CPB Netherlands Bureau for Economic Policy Analysis

CPB Discussion Paper | 351

Collateral Damage?

Decreasing House Prices and Entrepreneurial Lending

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Collateral Damage? - Decreasing House Prices and Entrepreneurial Lending

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May 10, 2017

Abstract

We study the effect of housing collateral on entrepreneurial lending in the Netherlands. This residential collateral channel is especially relevant for sole proprietors for whom there is no legal distinction between the owner and the business. We make use of unique administrative data on outstanding bank credit of all Dutch sole proprietorships in the period $2007 - 2012$. Our estimates indicate that home owning entrepreneurs were hit less severe in the times of crisis than renting entrepreneurs.

Relative to renters, during the economic crisis, the incidence of having outstanding bank credit decreased 2% percent less for home owners. Home owners also experience a 40 basis points weaker increase in costs of credit compared to renters. Within the group of home owners higher LTVs only go along with higher prices during the crisis relative to lower LTVs.

JEL Classification Numbers: G23, R2, R31, L26
Keywords: house price shocks, negative equity, entrepreneurial lending.

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1 Introduction

What are crucial determinants to obtain credit as a small business owner? This is a key question raised by policy makers, economists and entrepreneurs themselves. A large literature has demonstrated that small businesses owners depend strongly on financial institutions to obtain capital for their business activities. In particular, there has been a focus on the role of the borrower's collateral. It serves as commitment device for the entrepreneur to overcome potential problems, such as ex-post moral hazard, arising from asymmetric information between the lender and borrower. Furthermore, the collateral protects the lender against unforeseeable risks, such as an unexpected default of the borrower.

For small businesses, the collateral may consist of specific personal assets, such as the amount of equity in the entrepreneur's house. It makes home owners personally liable for business debts (see for instance (Tirole, 2010; Avery, Bostic & Samolyk, 1998)). As a consequence, a number of theoretical studies address potential multiplier effects of residential property markets on the economy (Bernanke & Gertler, 1989; Kiyotaki & Moore, 1997; Iacoviello, 2005). Recent empirical research shows some evidence of the importance of the housing market for business creation (Schmalz, Sraer & Thesmar, 2017; Adelino, Schoar & Severino, 2015). Their estimates indicate that the probability to start a new business is positively related to increases in the value of the collateral.

We examine the role of the collateral lending channel for Dutch small business owners, using administrative panel data of sole proprietorships

for the period 2007 through 2012. We have access to data that contain, amongst others, information on the outstanding amount of business loans, the costs of credit, industry, location, value of the entrepreneur's house, value of the outstanding mortgage of the house, (household) income and other household characteristics. The sole proprietors do not have limited liability. In particular, we investigate the role of the housing market for the provision and price of small business loans. During this period, transaction prices on the Dutch owner-occupied housing market declined by 23 percent on average.

We hypothesize that the entrepreneur's house can be used as a source of collateral for credit from banks. A declining value of residential collateral due to a negative economic shock will enhance an economic downturn. This is because, if the value of collateral decreases, the borrower will have less collateral to pledge to the lender and the lender is thus less willing to give credit. Whereas previous empirical studies focus on the residential collateral channel during times of economic upswings and booming housing markets, we focus on a period of an economic downturn that went along with decreasing property prices. This is important to investigate, because the economic recovery through entrepreneurial activities can be delayed by the deterioration of the housing collateral during an economic crisis. Note that, next to that, supply-side effects could also contribute to a further amplification of economic downturns. During a crisis, banks might be willing to take less risk, which could result in stricter business credit lending rules.

This paper provides three new contributions to the empirical literature

of the housing collateral channel. First, to the best of our knowledge, this is the first analysis that *directly* explores the link between the entrepreneur's private housing collateral and the business loan.[1] This is a novelty since most of the current papers did not obtain individual data on both house prices and entrepreneurial activity, but rather observe at least one of these variables at the regional level. Moreover, we obtained data on outstanding bank credit and total interest paid for this credit, while other papers use more indirect measures, such as regional business creation or employment, to test the collateral channel (see for example Adelino et al. (2015)). From our data we construct two dependent variables: a 0-1 business loan indicator (loan incidence) and the total interest paid as a percentage of the total amount of business loans (loan price).

The second contribution is our identification strategy. We apply a difference - in - differences (DD) approach to identify the causal effect of the collateral value on the entrepreneurial bank credit. We make use of the burst of the Dutch housing market in 2008 as an unexpected decline ('treatment') in the value of home equity which can serve as collateral. Declining house prices pushed a substantial number of entrepreneurs into negative home equity.

The third contribution is that the data and DD-framework allow us to test the collateral channel hypothesis both within the group of home owners and by comparing home owners and renters. In other words, we have different treatment and control groups of entrepreneurs who differ in their

[1]Note that Schmalz et al. (2017) have survey information on assets, sales and debt at the firm level. However, they did not obtain information on the value of the entrepreneur's house.

exposure to the house price shock. Within the group of home owners we compare entrepreneurs with different pre-crisis levels of mortgage debt relative to the value of their house (loan-to-value ratios) to test whether entrepreneurs with higher loan-to-value (LTV) ratios were hit harder during the crisis. Next, we compare home owning and renting entrepreneurs. Whereas the amount of collateral declined substantially for home owners since the start of the crisis, the amount of housing collateral did, by definition, not change for renters. There is a large rental sector in the Netherlands of about 30 percent of the housing stock, which is not fully restricted to the lower part of the income distribution (Kattenberg & Hassink, 2017). Hence, comparable entrepreneurs may reside in both the rental and the owner-occupied sector.

There are three major empirical findings. First, the DD-estimates indicate that the price of business credit increased more for homeowners with the highest pre-crisis LTV ratios compared to owners with the lowest pre-crisis LTVs. This result is in line with the residential collateral hypothesis. Second, the DD-estimates show that the price of business credit increased since the start of the crisis, but the increase was stronger for tenants than for home owning entrepreneurs. This result is not in line with the residential collateral hypothesis and suggests that risks increased more for tenants than for home owners according to banks, despite the decline in collateral values. One possible explanation is that banks apply stricter lending rules since the crisis, which makes it more expensive to get a loan without any collateral. It could also be the case that, for some reason, the creditworthiness of renting entrepreneurs worsened compared to that of home owning

entrepreneurs. Third, although we do find effects on the price of the business loans, we do not find evidence for an effect on the incidence of these loans.

The setup of the paper is as follows. Section 2 gives an overview of the related literature. Section 3 presents the empirical strategy. In Section 4 we describe our data set. We present and discuss our results in Section 5 and finally we conclude in Section 6.

2 Related literature

This paper fits in three strands of literature on the interaction between the housing markets and real economic outcomes that regained interest since the start of the financial crisis. The first strand looks at the microeconomic relationship between housing and economic outcomes. For instance, Mian, Rao & Sufi (2013) and Mian & Sufi (2014) find evidence for a link between household balance sheets on the one hand and consumption and employment on the other hand. The idea is that deteriorating household balance sheets induce cuts in household spending. This reduced demand translates, in turn, into reduced employment. Wealth effects and credit constraints are two possible explanations for these findings. We add to this literature by investigating the relationship between household collateral and entrepreneurship.

Several models point to the existence of liquidity constraints (e.g. Evans & Jovanovic, 1989) or credit constraints (e.g. Blanchflower & Oswald, 1998). These constraints can, under certain conditions, prevent individuals from

becoming entrepreneurs. Similarly, a lack of pledgeable collateral could induce constraints for existing entrepreneurs who want to expand their business or refinance their loans (e.g. Cagetti & De Nardi, 2006).

There are two seminal papers which describe the macroeconomic mechanisms of the collateral lending channel. Bernanke & Gertler (1989) describe the mechanism where increases in collateral value ease credit constraints for entrepreneurs which translates into economic growth. This model was later extended by Kiyotaki & Moore (1997). They argue that shocks in collateral cause a drop in the net worth of a firm. As a consequence, this can have substantial multiplier effects over many periods on the investment behavior and on earnings of the firm. Eventually these shocks can amplify and spread out on the whole economy. Their work was later extended by Iacoviello (2005) who also finds multiplier effects of demand shocks due to shocks in entrepreneurial housing collateral. These models were supported with empirical evidence by for instances Goodhart & Hofmann (2008), who find a link between house prices, private credit and macroeconomic outcomes.

The third strand of papers is a set of empirical studies with a microeconomic focus. Most of these papers study the relationship between collateral and business creation. In an interesting and important paper Adelino et al. (2015) show that the $2002 - 2007$ house price boom in the US resulted in an increase of small business starts. Their results suggest that the collateral channel is especially important for small firms. Next, they find that the collateral channel is more important in industries with low start-up capital needs. For instance, in industries within manufacturing capi-

tal needs of entrepreneurs are too high to be financed with loans against individual property. In such industries the household balance sheet is a less important factor in explaining business creation. However, one of the potential shortcomings of their study is that they have only data on the county level and not at the individual firm level. [2]

Schmalz et al. (2017) compare business start-up probabilities of French home owning and renting households in regions with varying house price appreciations during the period $1992 - 2002$. They show that homeowners who experience larger house price increases are more likely to start a new business compared to renters in the same region. Besides that, in regions with strong house price increases firms of home owning entrepreneurs (i) are larger at time of creation, (ii) use more debt, and (iii) create more value added.

Instead of focusing on business creation, Chaney, Sraer & Thesmar (2012) analyze the impact of real estate prices on corporate investment. They obtained a sample of large US firms and estimate how firm investments respond to an increase in the value of real estate that the firm actually owns. So in contrast to what we are doing, they look at the business collateral channel and not at the personal collateral channel. They find that a $ 1 increase in business collateral value leads to $ 0.06 extra investments.

[2] A study which is closely related to the previous paper is the one by Balasubramanyan & Coulson (2013) who find a link between house prices and start of small businesses in the US. They find no relation between house prices and start-up of greater businesses.

3 Empirical strategy

We consider a linear reduced-form equation in which features of the loan are explained by the residential collateral. We distinguish two dependent variables. The first dependent variable is the $0-1$ indicator Inc, which is one if the entrepreneur has bank credit on its balance sheet during the year (and zero elsewhere).[3] The second dependent variable is the relative price P of the loan, which is defined as the total annual interest payment relative to the total amount of business loans on the entrepreneur's balance sheet.

As identification strategy, we apply the difference - in - differences method (DD method). The advantage of the DD method is that under some assumptions (common trends and stable unit treatment value assumption, SUTVA) it renders consistent parameter estimates of γ in the following general specification:

$$
\begin{aligned}
Loan_{it} = \alpha_i + \lambda_t + \beta S_i + \delta T_t + \gamma(S_i \times T_t) + \xi X_{it} + \epsilon_{it} \\
Loan = P, Inc \\
i = 1, .., N;\ t = 2007, ..., 2012 \\
T_t = 1 \text{ if } t = 2010, ..., 2012 \text{ (and zero elsewhere)}
\end{aligned}
\tag{1}
$$

In equation 1 subscripts i and t refer to entrepreneur i and the year t, respectively. S_i is a dummy variable (or set of dummy variables) which divides our sample into a control group and one or more treatment groups.

[3] Since the same loan-to-value-ratio indicates different absolute values of home equity for different house prices, we focus on the probability to obtain credit.

The dummy T_t equals 1 for the year after the start of the financial crisis. To put it more precisely, the treatment in our model is the unexpected and substantial decline in house prices that started after 2009 and we assume that the treatment lasts until the end of the sample period. Our coefficient of interest is the DD estimator γ. The DD estimator is interpreted as the effect on $Loan_{it}$ of being in the treatment group after the start of the financial crisis compared to the effect of not being in the treatment group. In our preferred specification we include household fixed effects α_i, year dummies λ_t, and background characteristics X_{it}. ϵ_{it} is an idiosyncratic error term.

We estimate two alternative specifications of equation 1. In the first variant, we consider the group of home owners only and divide them in three groups. The control group is formed by homeowners with a loan-to-value-ratio below 0.75 in 2007, prior to the economic downturn. The majority of home owners in this group has still positive home equity in 2012, after the substantial decline in house prices. The treatment groups are formed by home owners with LTVs of 75-100 percent and home owners with LTVs of 100-140 percent in 2007. A large fraction of the first treatment group is pushed into negative home equity during the crisis, and therefore we expect γ to be positive in the price equation and negative in the incidence equation. For the group with LTVs between 100 and 140 percent it is less clear what to expect under the collateral hypothesis, since this group is already in negative equity in the pre-crisis period.[4]

[4]On the one hand, we do not expect to find an effect for this group since the amount of excess collateral is zero both before and after the crisis. On the other hand, one could argue that before the crisis these entrepreneurs were still able to obtain credit under rela-

In the second variant of equation 1, we follow Schmalz et al. (2017) and consider both home owners and renters. We include all renting entrepreneurs in the control group, since this group is not affected by the decline in collateral values since 2009. The group of home owning entrepreneurs, instead, is affected by declining house prices. For all home owners the absolute amount of collateral declined, holding constant the outstanding mortgage amount. Therefore the residential collateral hypothesis predicts that γ is positive in the price equation and negative in the incidence equation.

A potential problem with our DD strategy is that multiple treatments may happen in the same period. For instance, considering the market for small business loans, banks implemented stricter lending conditions. As long as these stricter lending conditions affected renters and home owners in the same way, this is not a problem in our DD framework. If banks increased the requirements for renters more than for home owners, and we cannot control for this directly, our DD estimator no longer identifies the effect of declining collateral values only. This is something we need to take into account when interpreting our results. It also implies that our first variant of equation 1, where we compare different groups of home owners, is a cleaner comparison as we estimate a DD on a more homogeneous group of entrepreneurs.

tively favorable conditions fostered by expectations of future house price increases.

4 Data

We use administrative data from Statistics Netherlands to study the residential collateral channel. Our core dataset contains **end-of-year credit amounts** and **costs of credit** of all sole proprietors during the period $2007 - 2012$. The amounts of outstanding credit are collected from the tax returns of this group of entrepreneurs. The data includes information at the entrepreneur level on the total amount of business loans at monetary and financial institutions in the Netherlands. Moreover, we have information on the annual total interest paid for these loans. Finally the credit dataset includes a unique entrepreneur identifier which allows us to merge the data to other administrative datasets from Statistics Netherlands.

We merge our data to a file including information on all self-employed individuals in the Netherlands.[5] The self-employed data provides us with information on the profits of the entrepreneur, the size (in terms of employees), and the main industry where the firm is active. Next, the dataset includes a person identifier, which we use to merge income, wealth, and demographic data of the entrepreneur's household.

The wealth data includes information on the outstanding mortgage amount of all households in our data set. We also obtained administrative data on house values. To be more precise, our data includes the so-called WOZ-value, which is determined every year by municipalities. The WOZ-value of every house is based on recent local transaction prices and is used for property tax purposes. Based on the wealth data and the WOZ-values

[5]Note that we restrict our sample to the jurisdiction of only sole proprietors (in Dutch: 'eenmanszaken').

we construct the loan-to-value-ratio (LTV) of owner-occupying households in 2007 and divide households into three groups according to their pre-crisis LTVs (0-75 percent, 75-100 percent, and 100-140 percent). Three important remarks have to be made with regard to this variable: First,we only consider the value of the (private) house and do not include firm-specific assets in our definition of the LTV. Second, we select these LTV categories because the first (0-75) always remains with positive home equity in the period of investigation, the second (75-100) falls into negative home equity due to declining house prices in the period of investigation and the third always remains with negative home equity. Lastly, households with LTVs above 140 percent in 2007 are excluded from our analysis.[6]

Our main analyses is based on a balanced panel of all sole proprietors in the Netherlands. We restrict our sample to entrepreneurs for whom business profits form the main source of income. By doing so, we exclude entrepreneurial households that earn a substantial share of their income from sources other than their own business. We discard all home owners with houses worth less than 100,000 € in 2007. Moreover, we discard all business credits which are greater or equal to 1,000,000 €. We only analyze households who do not move residence in the period of our analysis. The main reason for this selection is that residential moves often go along with changes in the loan-to-value ratio which can influence the creditworthiness of a firm for other reasons than a change in the house price. Next, we want to avoid that households could migrate from treatment to control

[6]The main reason is that these extraordinary high LTVs stem from measurement errors in the data which arise when households move.

group and vice versa if we allow for residential moves during our sample period. [7]

4.1 Descriptives

Table 2 shows the mean, standard deviation, and median for the most important variables in our analysis. The statistics in Table 2 are for the balanced panel, which includes both owner-occupying and renting entrepreneurs. Renters form 18 percent of the sample. Table 3 shows descriptives statistics of the sample of home owners. The majority of home owners have a pre-crisis LTV between 0 and 75 percent, about 20 percent has an LTV between 75 and 100 percent, while 10.9 percent was in negative equity before the crisis. In the last available year (2012) the latter number nearly doubled to 21.5 percent. The average house value was just 324, 164 euro in 2008 and decreased to 280, 990 euro in 2012. This indicates an average price decline of about 13 percent. [8]

The home owning entrepreneurs in our sample had, on average, 16, 581 euro of outstanding business credit on their balance sheet by the end of 2008. This number decreased to about 14, 926 euro in 2012. The average total costs of business credit decreased from 1, 363 euro in 2008 to 1341 euro in 2012. [9]

[7] More details on the construction and selection of the data can be found in Appendix A.

[8] House prices decreased even further after 2012. From the peak in August 2008, house prices in the Netherlands decreased by about 23 percent reaching the lowest point in June 2013.

[9] Tables 4 and 5 show the same descriptive statistics for the sub samples of entrepreneurs who have credit in at least one of the years in the sample period.

4.1.1 House price development and home owner status

Figure 1 displays the development of house values for renters and the different groups based on pre-crisis LTV ratios. The picture clearly shows that renting entrepreneurs live, on average, in lower-valued houses than home-owning entrepreneurs. Next, entrepreneurs with the highest pre-crisis LTV ratios live in lower-valued houses than entrepreneurs with lower pre-crisis debt ratios. However, the pattern of slightly increasing house values before 2008 and gradually declining house values after 2008 is similar for all groups of entrepreneurs. This is important for our DD analysis, because it shows that all entrepreneurs received about the same "treatment".

– FIGURE 1 ABOUT HERE –

4.1.2 Propensity to obtain credit and home owner status

Figure 2 presents the development of our first dependent variable, the business loan incidence (Inc), for the four different groups of entrepreneurs. First, it shows that renting entrepreneurs obtain, on average, less often a business loan than home-owning entrepreneurs. Second, there are virtually no differences between the three groups of home-owning entrepreneurs. Entrepreneurs with high and low pre-crisis debt ratios are equally likely to obtain business credit to finance their activities. Third, after 2009, the loan incidence drops sharply for all groups of entrepreneurs and the propensity to have business credit continues to drop in the period 2010-2012. Based on this figure only, we do not find evidence that

the decreased value of private collateral influences the likelihood to have business credit as an entrepreneur.

– FIGURE 2 ABOUT HERE –

4.1.3 Relative costs of credit and home owner status

In Figure 3 we show the development of the average costs of business credit for the four groups of entrepreneurs according to their status on the housing market. Renting entrepreneurs pay on average the highest average interest rates, followed by entrepreneurs with the highest LTV ratios. Lower pre-crisis debt ratios go hand in hand with lower average costs of business credit. The average costs of credit increase over the sample period, both before and after the crisis. The increase seems to be stronger for entrepreneurs who are renting or had high pre-crisis debt ratios.

– FIGURE 3 ABOUT HERE –

5 Regression results

5.1 Owner-occupiers

First, we estimate the regression equation 1 for the selection of home owners. We make use of a balanced panel of 516,504 observations of 86,084 entrepreneurs. Table 6 shows the parameter estimates of the loan incidence (Inc) equation.[10] In the first two columns we do not include fixed

[10]We estimate a linear probability model with standard errors clustered at the firm level.

effects (FE), while we include postcode FE and firm FE in columns (3)-(4) and (5)-(6), respectively. We prefer the specification with firm FE and show the other results for reasons of comparison.

— TABLE 6 ABOUT HERE —

Entrepreneurs with an LTV between 0 and 75 percent in 2007 form the reference group in Table 6. The estimates without firm FE show that the likelihood to have business credit on the balance sheet was about the same for all groups of entrepreneurs in the pre-crisis period. Since 2009, the likelihood to have credit decreased by about 3.6 percentage points for our reference group of entrepreneurs. This parameter estimate is statistically significant and remarkably stable among all specifications. Finally, the interaction terms between the pre-crisis LTV dummies and the treatment dummy are not significant in our preferred specification. The interpretation of this finding is that the likelihood to have credit decreased since 2009 at the same rate for entrepreneurs with higher LTV ratios compared to the reference group with the lowest LTV ratios. [11]

Then, we estimate regression equation 1 again, but now with the relative costs of credit (P) as dependent variable. The results are presented in Table 7. The number of observations decreases to $84,858$ ($14,143$ unique firms) since we only include firms with a positive amount of business credit during at least one of the years in the period of estimation.

[11] Note that we find a negative interaction effect in specifications (2) and (4) for entrepreneurs with a pre-crisis LTV between 75 and 100 percent. This would indicate that those entrepreneurs who were pushed into negative home equity were less likely to have business credit on their balance sheet since the start of the crisis, compared to entrepreneurs with an LTV between 0 and 75 percent. This effect disappears when we add firm FE.

The estimates in the first four columns show that before 2009 the costs of credit were higher for firms with higher pre-crisis LTV ratios. Since 2009 the costs of credit increase for our reference group of entrepreneurs. The increase is about 1.2 percentage points in the specifications with FE (column 6). In contrast to the loan-incidence equation, we find statistically significant interaction effects in the price equation. Since 2009, the increase in the average costs of credit is stronger for entrepreneurs with higher pre-crisis LTV ratios compared to the increase for the reference group. For entrepreneurs with an LTV between 75 and 100 percent we find an additional effect of 0.4 percentage points, while we find an additional effect of about 0.7 percentage points for the group with a pre-crisis debt ratio between 100 and 140 percent. These findings are all in line with the collateral hypothesis.

— TABLE 7 ABOUT HERE —

5.2 Owner-occupiers vs. renters

We now discuss the full sample results where both home-owning and renting entrepreneurs are included. Table 8 presents the estimated coefficients of the loan incidence equation. From the first four columns it is clear that owner-occupiers are more likely to have a positive amount of business credit on their balance sheet than renters. This finding is in line with the collateral hypothesis.

Next, the likelihood to have business credit decreased after 2009 for the reference group (renting entrepreneurs). This decrease is about 4 percent-

age points [12]. The coefficient on the interaction term between the owner-occupier dummy and the treatment dummy is positive and statistically significant, but small. The loan incidence decreased for home owners as well after 2009, but by about 0.6 percentage points (or 2%) less than for renters.[13] This result is not in line with the collateral hypothesis. While the collateral of renters is not affected by the decline in house values, the collateral value of home owners declined substantially. Therefore, we expected to find a stronger decrease in loan incidence for owners than for renters.

— TABLE 8 ABOUT HERE —

In Table 9 we present the estimation results for the price equation. The findings are in line with the effects we find for the loan incidence. First, home owners pay on average lower interest rates than renters (columns (1)-(4)). Second, the average costs of business credit increase for renters since the start of the financial crisis. This increase is estimated at about 1.8 percentage points in our preferred specification. Third, the increase in costs of credit is less strong for home owners compared to renting entrepreneurs. For home owners the increase after 2009 was about .4 percentage points smaller (or on average 40 basis points).

— TABLE 9 ABOUT HERE —

[12] The average loan incidence for renters was about 25 percent before 2009

[13] We calculate this relative effect size as follows: $\frac{0.0058}{0.2967}$. 0.0058 is the point estimate of the interaction effect and the average loan incidence of home owners in our sample period is 0.2967.

5.3 Heterogeneous effects across industries and age

As a first check of our results we estimate our model separately for the largest industries in our sample.[14] Adelino et al. (2015) suggest that the collateral channel is less important in industries with high capital needs. If capital needs are high, the amount of private collateral is often not sufficient to finance entrepreneurial activities. [15]

Our regressions per industry are presented in Tables 10-11 (within home owners) and Tables 12-13 (owners vs. renters). Within the group of home owners we find a statistically significant decrease in the propensity to have business credit for the reference group (LTV 0-75 percent) in almost all industries since 2009. However, just as in our main specification, we do not find evidence for differences between the different LTV categories. The picture that emerges from Table 11 is that the costs of credit have increased for the reference group since 2009, for all industries. In some industries (hotel and catering, consultancy and research, rental of movable goods, and education) we find evidence for an additional increase for the highest pre-crisis LTV categories.

The results in Table 12 are, in general, in line with our findings for the full sample. We find evidence for a decrease in the propensity to have credit for renters since 2009. Next, this decrease is smaller for owner-occupying entrepreneurs. This result is not statistically significant for all

[14] We only include industries that have at least 600 observations ($N \times T$)

[15] In the Netherlands, debt-to-asset ratios are the highest in hotel and catering, transport and storage, construction, and retail businesses (CPB, 2014). In health care, information and communication, consultancy, wholesale, and agriculture debt-to-asset ratios are typically lower.

industries. Probably this is related to the sample size, as we find significant results in the industries with the highest number of observations. The cost of credit results in Table 13 are also in line with our previous findings, although the interaction effects are hardly significant.

All in all, we do not find convincing evidence for the hypothesis that the collateral channel is less important in industries with high capital needs. First, our estimates become less precise when we estimate our models per industry. Second, as Adelino et al. (2015) also recognize, the collateral channel is probably more important for small firms in general. The median amount of business credit in our sample is about 45,000 euro. For such amounts, private housing collateral might still be important for obtaining business credit.

Next, we check whether the results vary with the age of the firm. Firms that exist longer might have a better track record at the bank, which makes private collateral less important for these entrepreneurs. As we did not obtain reliable data about the exact age of firms, we proxy for firm age by splitting the sample in groups according to the entrepreneur's age.

From Table 14 it appears that the negative post-treatment effect for the reference group (LTV 0-75 percent) is concentrated in the older age categories. This could be related to the fact that most households with low LTV ratios are in fact the oldest households. What is more interesting is that we find a decrease in the propensity to have business credit in the 75-100 percent LTV group for entrepreneurs between age 30 and 50 compared to the reference group. These entrepreneurs were pushed into negative equity

after 2009 and the results seem to suggest that this reduced the propensity to have business credit. We do not find significant interaction effects for the highest LTV category. Table 15 shows that the estimated interaction effects in the costs of credit equation are not so significant. Moreover, we do not observe a clear pattern over age categories.

Finally, we compare renters and owners within different age categories in Tables 16 and 17. There is no clear age pattern for the interaction term in the loan incidence equation. However, the cost of credit interaction term is only significant for the oldest entrepreneurs (from 45 to 60 years). This indicates that the costs of credit increased less for older home owners compared to renters since 2009. Young entrepreneurs faced an equal increase in the costs of credit since 2009, independent of whether they where renter or owner-occupier. The latter effect provides some evidence for the hypothesis that private collateral becomes less important for older firms.

5.4 Discussion

There are two reasons that can potentially explain our findings. First, despite the fact that we control for unobserved time constant heterogeneity in our empirical analysis, there might still be variables such as creditworthiness which influence an entrepreneur's probability to obtain credit and price of credit. If, for instance, the creditworthiness of renters declined more strongly in our treatment period, our empirical analysis cannot distinguish between higher levels of creditworthiness or home owner status. A second reason can be that in our time period multiple 'treatments' took

place. This can for instance be, that banks also enforced stricter lending conditions for renters than for home owners since 2009. If this was the case the DD estimator where we compare renters and home owners no longer identifies the effect of declining collateral values only. We tackle this potential issue by comparing only home owners with different levels of home equity.

6 Conclusion

In this study we investigate the effect of private housing collateral on entrepreneurial lending in the Netherlands. We construct a unique administrative panel data set with individual data on business credit, house values, mortgage amounts, and a rich set of background characteristics of entrepreneurial households. This data set is unique in the sense that previous studies observed at least on of the variables at a higher aggregated level. Next, the individual level data on actually obtained business credit and the costs of it allow us to *directly* test the collateral channel. Our data set include all sole proprietorships in the Netherlands during the period 2007-2012. This is an interesting group to test the collateral lending channel, because these entrepreneurs do not have limited liability. The underlying idea is that the entrepreneur's house can be used as a source of collateral to obtain credit from banks.

To identify the importance of the collateral lending channel in the Netherlands, we use the house price drop during the period 2008-2013 as an unexpected shock to private collateral values. We compare entrepreneurs

with different exposure to this house price shock in a DD framework. In a first set of regressions we compare home owners with different pre-crisis LTV ratios. The hypothesis is that entrepreneurs who were pushed into negative home equity face more problems to finance their activities with debt compared to entrepreneurs with lower pre-crisis private debt ratios. In a second set of regressions we compare renting and owner-occupying entrepreneurs in our DD framework. Here the underlying idea is that the collateral value of renters is not affected by the house price drop since 2008/2009, while home owners face a decline in the collateral value that they can potentially use to obtain credit for their businesses. We focus on two outcome variables: the business loan incidence and the relative costs of business credit.

Our four main findings can be summarized as follows. First, we find no effect of declining collateral on the incidence of credit if we compare different states of home ownership in the form of LTV ratios. Second, if we compare renters and home owners, in our treatment period the probability of having credit decreases for both groups. However, for home owners the loan incidence decreases less than for renters. Third, the effect of declining housing collateral seems to be reflected in the price borrowers have to pay for their credit. Within the group of home owners, those with higher pre-crisis mortgage debt relative to their home value pay higher prices for their credit. The gap between high and low LTV ratios widens in our treatment period, probably due to declining housing collateral values. Fourth, when we compare renters and home owners, home owners always paid less for their credit. The difference becomes larger in times of declining house

prices.

Our results can only partially be explained by the collateral lending channel hypothesis. In line with the collateral lending channel we find that home owners with lower values of home equity have to pay more for their credit compared to home owners with higher home equity levels. This can be explained by the fact that lenders charge a higher risk premium for entrepreneurs with less collateral. Some of our empirical findings cannot be explained with the collateral lending channel hypothesis. First, we find no effects on the probability to have credit on the balance sheet for home owners with less collateral compared to home owners with more collateral. Next, we find a positive effect of home owners compared to renters in times of declining house prices on the propensity to have business credit. The relative price of credit increases less for home owners compared to renters in times of declining house prices.

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Appendix A Construction of the Data Set

In this section we describe the construction process of our core data set. Our final data set is a results of a merging process of more than 10 independent administrative data sets.

1. We start with registry data sets 'ZELFSTANDIGENTAB' from the years 2007 until 2013 which contains all self-employed individuals in the Netherlands.

2. We merge this data set with a person-specific identifier by making use of 'ZELFSTANDIGENKOPPEL' to match information on the firm with individual.

3. We merge this data with a building-specific identifier in the data set 'GBADRESSOBJECTBUS'.

4. We add information on housing values in the data set 'EIGENDOM-WOZTAB'.

5. We add information on the jurisdiction of the company by making use of the general nation-wide company register ('ABR'). We restrict our sample only on those observations which have the jurisdiction 'eenmanszaak' (sole-proprietorship).

6. We merge this data set with a tailor-made data set which contains balance sheet information of all sole proprietors. The most important variables are outstanding bank credit and the costs of outstanding bank credit.

7. We add information on the household composition, such as persons living in the household and marital status, by making use of the 'GBAHUISHOUDENBUS'.

8. We make use of the 'GBAPERSOONSTAB2014' to append information personal information on the household head such as age.

9. We further augment this data with information on yearly household income and household financial wealth in the data sets 'IHI' and 'IVB' from the years 2007 until 2014. All information is dated-back to the situation in 31^{st} of December of each respective year. This means that for instance wealth information from the 1^{st} of January in 2014 is dated back to the year 2013.

10. In this step we add information on the postal code areas of the respective building where a self-employed is living ('VSLGWB'). This leaves us with a baseline unbalanced panel data set of $3,480,182$ firm-year observations.

11. In a next step we clean the data set in several ways. This process is shown in table 1

Table 1: Construction of a balanced panel of sole proprietorships

Selection or cleaning procedure	N
Starting data set, all entrepreneurs from $2007-2013$, see step 10.	$3,480,182$
Drop individuals with age ≤ 19 and > 65	$3,330,233$
Missing values in location, drop farms, recreational apartments, non-appartments	$3,206,547$
Drop negative values of credits	$3,205,895$
Drop values with negative costs and positive values of credit	$3,137,574$
Drop sectors with less than 500 observations	$3,136,152$
Drop year 2013 because we lack information on homeownership status	$2,572,842$
Drop households with more than four breadwinners	$2,547,212$
Keep only households with business as main income source	$2,499,920$
Drop extreme values of entrepreneurial and household wealth ($< 1^{st}$ and $> 99^{th}$ perc.)	$2,400,903$
Drop missing LTVs	$2,384,561$
Drop observations with credit $> 1,000,000$	$2,348,396$
Drop home owners with a home value lower than $100,000$	$2,347,531$
Make panel balanced	$963,714$
Drop observations with switches in home ownership status and residential moves	$676,812$
Drop observations with negative household income	$629,670$

Appendix B Descriptive Statistics

Table 2: Descriptive statistics - home owners and renters

	2007 mean/sd/p50	2008 mean/sd/p50	2009 mean/sd/p50	2010 mean/sd/p50	2011 mean/sd/p50	2012 mean/sd/p50
1 if bank credit	0.29	0.30	0.31	0.27	0.26	0.25
	0.454	0.460	0.461	0.446	0.440	0.434
	0.00	0.00	0.00	0.00	0.00	0.00
Outstanding bank credit	13549.16	14715.56	14931.39	14118.55	13737.34	13152.67
	43613.751	46474.191	46827.653	46073.387	45744.954	44637.428
	0.00	0.00	0.00	0.00	0.00	0.00
Costs of Credit	1087.81	1242.87	1283.65	1268.24	1254.80	1225.04
	2804.466	3107.459	3167.242	3122.730	3073.358	3012.080
	94.00	126.00	138.00	146.00	154.00	156.00
Renters	0.180	0.180	0.180	0.180	0.180	0.180
House price	303024.04	304378.62	296583.46	289853.85	278659.60	263445.04
	145081.683	146521.452	141838.480	138431.525	133004.511	125605.743
	266000.00	267000.00	260000.00	255000.00	245000.00	232000.00
Household income	63464.574	66119.489	64353.910	63317.784	64788.506	64056.407
	44354.591	45304.550	44975.132	45242.223	45800.912	47570.824
	55359.00	57634.00	55932.00	54859.00	56435.00	54934.00
Age	44.347	45.347	46.347	47.347	48.347	49.347
	8.592	8.592	8.592	8.592	8.592	8.592
	44.00	45.00	46.00	47.00	48.00	49.00
Fraction of men	0.702	0.702	0.702	0.702	0.702	0.702
Fraction with registered partnership	0.808	0.809	0.809	0.808	0.807	0.804
Fraction with children	0.582	0.583	0.579	0.573	0.563	0.553
Fraction married	0.609	0.618	0.625	0.630	0.633	0.635
Unique observations			104945			

Notes. The table reports descriptive statistics for the sample of home owners and renters.

Table 3: Descriptive statistics - home owners

	2007	2008	2009	2010	2011	2012
	mean/sd/p50	mean/sd/p50	mean/sd/p50	mean/sd/p50	mean/sd/p50	mean/sd/p50
1 if bank credit	0.30	0.32	0.32	0.29	0.28	0.27
	0.460	0.466	0.467	0.454	0.448	0.442
	0.00	0.00	0.00	0.00	0.00	0.00
Outstanding bank credit	15272.18	16581.99	16812.41	15968.25	15573.56	14926.49
	46628.001	49776.832	50101.805	49374.375	49023.748	47880.603
	0.00	0.00	0.00	0.00	0.00	0.00
Costs of Credit	1193.75	1363.98	1406.38	1388.07	1374.55	1341.98
	2976.239	3302.273	3364.358	3315.561	3260.397	3196.345
	116.00	144.00	159.00	165.00	171.00	172.00
LTV $[0, 75)$	0.69	0.68	0.66	0.65	0.63	0.59
LTV $[75, 100)$	0.202	0.206	0.206	0.203	0.198	0.191
LTV $[100, 140)$	0.109	0.110	0.130	0.147	0.176	0.215
House price	322552.07	324164.26	316343.32	309119.83	297412.72	280990.98
	145440.957	146704.761	142163.207	138508.402	132851.250	125339.571
	285000.00	287000.00	280000.00	274000.00	264000.00	249500.00
Outstanding mortgage	168633.668	171214.884	171815.250	171669.627	171016.868	169165.738
	121228.090	121387.407	122069.959	123067.590	123571.084	123925.455
	152521.00	155647.00	157000.00	157000.00	156584.50	155366.50
Household income	68830.917	71611.104	69725.908	68683.291	70185.695	69493.006
	45432.132	46311.717	46015.083	46426.139	46933.903	48897.964
	60122.50	62654.00	60948.00	59973.50	61544.00	60285.50
Age	44.252	45.252	46.252	47.252	48.252	49.252
	8.529	8.529	8.529	8.529	8.529	8.529
	44.00	45.00	46.00	47.00	48.00	49.00
Fraction of men	0.700	0.700	0.700	0.700	0.700	0.700
Fraction with registered partnership	0.858	0.858	0.858	0.857	0.856	0.853
Fraction with children	0.620	0.622	0.618	0.612	0.600	0.589
Fraction married	0.66	0.67	0.68	0.68	0.68	0.68
Unique observations			86084			

Notes. The table reports descriptive statistics for the sample of home owners.

Table 4: Descriptive statistics - home owners and renters with credit

	2007 mean/sd/p50	2008 mean/sd/p50	2009 mean/sd/p50	2010 mean/sd/p50	2011 mean/sd/p50	2012 mean/sd/p50
Relative costs of credit	0.08	0.09	0.09	0.09	0.09	0.10
	0.054	0.053	0.054	0.057	0.060	0.067
	0.07	0.07	0.07	0.07	0.07	0.07
Outstanding bank credit	70776.928	74639.689	74814.866	72391.423	70400.102	67942.676
	85394.904	89074.419	88878.296	86943.447	85794.901	84046.659
	40163.50	43746.50	44111.50	42354.50	40500.00	39042.50
Costs of Credit	4500.84	5096.83	5163.46	5028.37	4915.27	4784.25
	5079.782	5556.476	5598.034	5450.683	5330.120	5247.336
	2849.00	3266.00	3365.50	3275.50	3208.00	3100.00
Renters	0.107	0.107	0.107	0.107	0.107	0.107
House price	307921.10	309255.45	302458.97	295633.98	284522.30	268897.11
	137761.425	139304.131	135757.779	132803.058	127938.825	120779.448
	273500.00	275000.00	269000.00	263000.00	253000.00	239000.00
Household income	60641.353	63319.484	61323.548	60734.111	63018.887	61554.573
	39313.693	41085.058	40933.480	40701.823	41555.136	42757.041
	52894.00	55434.50	53455.50	52708.50	54957.50	53174.00
Age	44.750	45.750	46.750	47.750	48.750	49.750
	8.035	8.035	8.035	8.035	8.035	8.035
	45.00	46.00	47.00	48.00	49.00	50.00
Fraction of men	0.828	0.828	0.828	0.828	0.828	0.828
Fraction with registered partnership	0.858	0.860	0.858	0.856	0.854	0.850
Fraction with children	0.665	0.663	0.656	0.648	0.632	0.619
Fraction married	0.680	0.687	0.691	0.694	0.696	0.693
Unique observations			15836			

Notes. The table reports descriptive statistics for the sample of home owners and renters who obtained credit in at least one year of our sample period.

Table 5: Descriptive statistics - home owners with credit

	2007 mean/sd/p50	2008 mean/sd/p50	2009 mean/sd/p50	2010 mean/sd/p50	2011 mean/sd/p50	2012 mean/sd/p50
Relative costs of credit	0.08	0.08	0.08	0.09	0.09	0.09
	0.053	0.052	0.052	0.056	0.058	0.065
	0.06	0.07	0.07	0.07	0.07	0.07
Outstanding bank credit	74204.13	78280.82	78384.55	75891.65	73866.45	71338.10
	87067.211	91062.804	90757.626	88892.817	87635.366	85972.384
	44123.00	46830.00	47263.00	45430.00	44024.00	42000.00
Costs of Credit	4662.966	5273.260	5333.675	5187.843	5072.895	4937.006
	5189.350	5675.184	5727.530	5566.977	5435.245	5349.022
	2982.00	3417.00	3495.00	3420.00	3351.00	3222.00
LTV $[0, 75)$	0.74	0.73	0.71	0.70	0.67	0.63
LTV $[75, 100)$	0.17	0.18	0.18	0.18	0.18	0.18
LTV $[100, 140)$	0.087	0.089	0.105	0.120	0.145	0.181
House price	319536.88	321070.51	314091.59	307088.71	295736.30	279408.36
	138622.535	139920.591	136481.179	133429.848	128423.069	121295.999
	285000.00	287000.00	281000.00	274000.00	265000.00	250000.00
Outstanding mortgage	156610.522	159418.625	160756.860	161545.429	161648.358	160774.174
	110358.520	110380.322	111290.479	112402.704	112763.251	112856.704
	142372.00	145307.00	147478.00	147500.00	147945.00	147690.00
Household income	62786.284	65576.263	63555.035	62998.790	65328.401	63810.401
	39909.059	41724.580	41653.013	41506.921	42308.230	43610.848
	54801.00	57520.00	55597.00	54898.00	57094.00	55438.00
Age	44.631	45.631	46.631	47.631	48.631	49.631
	8.018	8.018	8.018	8.018	8.018	8.018
	44.00	45.00	46.00	47.00	48.00	49.00
Fraction of men	0.827	0.827	0.827	0.827	0.827	0.827
Fraction with registered partnership	0.877	0.878	0.877	0.875	0.873	0.868
Fraction with children	0.682	0.681	0.673	0.666	0.650	0.637
Fraction married	0.702	0.708	0.713	0.715	0.716	0.713
Unique observations			14143			

Notes. The table reports descriptive statistics for the sample of home owners who obtained credit in at least one year of our sample period.

Appendix C Results

Table 6: Propensity to have bank credit – home owners

	(1)	(2)	(3)	(4)	(5)	(6)
LTV 2007 $[0,75)$			*Baseline*			
LTV 2007 $[75,100)$	0.0008	0.0052	0.0078*	0.0149***		
	(0.004)	(0.004)	(0.004)	(0.004)		
LTV 2007 $[100,140)$	-0.0016	0.0095	0.0017	0.0172**		
	(0.005)	(0.005)	(0.005)	(0.005)		
$\mathbb{1}(year > 2009)$	-0.0359***	-0.0319***	-0.0359***	-0.0350***	-0.0359***	-0.0356***
	(0.001)	(0.002)	(0.001)	(0.002)	(0.001)	(0.002)
LTV 2007 $[75,100) \times \mathbb{1}(year > 2009)$	-0.0014	-0.0075**	-0.0014	-0.0081**	-0.0014	-0.0039
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
LTV 2007 $[100,140) \times \mathbb{1}(year > 2009)$	0.0056	-0.0037	0.0056	-0.0043	0.0056	0.0020
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
HH income $25,000 - 50,000$		0.0209***		0.0166***		-0.0118***
		(0.004)		(0.004)		(0.002)
HH income $50,000 - 75,000$		-0.0300***		-0.0298***		-0.0242***
		(0.004)		(0.004)		(0.002)
HH income $75,000 - 100,000$		-0.0819***		-0.0726***		-0.0312***
		(0.005)		(0.004)		(0.002)
HH income $> 100,000$		-0.1282***		-0.1048***		-0.0391***
		(0.005)		(0.005)		(0.003)
R-squared	0.00	0.02	0.05	0.07	0.01	0.01
Controls	NO	YES	NO	YES	NO	YES
Firm-FE	NO	NO	NO	NO	YES	YES
Postcode-FE	NO	NO	YES	YES	NO	NO
Observations			516,504			
Number of firms			86,084			

Notes. The table reports results of linear probability models. The dependent variable takes the value one if a firm has bank credit on its balance sheet in a specific year. The variable '*LTV* 2007 $[0,75)$' is our baseline category with all households with a loan-to-value ratio between 0 and 75 % in 2007. The other categories are defined equivalently. The variable 'HH income' is a categorical variable for different levels of household income. The omitted category are household incomes between 0 and 25,000 Euros. Our control variables are marital status, partner status, gender, an indicator variable whether children are living in the household and year dummies. Robust standard errors are clustered on the firm level.*** p<0.001, ** p<0.01, * p<0.05

Table 7: Costs of credit – home owners

	(1)	(2)	(3)	(4)	(5)	(6)
LTV 2007 $[0, 75)$			*Baseline*			
LTV 2007 $[75, 100)$	0.0149***	0.0146***	0.0136***	0.0129***		
	(0.001)	(0.001)	(0.001)	(0.001)		
LTV 2007 $[100, 140)$	0.0203***	0.0199***	0.0191***	0.0183***		
	(0.001)	(0.001)	(0.002)	(0.002)		
$\mathbb{1}(year > 2009)$	0.0051***	0.0119***	0.0051***	0.0122***	0.0051***	0.0116***
	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)
LTV 2007 $[75, 100) \times \mathbb{1}(year > 2009)$	0.0043***	0.0044***	0.0043***	0.0043***	0.0043***	0.0040***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
LTV 2007 $[100, 140) \times \mathbb{1}(year > 2009)$	0.0076***	0.0077***	0.0076***	0.0077***	0.0076***	0.0071***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
HH income $25,000 - 50,000$		0.0004		0.0000		0.0012
		(0.001)		(0.001)		(0.001)
HH income $50,000 - 75,000$		-0.0022*		-0.0025*		0.0023**
		(0.001)		(0.001)		(0.001)
HH income $75,000 - 100,000$		-0.0042***		-0.0044***		0.0042***
		(0.001)		(0.001)		(0.001)
HH income $> 100,000$		-0.0117***		-0.0123***		0.0051***
		(0.001)		(0.001)		(0.001)
R-squared	0.03	0.03	0.12	0.12	0.01	0.01
Controls	NO	YES	NO	YES	NO	YES
Firm-FE	NO	NO	NO	NO	YES	YES
Postcode-FE	NO	NO	YES	YES	NO	NO
Observations			$84,858$			
Number of firms			$14,143$			

Notes. The table reports results of linear regression models. The dependent variable is the total amount of costs of bank credit divided by the total amount of outstanding bank credit. The variable '*LTV* 2007 $[0, 75)$' is our baseline category with all households with a loan-to-value ratio between 0 and 75 % in 2007. The other categories are defined equivalently. The variable 'HH income' is a categorical variable for different levels of household income. The omitted category are household incomes between 0 and 25,000 Euros. Our control variables are marital status, partner status, gender, an indicator variable whether children are living in the household and year dummies. We exclude all entrepreneurs who did not obtain bank credit in our sample period. Robust standard errors are clustered on the firm level.*** p<0.001, ** p<0.01, * p<0.05

Table 8: Propensity to have bank credit – renters and home owners

	(1)	(2)	(3)	(4)	(5)	(6)
Renters			*Baseline*			
$\mathbb{1}(Homeowner)$	0.0794***	0.0787***	0.0278***	0.0359***		
	(0.010)	(0.008)	(0.004)	(0.004)		
$\mathbb{1}(year > 2009)$	-0.0416***	-0.0412***	-0.0416***	-0.0428***	-0.0416***	-0.0434***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
$\mathbb{1}(Homeowner) \times \mathbb{1}(year > 2009)$	0.0060*	0.0060*	0.0060*	0.0058*	0.0060**	0.0058**
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
HH income $25,000 - 50,000$		0.0357***		0.0302***		-0.0119***
		(0.003)		(0.003)		(0.002)
HH income $50,000 - 75,000$		-0.0095*		-0.0111**		-0.0232***
		(0.004)		(0.004)		(0.002)
HH income $75,000 - 100,000$		-0.0616***		-0.0546***		-0.0306***
		(0.004)		(0.004)		(0.002)
HH income $> 100,000$		-0.1090***		-0.0879***		-0.0383***
		(0.004)		(0.004)		(0.003)
R-squared	0.01	0.02	0.05	0.07	0.01	0.01
Controls	NO	YES	NO	YES	NO	YES
Firm-FE	NO	NO	NO	NO	YES	YES
Postcode-FE	NO	NO	YES	YES	NO	NO
Observations			629,670			
Number of firms			104,945			

Notes. The table reports results of linear probability models. The dependent variable takes the value one if a firm has bank credit on its balance sheet in a specific year. The variable 'Renter' is the baseline category which contains all renters in our sample. The variable 'HH income' is a categorical variable for different levels of household income. The omitted category are household incomes between 0 and 25,000 Euros. Our control variables are marital status, partner status, gender, an indicator variable whether children are living in the household and year dummies. *** p<0.001, ** p<0.01, * p<0.05

Table 9: Costs of credit – renters and home owners

	(1)	(2)	(3)	(4)	(5)	(6)
Renters			*Baseline*			
$\mathbb{1}(Homeowner)$	-0.0247***	-0.0238***	-0.0228***	-0.0217***		
	(0.001)	(0.001)	(0.001)	(0.001)		
$\mathbb{1}(year > 2009)$	0.0104***	0.0192***	0.0104***	0.0194***	0.0104***	0.0176***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
$\mathbb{1}(Homeowner) \times \mathbb{1}(year > 2009)$	-0.0039**	-0.0039**	-0.0039**	-0.0039**	-0.0039**	-0.0040**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
HH income $25,000 - 50,000$		0.0009		0.0007		0.0013*
		(0.001)		(0.001)		(0.001)
HH income $50,000 - 75,000$		-0.0010		-0.0013		0.0029***
		(0.001)		(0.001)		(0.001)
HH income $75,000 - 100,000$		-0.0030**		-0.0031**		0.0051***
		(0.001)		(0.001)		(0.001)
HH income $> 100,000$		-0.0098***		-0.0106***		0.0059***
		(0.001)		(0.001)		(0.001)
R-squared	0.02	0.03	0.11	0.11	0.01	0.01
Controls	NO	YES	NO	YES	NO	YES
Firm-FE	NO	NO	NO	NO	YES	YES
Postcode-FE	NO	NO	YES	YES	NO	NO
Observations			95,016			
Number of firms			15,836			

Notes. The table reports results of linear regression models. The dependent variable is the total amount of costs of bank credit divided by the total amount of outstanding bank credit. The variable 'Renter' is the baseline category which contains all renters in our sample. The variable 'HH income' is a categorical variable for different levels of household income. The omitted category are household incomes between 0 and 25,000 Euros. Our control variables are marital status, partner status, gender, an indicator variable whether children are living in the household and year dummies. We exclude all entrepreneurs who did not obtain bank credit in our sample period. Robust standard errors are clustered on the firm level.*** p<0.001, ** p<0.01, * p<0.05

Table 10: Propensity to have bank credit by industry – home owners

	(1) Agriculture	(2) Industry	(3) Construction	(4) Wholesale & retail business	(5) Transport & storage	(6) Hotel & catering	(7) Information & communication	(8) Financial institutions
$\mathbb{1}(year > 2009)$	-0.063*	-0.052**	-0.025**	-0.086***	-0.092***	-0.050*	-0.059	-0.129*
	(0.027)	(0.017)	(0.009)	(0.009)	(0.021)	(0.022)	(0.033)	(0.056)
LTV 2007 $[75, 100) \times \mathbb{1}(year > 2009)$	-0.013	0.043	-0.009	-0.005	-0.004	-0.003	-0.030	0.047
	(0.062)	(0.027)	(0.013)	(0.015)	(0.028)	(0.036)	(0.040)	(0.065)
LTV 2007 $[100, 140) \times \mathbb{1}(year > 2009)$	-0.176*	-0.019	0.011	-0.001	0.029	0.041	0.007	0.080
	(0.077)	(0.035)	(0.015)	(0.022)	(0.042)	(0.044)	(0.046)	(0.087)
Observations	3,588	10,380	47,856	29,298	6,462	4,806	3,942	1,032
Number of firms	598	1,730	7,976	4,883	1,077	801	657	172

	(9) Real estate	(10) Consultancy research & service	(11) Rental of movable goods & business services	(12) Education	(13) Health care	(14) Culture & sport	(15) Other services
$\mathbb{1}(year > 2009)$	-0.077	-0.086***	-0.026	-0.078**	-0.126***	-0.083**	-0.083***
	(0.060)	(0.013)	(0.022)	(0.026)	(0.019)	(0.027)	(0.014)
LTV 2007 $[75, 100) \times \mathbb{1}(year > 2009)$	-0.038	-0.006	0.021	-0.047	-0.010	0.028	-0.015
	(0.096)	(0.018)	(0.032)	(0.035)	(0.027)	(0.040)	(0.021)
LTV 2007 $[100, 140) \times \mathbb{1}(year > 2009)$	0.018	0.051*	0.048	0.005	-0.020	0.021	0.001
	(0.089)	(0.025)	(0.042)	(0.047)	(0.036)	(0.048)	(0.028)
Observations	804	21,216	7,008	5,616	8,190	4,758	14,142
Number of firms	134	3,536	1,168	936	1,365	793	2,357
Controls	YES	YES	YES	YES	YES	YES	YES
Firm-FE	YES	YES	YES	YES	YES	YES	YES

Notes. The table reports regression results of the propensity to receive credit by industry. All regression contain the full set of controls in table 6. Robust standard errors are clustered on the firm level.*** p<0.001, ** p<0.01, * p<0.05

Table 11: Costs of bank credit by industry – home owners

	(1) Agriculture	(2) Industry	(3) Construction & retail business	(4) Wholesale & storage	(5) Transport & catering	(6) Hotel & communication	(7) Information
$\mathbb{1}(year > 2009)$	0.006	0.008***	0.016***	0.015***	0.009*	0.007*	0.009
	(0.004)	(0.002)	(0.001)	(0.001)	(0.004)	(0.003)	(0.005)
LTV 2007 $[75, 100) \times \mathbb{1}(year > 2009)$	0.001	0.003	0.004	0.003	-0.001	0.012*	0.010
	(0.007)	(0.004)	(0.002)	(0.003)	(0.006)	(0.005)	(0.009)
LTV 2007 $[100, 140) \times \mathbb{1}(year > 2009)$	0.002	0.008	0.004	0.001	-0.000	0.015	-0.006
	(0.007)	(0.006)	(0.003)	(0.004)	(0.009)	(0.008)	(0.007)
Observations	1,926	5,484	21,228	17,352	3,498	3,066	1,272
Number of firms	321	914	3,538	2,892	583	511	212

	(8) Financial institutions	(9) Consultancy research & service	(10) Rental of movable goods & business services	(11) Education	(12) Health care	(13) Culture & sport	(14) Other services
$\mathbb{1}(year > 2009)$	0.013	0.007***	0.014***	0.012**	0.010***	0.007	0.009***
	(0.007)	(0.002)	(0.004)	(0.004)	(0.002)	(0.004)	(0.002)
LTV 2007 $[75, 100) \times \mathbb{1}(year > 2009)$	-0.008	0.004	0.010	0.008	0.003	0.012	0.005
	(0.008)	(0.003)	(0.007)	(0.005)	(0.003)	(0.007)	(0.003)
LTV 2007 $[100, 140) \times \mathbb{1}(year > 2009)$	0.015	0.014**	0.028**	0.015	0.004	0.005	0.007
	(0.020)	(0.005)	(0.009)	(0.008)	(0.006)	(0.009)	(0.005)
Observations	558	7,968	3,090	2,250	4,464	1,776	7,752
Number of firms	93	1,328	515	375	744	296	1,292
Controls	YES	YES	YES	YES	YES	YES	YES
Firm-FE	YES	YES	YES	YES	YES	YES	YES

Notes. The table reports regression results of the costs of bank credit by industry. All regression contain the full set of controls in table 7. Robust standard errors are clustered on the firm level.*** p<0.001, ** p<0.01, * p<0.05

Table 12: Propensity to have bank credit by industry – renters and owners

	(1) Agriculture	(2) Industry	(3) Construction	(4) Wholesale & retail business	(5) Transport & storage	(6) Hotel & catering	(7) Information & communication	(8) Financial institutions
$\mathbb{1}(year > 2009)$	-0.117*	-0.130***	-0.043**	-0.164***	-0.120***	-0.086*	-0.174***	-0.232
	(0.057)	(0.029)	(0.015)	(0.017)	(0.027)	(0.034)	(0.044)	(0.155)
$\mathbb{1}(Homeowner) \times \mathbb{1}(year > 2009)$	0.040	0.078**	0.016	0.074***	0.032	0.041	0.095*	0.114
	(0.056)	(0.028)	(0.014)	(0.017)	(0.025)	(0.032)	(0.041)	(0.153)
Observations	4,020	11,796	54,834	33,828	8,586	6,108	4,716	1,104
Number of firms	670	1,966	9,139	5,638	1,431	1,018	786	184

	(9) Real estate	(10) Consultancy research & service	(11) Rental of movable goods & business services	(12) Education	(13) Health care	(14) Culture & sport	(15) Other services
$\mathbb{1}(year > 2009)$	0.187	-0.136***	-0.092**	-0.140***	-0.098*	-0.150***	-0.137***
	(0.159)	(0.023)	(0.030)	(0.035)	(0.048)	(0.037)	(0.027)
$\mathbb{1}(Homeowner) \times \mathbb{1}(year > 2009)$	-0.261	0.052*	0.071*	0.048	-0.030	0.059	0.048
	(0.154)	(0.023)	(0.029)	(0.034)	(0.047)	(0.035)	(0.026)
Observations	882	24,096	8,598	6,864	8,784	6,072	16,164
Number of firms	147	4,016	1,433	1,144	1,464	1,012	2,694
Controls	YES	YES	YES	YES	YES	YES	YES
Firm-FE	YES	YES	YES	YES	YES	YES	YES

Notes. The table reports regression results of the propensity to receive credit by industry. All regression contain the full set of controls in table 8. Robust standard errors are clustered on the firm level.*** p<0.001, ** p<0.01, * p<0.05

Table 13: Costs of bank credit by industry – renters and owners

	(1) Agriculture	(2) Industry	(3) Construction	(4) Wholesale & retail business	(5) Transport & storage	(6) Hotel & catering	(7) Information & communication	(8) Financial institutions
$\mathbb{1}(year > 2009)$	0.005	0.014**	0.023***	0.017***	0.006	0.014*	0.014	-0.050
	(0.007)	(0.005)	(0.003)	(0.003)	(0.005)	(0.006)	(0.008)	(0.041)
$\mathbb{1}(Homeowner) \times \mathbb{1}(year > 2009)$	-0.001	-0.004	-0.006*	-0.001	0.005	-0.002	-0.002	0.063
	(0.007)	(0.005)	(0.003)	(0.003)	(0.005)	(0.006)	(0.008)	(0.043)
Observations	2,136	6,084	23,478	19,308	4,374	3,636	1,488	582
Number of firms	356	1,014	3,913	3,218	729	606	248	97

	(9) Real estate	(10) Consultancy research & service	(11) Rental of movable goods & business services	(12) Education	(13) Health care	(14) Culture & sport	(15) Other services
$\mathbb{1}(year > 2009)$	0.048	0.019***	0.027***	0.028***	0.011	0.007	0.017***
	(0.036)	(0.005)	(0.006)	(0.007)	(0.009)	(0.008)	(0.004)
$\mathbb{1}(Homeowner) \times \mathbb{1}(year > 2009)$	-0.036	-0.009*	-0.009	-0.013*	0.000	0.004	-0.007
	(0.036)	(0.005)	(0.006)	(0.006)	(0.009)	(0.008)	(0.004)
Observations	438	8,766	3,720	2,664	4,668	2,070	8,544
Number of firms	73	1,461	620	444	778	345	1,424
Controls	YES	YES	YES	YES	YES	YES	YES
Firm-FE	YES	YES	YES	YES	YES	YES	YES

Notes. The table reports regression results of the costs of bank credit by industry. All regression contain the full set of controls in table 9. Robust standard errors are clustered on the firm level.*** p<0.001, ** p<0.01, * p<0.05

Table 14: Propensity to have bank credit by age – home owners

	(1) 20 - 25	(2) 25 - 30	(3) 30 - 35	(4) 35 - 40	(5) 40 - 45	(6) 45 - 50	(7) 50 - 55	(8) 55 - 60
$\mathbb{1}(year > 2009)$	0.075	0.030	0.003	-0.012	-0.046***	-0.071***	-0.134***	-0.183***
	(0.052)	(0.029)	(0.014)	(0.009)	(0.008)	(0.008)	(0.009)	(0.011)
LTV 2007 $[75, 100) \times \mathbb{1}(year > 2009)$	-0.086	0.012	-0.038**	-0.031**	-0.010	-0.025	-0.003	0.008
	(0.079)	(0.033)	(0.017)	(0.013)	(0.014)	(0.016)	(0.020)	(0.028)
LTV 2007 $[100, 140) \times \mathbb{1}(year > 2009)$	-0.043	0.052	-0.016	-0.017	0.001	-0.015	-0.046	-0.018
	(0.061)	(0.033)	(0.021)	(0.017)	(0.018)	(0.024)	(0.033)	(0.045)
Observations	1,590	7,956	19,266	34,980	37,806	31,380	25,158	17,310
Number of firms	265	1,326	3,211	5,830	6,301	5,230	4,193	2,885
Controls	YES	YES	YES	YES	YES	YES	YES	YES
Firm-FE	YES	YES	YES	YES	YES	YES	YES	YES

Notes. The table reports regression results of the propensity to receive bank credit by age of the owner. All regression contain the full set of controls in table 6. Robust standard errors are clustered on the firm level.*** p<0.001, ** p<0.01, * p<0.05

Table 15: Costs of bank credit by age – home owners

	(1) 20 - 25	(2) 25 - 30	(3) 30 - 35	(4) 35 - 40	(5) 40 - 45	(6) 45 - 50	(7) 50 - 55	(8) 55 - 60
$\mathbb{1}(year > 2009)$	0.044**	0.027***	0.015***	0.012***	0.011***	0.010***	0.010***	0.011***
	(0.015)	(0.006)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
LTV 2007 $[75, 100) \times \mathbb{1}(year > 2009)$	-0.014	0.008	0.007*	0.001	0.003	-0.000	0.007	0.005
	(0.015)	(0.007)	(0.003)	(0.002)	(0.002)	(0.003)	(0.004)	(0.004)
LTV 2007 $[100, 140) \times \mathbb{1}(year > 2009)$	-0.005	0.010	0.003	0.005	0.006*	0.013*	0.005	0.017
	(0.015)	(0.007)	(0.004)	(0.003)	(0.003)	(0.005)	(0.006)	(0.010)
Observations	492	2,544	8,160	16,356	18,900	16,278	12,936	9,186
Number of firms	82	424	1,360	2,726	3,150	2,713	2,156	1,531
Controls	YES	YES	YES	YES	YES	YES	YES	YES
Firm-FE	YES	YES	YES	YES	YES	YES	YES	YES

Notes. The table reports regression results of the costs of bank credit by age of the owner. All regression contain the full set of controls in table 7. Robust standard errors are clustered on the firm level.*** p<0.001, ** p<0.01, * p<0.05

Table 16: Propensity to have bank credit by age – renters and owners

	(1) 20 - 25	(2) 25 - 30	(3) 30 - 35	(4) 35 - 40	(5) 40 - 45	(6) 45 - 50	(7) 50 - 55	(8) 55 - 60
$\mathbb{1}(year > 2009)$	0.136	0.021	-0.052*	-0.069***	-0.087***	-0.125***	-0.158***	-0.248***
	(0.080)	(0.038)	(0.024)	(0.017)	(0.015)	(0.016)	(0.017)	(0.019)
$\mathbb{1}(Homeowner) \times \mathbb{1}(year > 2009)$	-0.076	0.025	0.040	0.045**	0.037*	0.050**	0.020	0.062**
	(0.078)	(0.038)	(0.024)	(0.017)	(0.015)	(0.016)	(0.017)	(0.019)
Observations	1,914	9,162	21,744	39,774	43,470	36,852	29,982	20,904
Number of id	319	1,527	3,624	6,629	7,245	6,142	4,997	3,484
Controls	YES	YES	YES	YES	YES	YES	YES	YES
Firm-FE	YES	YES	YES	YES	YES	YES	YES	YES

Notes. The table reports regression results of the propensity of bank credit by age of the owner. All regression contain the full set of controls in table 8. Robust standard errors are clustered on the firm level.*** p<0.001, ** p<0.01, * p<0.05

Table 17: Costs of bank credit by age – renters and owners

	(1) 20 - 25	(2) 25 - 30	(3) 30 - 35	(4) 35 - 40	(5) 40 - 45	(6) 45 - 50	(7) 50 - 55	(8) 55 - 60
$\mathbb{1}(year > 2009)$	0.048***	0.028**	0.019***	0.016***	0.010***	0.019***	0.020***	0.020***
	(0.013)	(0.009)	(0.005)	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)
$\mathbb{1}(Homeowner) \times \mathbb{1}(year > 2009)$	-0.010	0.004	-0.001	-0.002	0.002	-0.008**	-0.008**	-0.008*
	(0.013)	(0.008)	(0.004)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Observations	558	2,844	8,928	17,892	21,180	18,318	14,766	10,524
Number of firms	93	474	1,488	2,982	3,530	3,053	2,461	1,754
Controls	YES	YES	YES	YES	YES	YES	YES	YES
Firm-FE	YES	YES	YES	YES	YES	YES	YES	YES

Notes. The table reports regression results of the costs of bank credit by age of the owner. All regression contain the full set of controls in table 9. Robust standard errors are clustered on the firm level.*** p<0.001, ** p<0.01, * p<0.05

Appendix D Figures

Figure 1: House price development and status on the housing market

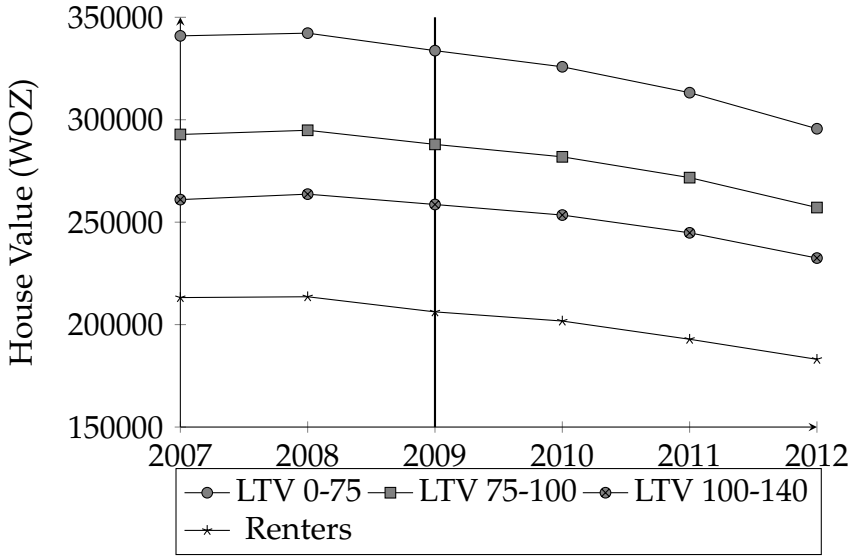


Figure 2: Propensity to have bank credit and status on the housing market

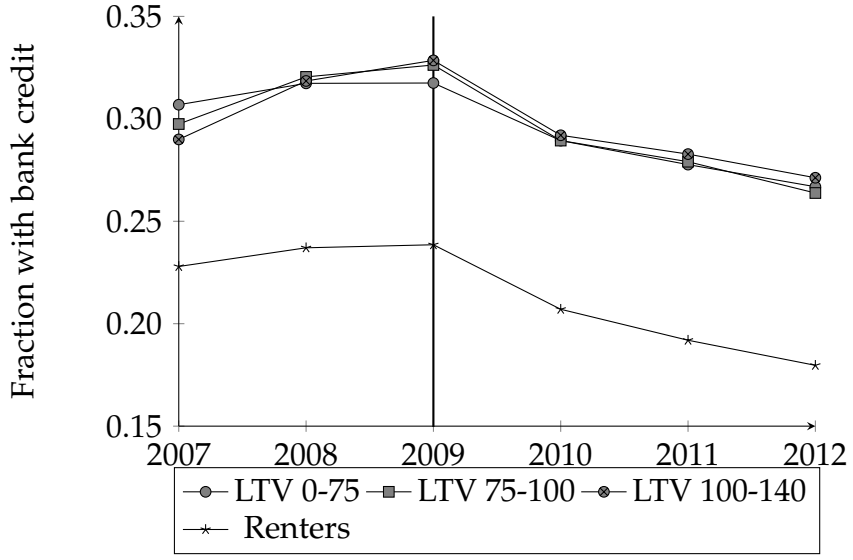
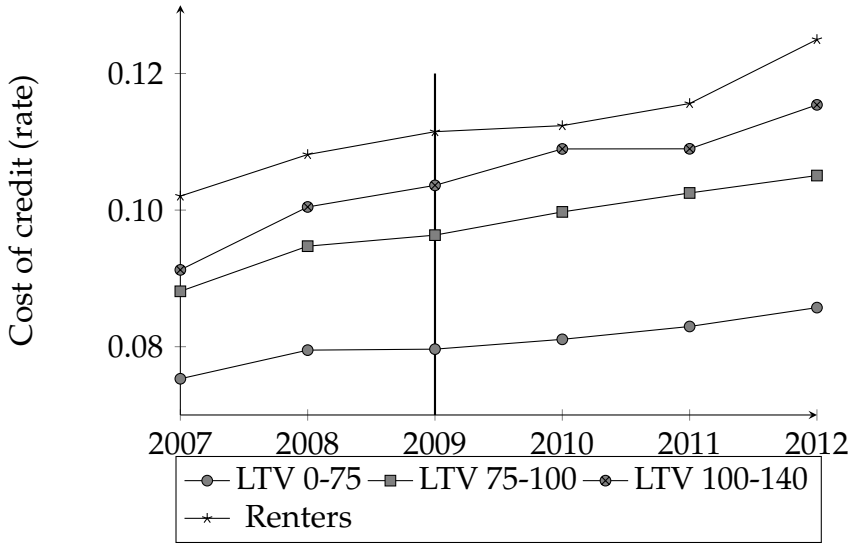


Figure 3: Cost of credit (zero excluded) and status on the housing market



Publisher:

CPB Netherlands Bureau for Economic Policy Analysis
P.O. Box 80510 | 2508 GM The Hague
T (088) 984 60 00

May 2017 | ISBN 978-90-5833-773-3