, salary, work years, and education. In the model using $Number\_lenders_{irt}$ and $Duration\_Min_{irt}$ as the independent variable, $Control_{irt}$ indicates control variables including gender, marriage, age, salary, work years, education, amount of funded loan, and borrowing interests. α_{irt} represents a full set of city, month, and year fixed effects, with standard errors clustered at the city and month level to account for any correlations of the error terms within each firm. The others are the same as regression model 1.

Table 4 reports the trend of houseowners' borrowing activities by time period and regions, from which, borrowing interests for the treated and control group declined by 18.4% and 19.9% respectively after the policy shock. The borrowing duration for the treated and control group increased 6.662 hours and 8.238 hours respectively. The number of investors increased 46.983 and 44.931, correspondingly.

From DD results shown in Table 5, we could further identify that the treated houseowners' P2P borrowing interest rates drop more significantly rather than those of control regions after the announcement of home-purchase restriction in their cities. This outcome means that treated houseowners could tend to post a lower borrowing costs to crowdfund in the P2P platform. We also find that the growth rate of borrowing duration is 2.6% less for treated houseowners compared with controlled ones after the shock, which demonstrates that treated houseowners could borrow relatively faster in the P2P platform compared with their counterparts due to the home-purchase restriction. In addition, the number of lenders has a significantly larger increase for the treated houseowners (by 5 lenders), which shows that more lenders are inclined to invest their money to the treated borrowers after the shock. This result responds to the previous theories of house borrowing collateral effect since housing value has also been seen as an explicit asset valued by banks or other financial intermediations.

4.13 Additional DDD Estimations

Following the spirit of Cai (2016), we further implement the following DDD model to confirm the results using the whole sample (houseowners and non-house owners). This DDD framework could control for potential city-specific effects in our study (Cai, 2016), since some cities might have some unique potential trends during the sample period. Factors other than the policy shock could affect the result. Based on this estimation, we target on the differences between houseowners in the treated regions and the control regions by considering the differences in non-houseowners before and after the shock.

(7) $$Interest_{irt} = \beta_0 + \beta_1 Treatpost_i + \beta_2\, Control_{ir} + \beta_3 Treatpost_i * hasHouse_i + \alpha_{irt}$$

(8) $$Number\_lenders_{irt} = \beta_0 + \beta_1 Treatpost_i + \beta_2\, Control_{ir} + \beta_3 Treatpost_i * hasHouse_i + \alpha_{irt}$$

(9) $$Duration\_Min_{irt} = \beta_0 + \beta_1 Treatpost_i + \beta_2\, Control_{ir} + \beta_3 Treatpost_i * hasHouse_i + \alpha_{irt}$$

From Table 6, we confirm the previous research results that the DDD interaction term for interest and duration of the borrowing is significantly negative and for number of the lenders is significantly positive. This outcome shows that treated houseowners could experience a greater decrease of interest rates and a larger increase of lenders' investment after the shock compared with all of the other households. However, there is an insignificant outcome for duration, which indicates that treated houseowners' duration of borrowing had not been strongly affected by the policy shock in this DDD setting. The reason shows that there might be other factors affecting treated houseowners' borrowing r duration rather than this policy shock.

4.2 Heterogeneity Effect

4.21 Household Characteristics

In order to estimate the effect of heterogeneity of the household characteristics on the variation of houseowner responses, a DDD framework is further conducted as follow:

$$(10)\quad Interest_{irt} = \beta_0 + \beta_1 Treatpost_i + \beta_2\, Control_{ir} + \beta_3 Treatpost_i * Individual\_Characteristics_i + \alpha_{irt}$$

$$(11)\quad Number\_lenders_{irt} = \beta_0 + \beta_1 Treatpost_i + \beta_2\, Control_{ir} + \beta_3 Treatpost_i * Individual\_Characteristics_i + \alpha_{irt}$$

$$(12)\quad Duration\_Min_{irt} = \beta_0 + \beta_1 Treatpost_i + \beta_2\, Control_{ir} + \beta_3 Treatpost_i * Individual\_Characteristics_i + \alpha_{irt}$$

In the model with $Interest_{irt}$, $Control_{ir}$ represents control variable, including gender, married, age, salary, work years, and education. In the model with $Number\_lenders_{irt}$ and $Duration\_Min_{irt}$, $Control_{ir}$ represents control variable, including gender, married, age, salary, work years, education, loan amount, and borrowing interests. $Individual\_Characteristics_i$ includes various household-level characteristics, like gender, marriage, education levels, job position, state-owned enterprise jobs, and car.

As results shown in the Table 7, the lowering interests is sharper for treated male houseowners compared with treated females, which indicates a gender discrimination in P2P market. There is a stronger decrease of interests after the shock for treated unmarried houseowners compared with treated married ones since unmarried houseowners might face less pressures compared to their counterparts. Significantly positive result in education shows that treated houseowners with high education enjoy a larger reduced interest. Also, treated houseowners with stable salary payment, state-owned enterprise jobs, or car, could experience a sharper declining borrowing costs after their city announced the policy due to their stronger financial position and lower default possibilities.

Meanwhile, Table 8 demonstrates that treated unmarried houseowners could achieve their borrowing goals quicker compared to those treated married ones with the same reason mentioned above. Also, treated houseowners with high education background, stable salary payment, state-owned enterprise jobs, or car, could attain their P2P borrowing targets faster than their counterparts after their city announced the housing policy due to their stronger financial position and lower default possibilities.

Table 9 illustrates that treated male houseowners could attract more lenders compared with female houseowners as the reason mentioned above. Treated houseowners with higher education background, stable salary payment, state-owned enterprise jobs, or car, could attain more investors' funds compared with their counterparts after the housing policy shocks because of their stronger financial position and lower default possibilities.

4.22 Additional DDDD Estimations

As mentioned above, we follow the methodology from Cai (2016) and implement the following DDDD (quadruple difference) model to confirm the heterogenous effect of the household characteristics using the whole sample (houseowners and non-house owners). This DDDD framework is able to control for potential city-specific effects in our study (Cai, 2016).

$$(13) \quad Interest_{irt} = \beta_0 + \beta_1 Treatpost_i + \beta_2\, Control_{ir} + \beta_3 Treatpost_i * hasHouse_i * Individual\_Characteristics + \alpha_{irt}$$

$$(14) \quad Number\_lenders_{irt} = \beta_0 + \beta_1 Treatpost_i + \beta_2\, Control_{ir} + \beta_3 Treatpost_i * hasHouse_i * Individual\_Characteristics + \alpha_{irt}$$

where $Individual\_Characteristics_i$ includes household-level characteristics as referred before. The results from Table 10 and Table 11 match our previous findings that treated male or unmarried houseowners could achieve greater P2P lending advantages, including lower interest rates and more lenders' investment. Treated houseowners with higher education background, stable salary payment, SOE jobs, or

car, could attain greater P2P lending advantages compared with their counterparts after the home-purchase restrictions.

4.23 City Characteristics

In order to estimate the heterogeneity effect of the city level characteristics on the variation of houseowner responses to the policy, we use the following DDD models:

(15) $$Interest_{irt}(Duration\_Min_{irt}) = \beta_0 + \beta_1 Treatpost_i + \beta_2\, Control_{ir} + \beta_1 Treatpost_i * GDP\_growth_i + \alpha_{irt}$$

(16) $$Interest_{irt}(Duration\_Min_{irt}) = \beta_0 + \beta_1 Treatpost_i + \beta_2\, Control_{ir} + \beta_1 Treatpost_i * Population\_growth_i + \alpha_{irt}$$

(17) $$Interest_{irt}(Duration\_Min_{irt}) = \beta_0 + \beta_1 Treatpost_i + \beta_2\, Control_{ir} + \beta_1 Treatpost_i * Wage\_growth_i + \alpha_{irt}$$

(18) $$Interest_{irt}(Duration\_Min_{irt}) = \beta_0 + \beta_1 Treatpost_i + \beta_2\, Control_{ir} + \beta_1 Treatpost_i * Real\_Estate\_growth_i + \alpha_{irt}$$

(19) $$Interest_{irt}\,(Duration\_Min_{irt}) = \beta_0 + \beta_1 Treatpost_i + \beta_2\, Control_{ir} + \beta_1 Treatpost_i * Residential\_growth_i + \alpha_{irt}$$

In the model with $Interest_{irt}$, $Control_{ir}$ represents control variable, including gender, married, age, salary, work years, and education. In the model with $Duration\_Min_{irt}$, $Control_{ir}$ include gender, married, age, salary, work years, education, loan amount, and borrowing interests. GDP_growth_i, $Population\_growth_i$, $Wage\_growth_i$, $Real\_State\_growth_i$, and $Residential\_growth_i$ represent three-year average city GDP growth rate, three-year average city population growth rate, two-year average city residential wage growth rate, three-year average city real estate investment growth rate, and two-year city residential investment growth rate, respectively. Results from Table 12 (panel A) demonstrate that treated houseowners' P2P interest rate has a significantly negative relationship with their residential city's GDP growth rate, population growth rate, residential wage

growth rate, real estate investment growth rate, and residential investment growth rate. From Table 12 (panel B), we could also find that treated houseowners' duration of funding is only significantly negative correlated with three-year average city GDP growth rate. The impacts from other city economic development indices are not obvious. This still could be summarized that the better economic situation of the city, especially for its real estate industry, more advantages the treated households could experience in their P2P borrowing activities. The result matches the study from Glewwe and Jacoby (2004) that local economic growth is a significant wealth effect that stimulates residential household activities. This DDD estimation already include several important city-specific factors so that the additional DDDD test is not necessary.

4.3 Dynamic Effects

The release of the house-purchase restriction policy may impact household borrowing activities for a certain period. Furthermore, the magnitude and the significance of the effect could vary over time. Through the following regression, our study estimates the dynamic effect of the house-purchase restriction policy on household P2P borrowing activities to check those dynamic possibilities.

(20) $$Interest_{irt} = \beta_0 + \beta_1 Treatpost_i + \beta_2\, Dynamic\_Month_t + \beta_3 Treatpost_i * Dynamic\_Month_t + \alpha_{irt}$$

(21) $$Number\_lenders_{irt} = \beta_0 + \beta_1 Treatpost_i + \beta_2\, Dynamic\_Month_t + \beta_3 Treatpost_i * Dynamic\_Month_t + \alpha_{irt}$$

(22) $$Duration\_Min_{irt} = \beta_0 + \beta_1 Treatpost_i + \beta_2\, Dynamic\_Month_t + \beta_3 Treatpost_i * Dynamic\_Month_t + \alpha_{irt}$$

where $Dynamic\_Month_t$ contains a set of month dummies after the shock.

The results in Table 13 indicate that the effect of house-purchase restriction policy on houseowners' P2P borrowing interest rates, duration, and number of lenders becomes significant right after the shock in October 2016 until July 2017. The impact persists throughout 9 months of the post period.

4.5 the Channel of the House Wealth Effect on Borrowing Outcomes

Since the home-purchase restriction will lead to a rising housing price in those treatment regions, which represents a higher house wealth for the borrowers with houses. To identify the channel of house wealth effect in our study, we conducted the following DD model to test the impact of the home-purchase restriction on non-houseowners. As shown in Table 14, treated non-houseowners do not face significant variations in their borrowing interest rates, duration, and number of lenders after the release of the policies. As a result, unlike houseowners, there is no such an effect on non-houseowners since their financial situation will not be seriously affected by the announcement of the policy or the effect is ambiguous.

(23) $$Interest_{irt} = \beta_0 + \beta_1 Treatpost_i + \beta_2\, Control_{ir} + \alpha_{irt}$$

(24) $$Number\_lenders_{irt} = \beta_0 + \beta_1 Treatpost_i + \beta_2\, Control_{ir} + \alpha_{irt}$$

(25) $$Duration\_Min_{irt} = \beta_0 + \beta_1 Treatpost_i + \beta_2\, Control_{irt} + \alpha_{irt}$$

According to the theories discussed in Section II, the channel of the effect of house value swings on household consumptions and decisions are generally explained through pure wealth effect or borrowing collateral effect (Sinai & Souleles, 2005; Cooper, 2013; Berger, 2017; Cloyne et al, 2019). The pure wealth effect means that the rising house prices increase real housing wealth for households, which encourages households borrow more and consume more as they feel richer, especially for elder people (Campbell & Cocco 2007; Case, Quigley, & Shiller 2013). The collateral effect indicates that the value of house collateral would increase along with the housing price appreciation. The rising collateral value would further decrease the borrowing cost, especially for households who are facing borrowing or collateral constraints (Campbell & Cocco 2007).

In order to examine the channel of house wealth effect in our estimation, we consider the financial constraints and age profile using the following a DDD model:

(26) $$Interest_{irt} = \beta_0 + \beta_1 Treatpost_i + \beta_2\, Control_{ir} + \beta_3 Treatpost_i * Loan_{ir} + \alpha_{irt}$$

(27) $$Number\_lenders_{irt} = \beta_0 + \beta_1 Treatpost_i + \beta_2\, Control_{ir} + \beta_3 Treatpost_i * Loan_{ir} + \alpha_{irt}$$

(28) $$Duration\_Min_{irt} = \beta_0 + \beta_1 Treatpost_i + \beta_2\, Control_{irt} + \beta_3 Treatpost_i * Loan_{ir} + \alpha_{irt}$$

where $Loan_{ir}$ is a dummy variable indicates that whether household has an existing loan (car or house loan). One is with loan and zero represents without loan.

The results from Table 15 demonstrate that houseowners with financial constraints experience a stronger impact from the home-purchase restrictions, which means they could take a shaper decreasing interest rate and quicker borrowing duration. This result matches the existing study in the collateral channel that houseowners with financial constraints involve in a more obvious health wealth effect (Cooper, 2013; Corradin & Popov, 2015; Cloyne et al., 2019).

Most existing literature studies the pure wealth effect through age profile (Campbell & Cocco 2007; Attanasio et al. 2009; Mian & Sufi 2011). They find that the pure wealth effect can be tested by looking at the heterogeneous effect with respect to age. As a result, our study further use age as an interaction term in the DDD model to test the pure wealth effect as follows:

(29) $$Interest_{irt} = \beta_0 + \beta_1 Treatpost_i + \beta_2\, Control_{ir} + \beta_3 Treatpost_i * age_{ir} + \alpha_{irt}$$

(30) $$Number\_lenders_{irt} = \beta_0 + \beta_1 Treatpost_i + \beta_2\, Control_{ir} + \beta_3 Treatpost_i * age_{ir} + \alpha_{irt}$$

(31) $$Duration\_Min_{irt} = \beta_0 + \beta_1 Treatpost_i + \beta_2\, Control_{irt} + \beta_3 Treatpost_i * age_{ir} + \alpha_{irt}$$

The insignificant research result from Table 10 shows that there is no strong correlation between age and the effect of policy shock. Therefore, the pure wealth effect is not appropriate in explaining the house wealth effect of the study.

In sum, based on the signs of home-purchase restriction, the increasing housing value help treated P2P borrowers, especially the ones with financial constraints, reduce the borrowing costs, shorten the borrowing duration, and attract more investors through the borrowing collateral effect.

V. Conclusion

Household borrowing costs and related activities in P2P lending platform are subject to great variations for diverse reasons. Government policies are often the causes to create such distortions. Based on a quasi-natural experiment in the announcement of home-purchase restriction policies in multiple of cities in China in late September and early October, our study uses a series of DD, DDD, and DDDD models to estimate the impact house-purchase restriction policy on houseowners' P2P borrowing interest rates, duration, and the number of lenders. We identify that home-purchase restriction is inclined to decrease treated houseowners' P2P borrowing interest rates and slowing down the duration growth rate, while increasing the number of lenders who fund this borrowing requests through the channel of borrowing collateral effect. Since the home-purchase restriction policy implies the increase of the house price and the house wealth for the houseowners, houseowners tend to have a higher borrowing collateral value that decreases their default risks and strengthen their financial position in the financial market. The DDD estimation considering household loans and age confirms the borrowing collateral effect that houseowners with borrowing constraints benefit more from the policy effect while age profile does not make significant impacts on this relationship.

We test the heterogenous effect of borrowers' characteristics on the policy shock. The results show that male or unmarried houseowners who resides in the treated region

could enjoy much lower interest rates, get the fund quicker, and attract more lenders in P2P funding activities compared with their counterparts in the treated regions after the announcement of the policy. Treated houseowners with higher education background, stable salary payment, state-owned enterprise jobs, or car, could take more advantages in P2P funding activities compared with their counterparts after their city announces the housing policy because of their stronger financial position and lower default likelihoods. We further consider the city economic situation in the policy shock. The results show that P2P interest rates decrease sharper for treated houseowners whose cities have a higher GDP growth rate, population growth rate, residential wage growth rate, real estate investment growth rate, and residential investment growth rate, while duration of funding also has a much slower increase for the treated houseowners whose cities have a higher GDP growth rate. Therefore, economic growth of the city is able to increase the wealth effect of the residents, which offers household a stronger financial position and more advantages in the P2P borrowing activities.

Our research contributes to the literature by exploring the effect of government housing policies on households and investors at the Chinese online micro-financing market. We examine the collateral channel of the house wealth effect on household borrowing activities based on housing price swings. We also shed new light on the individual and city factors influencing P2P borrowing activities by connecting macro-economic shocks with micro-financing variations.

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Table 1 The key Date of Restrictive House-purchase Policy for 21 cities in 2016

City Name	Restrictions Date
Beijing	30-09-2016
Tianjing	01-10-2016
Langfang	01-04-2016
Shanghai	27-05-2016
Nanjing	26-09-2016
Wuxi	02-10-2016

Suzhou	04-10-2016
Hangzhou	28-09-2016
Hefei	02-10-2016
Fuzhou	07-10-2016
Xiamen	06-10-2016
Nanchang	08-10-2016
Jinan	03-10-2016
Zhengzhou	01-10-2016
Wuhan	03-10-2016
Guangzhou	04-10-2016
Shenzhen	04-10-2016
Zhuhai	04-10-2016
Foshan	07-10-2016
Dongguan	07-10-2016
Chengdu	01-10-2016

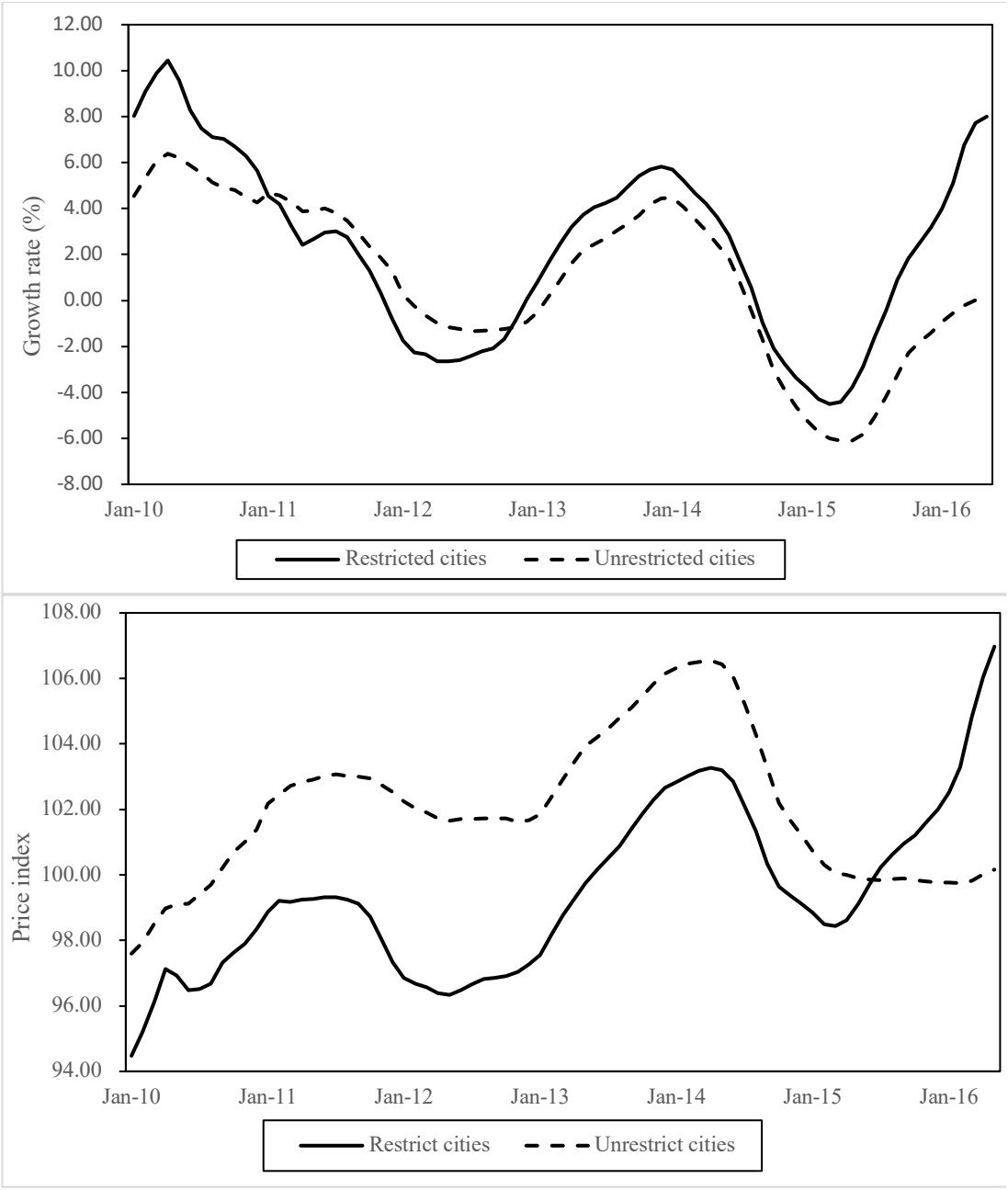

Figure 1 housing price index fluctuation over 2010-2016

The figure plots the housing price index and month-on-month growth rate over 2010-2016 for 70 cities. Restricted cities are the cities implementing the housing purchase restriction policy between September of 2010 and March of 2011. Data is from WIND database.

Table 2 Summary statistics

This table presents summary the mean for characteristics of funded loans, borrowers and cities in the pretreatment periods (1 Jan 2016 and 26 Sep 2016). Data on loans, borrowers is from Renrendai P2P platform. City characteristic data is from CSMAR. Standard deviations are in brackets. For The definition of the variables refers to Appendix table. ***, ** and * stand for significant at the 1%, 5% and 10% levels, respectively.

	Has house			Has no house	All sample
	Control	Treated	Difference		
VARIABLES	(1)	(2)	(3)	(4)	(5)
amount	87332.88	97766.27	-10433.4***	74255.82	82832.55
	(46853.46)	(51866.5)		(46240.19)	(48134.89)
interest	10.287	10.263	0.030***	10.161	10.225
	(0.479)	(0.488)		(0.51)	(0.499)
Duration(hour)	9.818	11.205	-1.392***	11.519	10.81
	(16.418)	(18.795)		(19.097)	(18.071)
No. investor	113.468	130.114	-16.600***	100.215	109.806
	(130.61)	(147.412)		(124.655)	(130.981)
gender	0.311	0.299	0.012***	0.34	0.323
	(0.463)	(0.458)		(0.474)	(0.468)
age	38.362	37.514	0.850***	34.531	36.465
	(8.547)	(8.258)		(8.196)	(8.539)
education	1.27	1.392	-0.122***	1.277	1.291
	(0.717)	(0.682)		(0.681)	(0.697)
married	0.763	0.756	0.007	0.608	0.69
	(0.426)	(0.43)		(0.488)	(0.462)
jobPosition	0.133	0.176	-0.043***	0.092	0.12
	(0.339)	(0.38)		(0.289)	(0.325)
houseLoan	0.539	0.624	-0.085***	0	0.302
	(0.498)	(0.484)		(0)	(0.459)
workYears	2.161	2.044	0.117***	1.837	1.994

	(1.022)	(1.045)		(1.072)	(1.06)
salary	3.289	3.941	-0.652***	3.223	3.355
	(1.206)	(1.247)		(1.147)	(1.211)
GDP growth rate	0.085	0.091	-0.006***	0.09	0.088
	0.045	0.018		(0.029)	(0.035)
wage growth rate	0.105	0.094	0.011***	0.097	0.1
	(0.028)	(0.024)		(0.028)	(0.028)
population growth rate	0.003	0.006	-0.002***	0.007	0.006
	(0.012)	(0.024)		(0.021)	(0.018)
residential investment growth rate	0.092	0.145	-0.053***	0.128	0.116
	(0.145)	(0.051)		(0.104)	(0.119)
real estate growth rate	0.017	0.129	-0.112***	0.091	0.068
	(0.159)	(0.066)		(0.121)	(0.138)
Observations	34654	13162		41101	88917

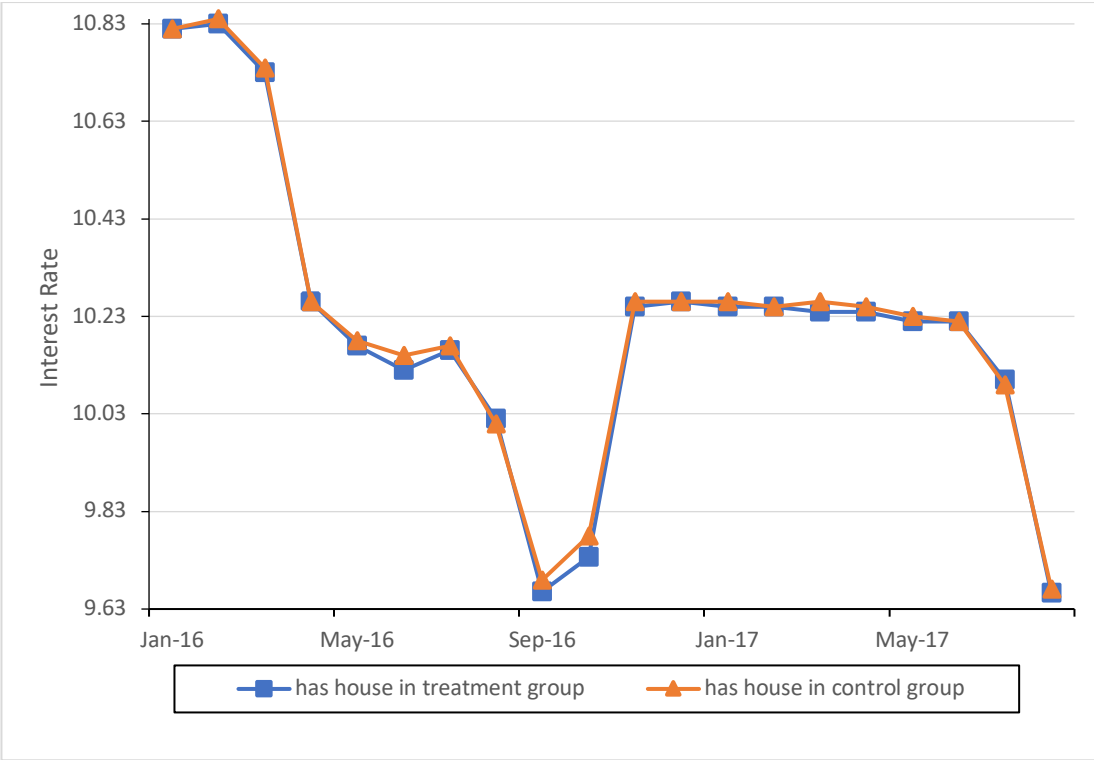

Figure 2.1 Evolution of borrowing cost for household with house, by treatment

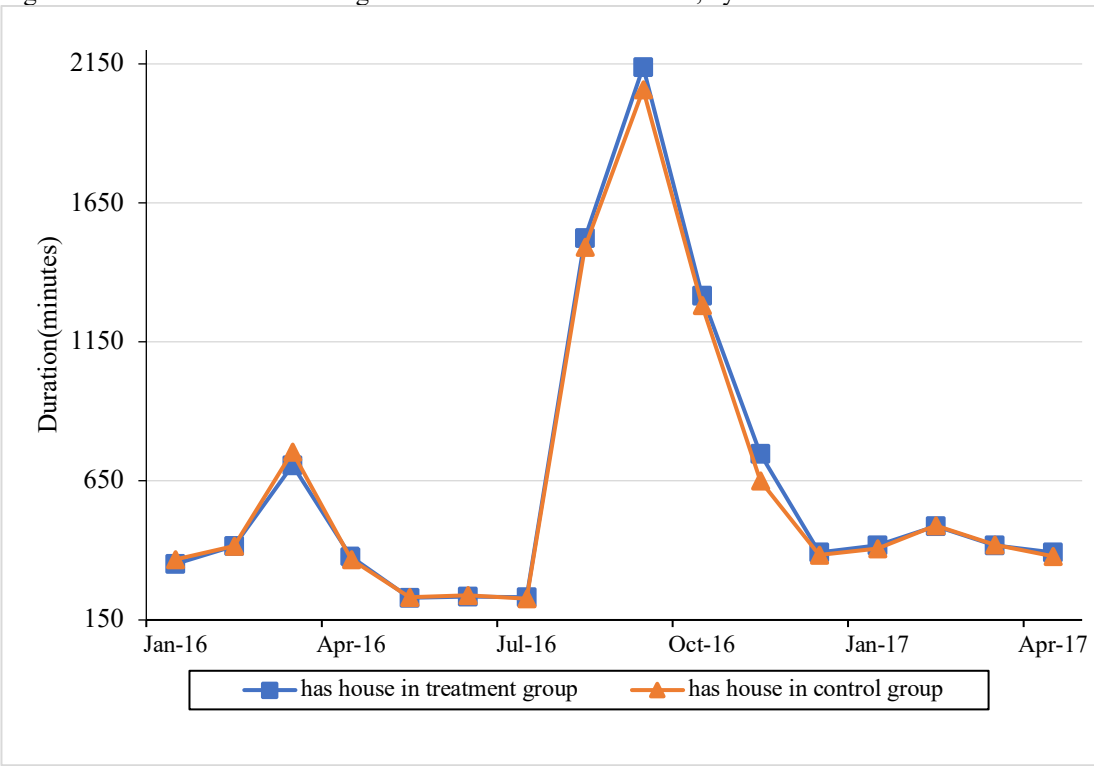

Figure 2.2 Evolution of duration for household with house, by treatment

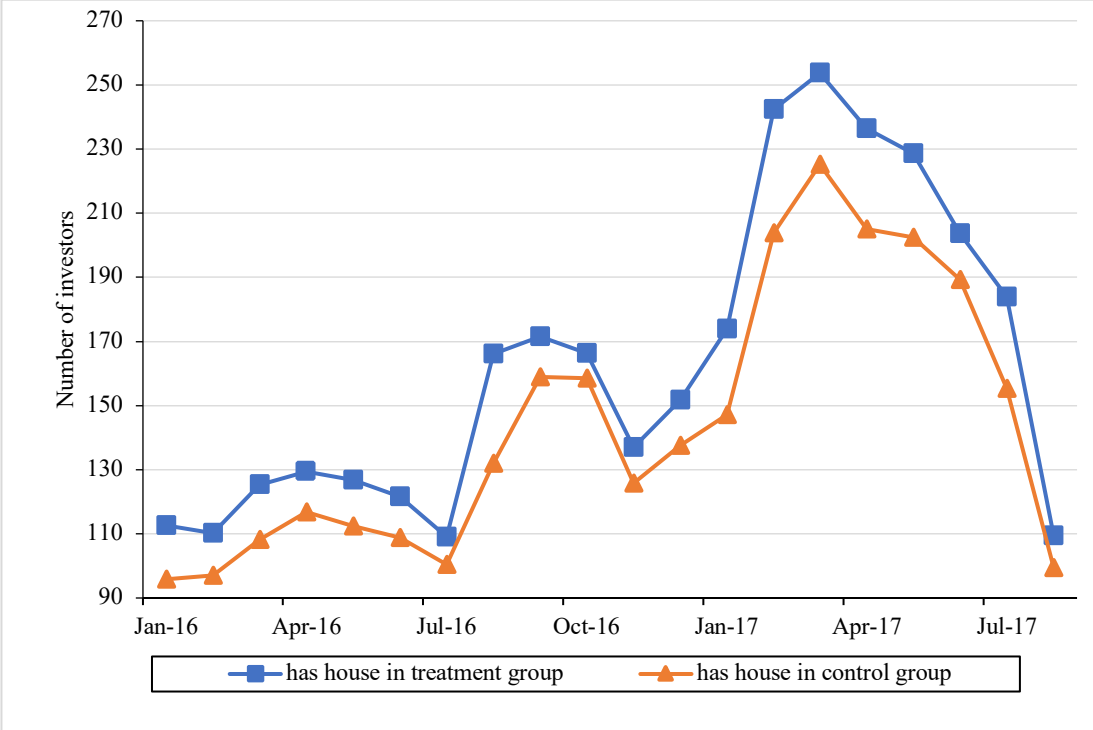

Figure 2.3 Evolution of No. of investors for household with house, by treatment

Table 3 Test common trend prior to policy intervention

The table reports common trend before the home-purchase restriction policy shock. Column 1, 3, 5 and 7 show the common trend assumption of DD estimation for subsample household who has house. Column 2, 4, 6, 8 for the subsample with no house. City fixed effects are controlled in all estimations. Standard errors are clustered at city level. Treated is a dummy variable with one for the cities implementing home-purchase restriction while zero otherwise. The definition of variables refers to Appendix table. ***, ** and * stand for significant at the 1%, 5% and 10% levels, respectively.

	interest		ln amount		ln duration		No investor
	Has house	Has no house	Has house	Has no house	Has house	nohousedur_min	hashouseNo
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)
treated×2016 February	-0.014	0.002	0.002	-0.016	0.033	0.108	1.707
	(-0.79)	(0.04)	(0.09)	(-0.48)	(0.42)	(1.17)	(0.33)
treated×2016 March	-0.054**	-0.124**	-0.025	-0.012	0.064	0.179**	0.683
	(-2.48)	(-2.29)	(-0.62)	(-0.22)	(1.35)	(2.42)	(0.16)
treated×2016 April	-0.030	-0.083	-0.015	0.031	0.107**	0.175**	6.255
	(-1.47)	(-1.43)	(-0.52)	(0.63)	(2.06)	(2.14)	(1.24)
treated×2016 May	-0.006	-0.100*	0.047	0.026	0.113*	0.178**	-1.812
	(-0.29)	(-1.76)	(1.43)	(0.45)	(1.74)	(2.07)	(-0.31)
treated×2016 June	-0.031*	-0.098*	0.019	0.025	0.399***	0.445***	5.937
	(-1.73)	(-1.69)	(0.56)	(0.43)	(5.92)	(4.93)	(1.12)

treated×2016 July	-0.013	-0.035	0.036	-0.005	-0.002	0.051	2.142
	(-0.64)	(-0.63)	(1.36)	(-0.15)	(-0.04)	(0.75)	(0.34)
treated×2016 August	-0.003	-0.025	0.031	0.002	0.036	0.041	1.024
	(-0.17)	(-0.51)	(1.17)	(0.06)	(0.54)	(0.60)	(0.16)
treated×2016 September	-0.023	-0.100**	0.007	-0.009	0.087**	0.145**	0.650
	(-1.30)	(-1.99)	(0.29)	(-0.24)	(2.08)	(2.15)	(0.14)
gender	-0.006*	0.009*	0.084***	0.115***	0.038***	0.020	7.065***
	(-1.78)	(1.88)	(13.75)	(12.68)	(3.21)	(1.35)	(5.98)
married	-0.015***	-0.021***	0.025***	0.047***	-0.011	0.019	3.415**
	(-3.97)	(-4.63)	(4.02)	(6.27)	(-1.01)	(1.32)	(2.19)
age	0.000	-0.001**	0.010***	0.012***	0.002***	0.004***	1.231***
	(0.62)	(-2.06)	(21.54)	(16.45)	(4.11)	(5.05)	(10.86)
salary	-0.017***	-0.047***	0.086***	0.081***	0.019***	0.037***	9.050***
	(-10.94)	(-9.32)	(26.61)	(15.24)	(4.47)	(5.38)	(13.29)
workYears	0.011***	0.027***	0.055***	0.115***	0.007	-0.003	10.237***
	(5.77)	(8.78)	(14.85)	(23.41)	(1.42)	(-0.44)	(14.92)
education	0.023***	0.036***	0.147***	0.207***	-0.013*	0.001	22.044***

	(7.19)	(4.46)	(25.61)	(19.61)	(-1.77)	(0.04)	(20.96)
Constant	10.827***	10.845***	10.291***	9.823***	5.323***	5.131***	-41.972***
	(758.64)	(246.05)	(352.37)	(197.20)	(149.61)	(76.77)	(-8.59)
Observations	47,807	41,064	47,807	41,064	47,807	41,064	41,064
R-squared	0.590	0.483	0.239	0.242	0.302	0.313	0.073

Table 4 Timely trend of borrowing cost, duration, and No. of investors

This table presents mean value of borrowing cost, duration and No. of investors for different groups within different period. Treated is a dummy variable with one for the cities implementing home-purchase restriction while zero for control. Standard deviations are in brackets. For The definition of the variables refers to Appendix table. ***, ** and * stand for significant at the 1%, 5% and 10% levels, respectively.

	2016.01.01-2016.09.26	2016.09.27-2017.08.31	difference
Interest			
treated	10.26	10.08	-0.184***
	(0.488)	(0.373)	
control	10.29	10.09	-0.199***
	(0.479)	(0.373)	
Duration			
treated	11.21	17.87	6.662***
	(18.795)	(25.287)	
control	9.818	18.06	8.238***
	(16.418)	(25.483)	
No. of investor			
treated	130.1	177.1	46.983***
	(147.412)	(188.989)	
control	113.5	158.4	44.931***
	(130.61)	(176.331)	

Table 5 The effect of the housing value fluctuation on credit access ability

The table reports the DD estimation results of the effect of the house wealth fluctuation on the borrowing cost, duration and number of investors. The results are for subsample with households having house. Treatpost is defined as 1 for cities after implementing home-purchase restriction and 0 otherwise. City fixed effects and time fixed effects are controlled in all estimations. Standard errors are shown in brackets and clustered at city and period level. The definition of the variables refers to Appendix table. ***, ** and * stand for significant at the 1%, 5% and 10% levels, respectively.

	interest		ln_duration		No_investor	
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
treatpost	-0.004***	-0.004**	-0.028	-0.026***	2.690	5.090***
	(-4.71)	(-2.27)	(-1.62)	(-4.40)	(0.86)	(5.36)
ln_amount				0.228***		123.982***
				(4.01)		(10.87)
interest				0.166		-12.617
				(0.75)		(-1.19)
gender		0.007		0.011*		-0.007
		(1.51)		(1.78)		(-0.01)
married		0.069		0.042		-4.177*
		(1.44)		(1.49)		(-1.79)
age		0.002**		0.001**		0.012
		(2.46)		(2.31)		(0.15)
salary		-0.013***		-0.004		1.387
		(-3.25)		(-0.28)		(1.20)
workYears		0.005		-0.014***		2.543**
		(0.93)		(-6.22)		(2.41)
education		0.007		-0.064***		8.720***
		(0.47)		(-8.67)		(3.44)
Constant	10.171***	10.065***	5.978***	1.791	143.762***	-1,143.469***
	(408.94)	(195.71)	(41.68)	(0.99)	(27.88)	(-5.68)
City fixed effect	Yes	Yes	Yes	Yes	Yes	Yes

Month-year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Observations	109,840	109,840	109,840	109,840	109,840	109,840
R-squared	0.440	0.449	0.231	0.249	0.058	0.285

Table 6 DDD estimation results of the effect of housing value change on borrowing outcomes

The table reports the DDD estimation results of the effect of the house wealth fluctuation on the borrowing cost, duration and number of investors. Treatpost is defined as 1 for cities after implementing home-purchase restriction and 0 otherwise. City fixed effects and time fixed effects are controlled in all estimations. Standard errors are shown in brackets and clustered at city and period level. The definition of the variables refers to Appendix table. ***, ** and * stand for significant at the 1%, 5% and 10% levels, respectively.

	interest		ln_duration		No_investor	
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
treatpost	0.038**	0.034**	0.003	-0.024	3.867	-4.267
	(2.26)	(2.07)	(0.12)	(-1.29)	(1.18)	(-1.49)
hasHouse	0.058***	0.025***	0.029***	-0.045***	27.572***	-2.170***
	(10.90)	(5.05)	(3.27)	(-5.36)	(18.03)	(-2.62)
treatpost×hasHouse	-0.040***	-0.039***	-0.029*	-0.006	7.603***	13.553***
	(-4.43)	(-4.50)	(-1.67)	(-0.37)	(3.84)	(7.05)
ln_amount				0.183***		111.990***
				(15.46)		(67.71)
interest				0.221***		-26.536***
				(6.64)		(-16.03)
gender		0.021***		0.022***		0.829*
		(8.45)		(3.46)		(1.67)
married		0.047***		0.030***		-3.863***
		(13.01)		(5.32)		(-6.27)
age		-0.000**		0.000		0.310***
		(-2.38)		(0.48)		(7.52)
salary		0.029***		0.022***		-1.786***
		(12.55)		(6.95)		(-6.07)
workYears		0.038***		-0.002		-0.814***
		(16.57)		(-0.47)		(-3.44)
education		0.017***		-0.033***		7.036***
		(6.84)		(-3.09)		(8.27)

Constant	10.090***	9.890***	6.029***	1.738***	122.039***	-851.087***
	(1,600.01)	(867.08)	(767.94)	(7.18)	(103.28)	(-40.36)
City fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Month-year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Observations	254,804	254,804	254,804	254,804	254,804	254,804
R-squared	0.321	0.341	0.224	0.245	0.050	0.285

Table 7 Heterogeneity of the house value effect on borrowing cost: household characteristics

The table presents heterogenous effect of the house value change on from individual characteristics. The dependent variable is borrowing cost. The results are for subsample with households having house. Treatpost is defined as 1 for cities after implementing home-purchase restriction and 0 otherwise. All control variables in Table 3 are included for all estimations. City fixed effects and time fixed effects are controlled in all estimations. Standard errors are shown in brackets and clustered at city and period level. The definition of the variables refers to Appendix table. ***, ** and * stand for significant at the 1%, 5% and 10% levels, respectively.

VARIABLES	(1)	(2)	(3)	(4)	(5)
treatpost×gender	0.014**				
	(2.49)				
treatpost×married		0.083***			
		(5.62)			
treatpost×education			-0.024***		
			(-2.95)		
treatpost×SOE				-0.069***	
				(-4.57)	
treatpost×hasCar					-0.063***
					(-3.50)
Constant	10.066***	10.078***	10.060***	10.070***	10.065***
	(1,004.90)	(990.26)	(984.40)	(990.56)	(1,005.81)
Controls	Yes	Yes	Yes	Yes	Yes
City fixed effect	Yes	Yes	Yes	Yes	Yes
Month-year fixed effect	Yes	Yes	Yes	Yes	Yes
Observations	109,840	109,840	109,840	104,606	109,840
R-squared	0.449	0.450	0.449	0.461	0.451

Table 8 Heterogeneity of the house value effect on duration: household characteristics

The table presents heterogenous effect of the house value change from individual characteristics. The dependent variable is duration. The results are for subsample with households having house. Treatpost is defined as 1 for cities after implementing home-purchase restriction and 0 otherwise. All control variables in Table 3 are included for all estimations. City fixed effects and time fixed effects are controlled in all estimations. Standard errors are shown in brackets and clustered at city and period level. The definition of the variables refers to Appendix table. ***, ** and * stand for significant at the 1%, 5% and 10% levels, respectively.

VARIABLES	(1)	(2)	(3)	(4)	(5)
treatpost×gender	-0.007				
	(-0.44)				
treatpost×married		0.134***			
		(7.17)			
treatpost×education			-0.045**		
			(-2.35)		
treatpost×SOE				-0.113***	
				(-4.00)	
treatpost×hasCar					-0.092***
					(-3.93)
Constant	1.790***	1.855***	1.789***	1.738***	1.861***
	(6.14)	(6.32)	(6.14)	(5.87)	(6.24)
Controls	Yes	Yes	Yes	Yes	Yes
City fixed effect	Yes	Yes	Yes	Yes	Yes
Month-year fixed effect	Yes	Yes	Yes	Yes	Yes
Observations	109,840	109,840	109,840	104,606	109,840
R-squared	0.249	0.249	0.249	0.247	0.249

Table 9 Heterogeneity of the house value effect on No. of investors: household characteristics

The table presents heterogenous effect of the house value change from individual characteristics. The dependent variable is No. of investors. The results are for subsample with households having house. Treatpost is defined as 1 for cities after implementing home-purchase restriction and 0 otherwise. All control variables in Table 3 are included for all estimations. City fixed effects and time fixed effects are controlled in all estimations. Standard errors are shown in brackets and clustered at city and period level. The definition of the variables refers to Appendix table. ***, ** and * stand for significant at the 1%, 5% and 10% levels, respectively.

VARIABLES	(1)	(2)	(3)	(4)	(5)
treatpost×gender	5.296**				
	(2.28)				
treatpost×married		-4.563			
		(-1.37)			
treatpost×education			9.147***		
			(4.35)		
treatpost×SOE				5.286**	
				(2.17)	
treatpost×hasCar					4.723*
					(1.92)
treatpost×loan					
Constant	-1,142.810***	-1,145.666***	-1,142.991***	-1,173.776***	-1,150.319***
	(-43.01)	(-43.14)	(-43.11)	(-44.11)	(-43.20)
Controls	Yes	Yes	Yes	Yes	Yes
City fixed effect	Yes	Yes	Yes	Yes	Yes
Month-year fixed effect	Yes	Yes	Yes	Yes	Yes
Observations	109,840	109,840	109,840	104,606	109,840
R-squared	0.285	0.285	0.285	0.284	0.285

Table 10 Heterogeneity of DDD estimation result of the effect of housing value change on borrowing cost: household characteristics

The table presents heterogenous effect of DDD estimation result of Table 8. The dependent variable is borrowing cost. Treatpost is defined as 1 for cities after implementing home-purchase restriction and 0 otherwise. All control variables in Table 3 are included for all estimations. City fixed effects and time fixed effects are controlled in all estimations. Standard errors are shown in brackets and clustered at city and period level. The definition of the variables refers to Appendix table. ***, ** and * stand for significant at the 1%, 5% and 10% levels, respectively.

VARIABLES	(1)	(2)	(3)	(4)	(5)
treatpost×hasHouse×gender	-0.007				
	(-0.87)				
treatpost×hasHouse×married		0.078***			
		(4.36)			
treatpost×hasHouse×education			-0.047**		
			(-2.44)		
treatpost×hasHouse×SOE				-0.007	
				(-0.44)	
treatpost×hasHouse×hasCar					-0.063***
					(-2.67)
Constant	9.890***	9.900***	9.875***	9.895***	9.884***
	(861.91)	(859.95)	(656.89)	(855.30)	(845.07)
Controls	Yes	Yes	Yes	Yes	Yes
City fixed effect	Yes	Yes	Yes	Yes	Yes
Month-year fixed effect	Yes	Yes	Yes	Yes	Yes
Observations	254,804	254,804	254,804	236,505	254,804
R-squared	0.342	0.343	0.342	0.354	0.344

Table 11 Heterogeneity of DDD estimation result of the effect of housing value change on No. of investors: household characteristics

The table presents heterogenous effect of DDD estimation result of Table 8. The dependent variable is No. of investors. Treatpost is defined as 1 for cities after implementing home-purchase restriction and 0 otherwise. All control variables in Table 3 are included for all estimations. City fixed effects and time fixed effects are controlled in all estimations. Standard errors are shown in brackets and clustered at city and period level. The definition of the variables refers to Appendix table. ***, ** and * stand for significant at the 1%, 5% and 10% levels, respectively.

VARIABLES	(1)	(2)	(3)	(4)	(5)
treatpost×hasHouse×gender	1.312				
	(0.53)				
treatpost×hasHouse×married		-5.530*			
		(-1.67)			
treatpost×hasHouse×education			6.858**		
			(2.13)		
treatpost×hasHouse×SOE				-9.532**	
				(-2.55)	
treatpost×hasHouse×hasCar					-6.017**
					(-2.01)
Constant	-849.941***	-849.156***	-849.884***	-871.913***	-853.707***
	(-40.48)	(-40.77)	(-39.88)	(-40.62)	(-40.73)

Controls	Yes	Yes	Yes	Yes	Yes
City fixed effect	Yes	Yes	Yes	Yes	Yes
Month-year fixed effect	Yes	Yes	Yes	Yes	Yes
Observations	254,804	254,804	254,804	236,505	254,804
R-squared	0.285	0.285	0.286	0.284	0.286

Table 12 Heterogeneity of the house value effect on borrowing outcomes: city characteristics

The table presents heterogenous effect of the house value change from city characteristics. The dependent variable is borrowing cost in panel A and duration in panel B. The results are for subsample with households having house. Treatpost is defined as 1 for cities after implementing home-purchase restriction and 0 otherwise. All control variables in Table 3 are included for all estimations. City fixed effects and time fixed effects are controlled in all estimations. Standard errors are shown in brackets and clustered at city and period level. The definition of the variables refers to Appendix table. ***, ** and * stand for significant at the 1%, 5% and 10% levels, respectively.

Panel A Dependant variable: *Interest Rate*

VARIABLES	(1)	(2)	(3)	(4)	(5)
treatpost×GDP growth rate	-0.556***				
	(-335.52)				
treatpost×wage growth rate		-0.196***			
		(-244.26)			
treatpost×population growth rate			-0.355***		
			(-131.43)		
treatpost×real estate growth rate				-0.052***	
				(-67.45)	
treatpost×investment growth rate					-0.035***
					(-19.22)

Constant	10.065***	10.062***	10.065***	10.065***	10.065***
	(190.95)	(187.51)	(191.59)	(195.73)	(195.72)
Controls	Yes	Yes	Yes	Yes	Yes
Observations	109,820	101,849	109,820	109,820	109,820
R-squared	0.448	0.451	0.448	0.448	0.448

Panel B Dependant variable: *Duration*

VARIABLES	(1)	(2)	(3)	(4)	(5)
treatpost×GDP growth rate	-0.997***				
	(-352.79)				
treatpost×wage growth rate		0.546			
		(0.84)			
treatpost×population growth rate			0.340		
			(0.97)		
treatpost×real estate growth rate				-0.062	
				(-0.71)	
treatpost×investment growth rate					0.355

					(1.20)
Constant	1.792	1.811***	1.790***	1.791	1.790***
	(0.99)	(5.98)	(6.13)	(0.99)	(6.14)
Controls	Yes	Yes	Yes	Yes	Yes
City fixed effect	Yes	Yes	Yes	Yes	Yes
Month-year fixed effect	Yes	Yes	Yes	Yes	Yes
Observations	109,820	101,849	109,820	109,820	109,820
R-squared	0.249	0.250	0.249	0.249	0.249

Table 13 Dynamic effect of housing value fluctuation on borrowing cost, duration and No. of investors

The table presents dynamic effect of housing value fluctuation on borrowing cost, duration and No. of investors. Treated is a dummy variable with one for the cities implementing home-purchase restriction while zero otherwise. All control variables in Table 3 are included for all estimations. City fixed effects and time fixed effects are controlled in all estimations. Standard errors are shown in brackets and clustered at city and period level. The definition of the variables refers to Appendix table. ***, ** and * stand for significant at the 1%, 5% and 10% levels, respectively.

	interest		ln_duration		No_investor	
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
treated×2016 November	0.033***	0.034***	0.080***	0.081**	5.088	4.155
	(5.70)	(5.78)	(3.18)	(3.11)	(1.41)	(1.08)
treated×2016 December	0.041***	0.038***	-0.022	-0.025	8.410***	8.117**
	(31.35)	(20.41)	(-0.98)	(-1.11)	(4.42)	(3.14)
treated×2017 January	0.036***	0.037***	-0.012	-0.012	21.343***	19.443***
	(11.56)	(8.34)	(-0.73)	(-0.72)	(9.75)	(6.89)
treated×2017 February	0.055***	0.047***	-0.030	-0.036	33.299***	28.105***
	(13.58)	(12.67)	(-1.09)	(-1.36)	(8.48)	(7.38)
treated×2017 March	0.027***	0.028***	-0.011	-0.012	23.470***	25.666***
	(9.61)	(7.09)	(-0.33)	(-0.35)	(5.16)	(5.63)
treated×2017 April	0.038***	0.040***	0.000	0.000	24.574***	25.609***

	(11.85)	(8.86)	(0.01)	(0.01)	(5.05)	(4.88)
treated×2017 May	0.040***	0.041***	-0.029	-0.028	21.174***	20.726***
	(7.67)	(6.28)	(-1.27)	(-1.23)	(5.64)	(5.63)
treated×2017 June	0.045***	0.043***	-0.005	-0.006	9.448	6.871
	(6.33)	(5.79)	(-0.33)	(-0.43)	(1.72)	(1.38)
treated×2017 July	0.050***	0.049***	-0.044*	-0.045*	21.845***	20.405***
	(4.54)	(4.61)	(-2.11)	(-2.10)	(6.08)	(6.01)
treated×2017 August	-0.037*	-0.033	-0.127***	-0.121***	-7.422*	-4.629
	(-1.88)	(-1.63)	(-5.31)	(-4.57)	(-2.12)	(-1.46)
Constant	9.758***	9.566***	6.618***	6.509***	163.365***	-65.859***
	(1,826.47)	(234.99)	(995.80)	(151.49)	(128.73)	(-5.62)
Controls	Yes	Yes	Yes	Yes	Yes	
City fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Month-year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Observations	60,621	60,621	60,621	60,621	60,621	60,621
R-squared	0.456	0.479	0.531	0.533	0.069	0.111

Table 14 Robustness check on the effect of the housing value fluctuation on credit access ability

The table reports the DD estimation results of the effect of the house wealth fluctuation on the borrowing cost, duration and number of investors. The results are for subsample with households having no house. Treatpost is defined as 1 for cities after implementing home-purchase restriction and 0 otherwise. City fixed effects and time fixed effects are controlled in all estimations. Standard errors are shown in brackets and clustered at city and period level. The definition of the variables refers to Appendix table. ***, ** and * stand for significant at the 1%, 5% and 10% levels, respectively.

	interest		ln_duration		No_investor	
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
treatpost	0.030	0.016	0.013	-0.018	13.448***	2.564
	(1.41)	(0.84)	(0.40)	(-0.63)	(4.04)	(0.82)
ln_amount				0.142***		106.369***
				(10.06)		(46.66)
interest				0.264***		-32.156***
				(6.38)		(-15.05)
gender		0.030***		0.031***		1.776***
		(10.30)		(4.01)		(2.79)
married		0.021***		0.021***		-3.430***
		(7.93)		(2.93)		(-5.12)
age		-0.002***		-0.001		0.427***
		(-9.01)		(-1.46)		(7.52)
salary		0.051***		0.044***		-2.178***
		(18.44)		(11.94)		(-6.26)
workYears		0.054***		0.012***		-2.078***
		(14.54)		(2.93)		(-6.97)
education		0.025***		-0.001		5.191***
		(7.31)		(-0.05)		(3.95)
Constant	10.077***	9.841***	6.084***	1.697***	123.607***	-729.853***

	(1,112.53)	(560.78)	(424.02)	(5.86)	(86.90)	(-23.89)
City fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Month-year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Observations	144,951	144,951	144,951	144,951	144,951	144,951
R-squared	0.251	0.297	0.225	0.250	0.043	0.290

Table 15 Mechanism tests of the effect of housing value change on borrowing outcomes

The table shows the results of the mechanism tests of the effect of housing value change on borrowing outcomes. The dependent variable is borrowing cost in column 1 and 3 and duration in column 2 and 4. The results are for subsample with households having house. Treatpost is defined as 1 for cities after implementing home-purchase restriction and 0 otherwise. Loan is a dummy variable equals to 1 if the household has house loan or car loan and 0 otherwise. All control variables in Table 3 are included for all estimations. City fixed effects and time fixed effects are controlled in all estimations. Standard errors are shown in brackets and clustered at city and period level. The definition of the variables refers to Appendix table. ***, ** and * stand for significant at the 1%, 5% and 10% levels, respectively.

	(1)	(2)	(3)	(4)
	wealth_int	wealth_dur	coll_int	coll_dur
VARIABLES	interest	ln_duration	interest	ln_duration
treatpost	-0.041**	0.085***	0.000	0.056***
	(-2.45)	(3.33)	(0.06)	(10.41)
age	0.001**	0.000	0.001***	(0.25)
	(2.29)	(0.86)	(3.28)	
treatpost×age	0.001	-0.002		
	(1.15)	(-1.24)		
loan			0.023**	0.015
			(2.62)	(1.06)
treatpost×loan			-0.029**	-0.067***
			(-2.56)	(-3.20)
Constant	10.155***	2.600	10.137***	2.614
	(228.14)	(1.01)	(226.61)	(1.02)
Controls	Yes	Yes	Yes	Yes
City fixed effect	Yes	Yes	Yes	Yes
Month-year fixed effect	Yes	Yes	Yes	Yes
Observations	98,720	98,720	98,720	98,720
R-squared	0.441	0.341	0.441	0.341

Appendix Table A1: Variable Definitions

VARIABLE	ABBR.	DESCRIPTION
Dependent Variables		
Loan's Interest	interest	The percentage of principle charged by loan platform to a borrower
Duration of processing	ln duration	Logarithm of minutes took by the borrower of the funding process
Number of lenders	no. of lenders	The total number of lenders who are willing to invest on the loan
Loan amount	ln amount	Logarithm of loan amount received by the borrower.
Individual Characteristics		
Gender	gender	A dummy variable with one if the borrower is a female; zero otherwise
Marital Status	married	A dummy variable with one is married and zero otherwise
Age	age	The age of the borrower.
Salary	salary	A variable indicating a borrower's monthly income level, where n=0 represents whose wage is no more than 1000 RMB, n=1 means monthly income is between 1000-2000 RMB, n=2 means monthly income is between 2000-5000 RMB; n=3 means monthly income is between 5000-10000RMB; n=4 means monthly income is between 10000-20000RMB; n=5 means monthly income is between 20000-50000 RMB; n=6 means monthly income is above 50000 RMB.
Education	education	A variable indicating the education level of borrowers, where n=0 (if the borrower is high school certificate and below), n=1 (if the borrower is college-degree holder), n=2 (if the borrower is university- degree holder), n=3(if the borrower is with postgraduate degree and above)
Car Ownership	hasCar	A dummy variable with one if the borrower owns a car; zero otherwise
House ownership	hasHouse	A dummy variable with one if the borrower owns a house; zero otherwise
House/Car Loan	houseLoan	A dummy variable with one if the borrower has either a house loan or a car loan; zero otherwise
Job Position	jobPosition	A dummy variable with one the borrower working for salariats and zero otherwise
Work Years	workYears	A variable showing the working experience of borrowers, where n=0 (if the working experience is no more than 1 year), n=1(if a borrower has 1-3 years' working experience), n=2 (if a borrower has 3-5 years' working experience), n=3 (if a borrower has more than 5 years' working experience)
State-own Employee	SOE	A dummy variable with one working for state-own companies and zero otherwise
City Characteristics		
GDP Three-Years' Average Growth Rate	GDP growth rate	An average growth rate of Gross Domestic Productions (GDP) from 2013 to 2015
Wage Three-Years' Average Growth Rate	wage growth rate	An average growth rate of residential wages from 2013 to 2015

Population Two-Years' Average Growth Rate	population growth rate	An average growth rate of the amount of population from 2014 to 2015
Real Estate Two-Years' Average Growth Rate	real estate growth rate	An average growth rate of the number of real estate investment from 2014 to 2015
Residential Investment Three-Years' Average Growth Rate	investment growth rate	An average growth rate of the quantities of residential investment from 2013 to 2015