Consumption Responses to Financial Liberalization: Evidence from Survey Data[1]

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Abstract

The Permanent Income Theory predicts that the consumption and borrowing decisions of credit-constrained households react mostly to the size and timing of payments (mortgage maturity) and less to interest rates. This paper studies the welfare consequences of mortgage expansions among indebted homeowners, the most likely credit-constrained households in Spain. The literature generally focuses on unconstrained household and documents small impacts of credit conditions, mainly of interest rates. The Spanish Survey of Household Finances (EFF) enables the use of the rapid expansion of mortgage markets during 1998-2007 in Spain to estimate household borrowing responses to changes in the timing of payments. Our identification strategy to draw exogenous variation in the loan maturity relies on the reluctance of banks to offer mortgages to individuals whose age at the loan expiration exceeds 65.

Our causal estimates suggest a great heterogeneity of the borrowing responses to increases in mortgage maturity among households who probably experience an increasing stream of income late in life. First, the distribution of the loan-to-value ratios demanded is shifted towards ratios over 80% and 90% at time of purchase among family heads aged under 45. Second, the response of loan payments relative to income is rather heterogeneous according to age at purchase: as a whole, a reduction of 10% in the number of households devoting more than 30% of their income to repay loans. However, 5% of the youngest households aged under 35 at the time of house purchase enter a state of financial distress, using more than 40% of their earnings.

Longer maturities allow households to smooth consumption and increase welfare. Nevertheless, the growing vulnerability of individuals whose future income expectations are materialized in the worst scenarios is a drawback.

JEL Codes: D12, D14, E21

Keywords: Credit constraints, mortgages, household consumption.

1 Introduction

Do the initial mortgage conditions at the time of home purchase have a lasting impact on the liabilities of homeowners and, hence, on consumption? The answer to this question is crucial to understand the consequences of likely future changes in the access to mortgage loans and to assess to what extent credit constraints affect borrowing and consumption. Our study examines a comprehensive data set of household finances and the episode of the development of mortgage markets during the last decades in Spain after the introduction of euro in 1999 to estimate the medium-term consequences of relaxing mortgage conditions on household borrowing and indirectly on consumption. Using a simple model of consumption, we argue that the responses of household borrowing and consumption to initial loan maturity and to interest rates are informative about the prevalence of credit constraints in the economy.

An extensive body of literature exists on the contemporaneous impact of particular aspects of credit market developments on household consumption. Leth Petersen (2010) analyzed heterogeneity in consumption responses to the possibility of borrowing against home equity. In particular, he studied a reform of the market of credit in Denmark that enabled house owners to use housing equity as a collateral in consumption loans, finding that younger households react much more to access to credit than other (presumably, not liquidity constrained) households.

Another line of research focuses on the marginal propensity of consumption out of housing wealth. Mian et al (2013) use administrative information about house prices and expenditure to explain how a drop in housing values during the recent economic crises affected consumption using zip-code variation. Campbell and Cocco (2007) estimate that a rise in house prices increases the consumption of older homeowners. Those papers emphasize the role of the possibility to borrow on the value of the house -see Mian and Sufi, 2011. However, the possibility of taking home equity loans is much less obvious in economies other than the US and the UK, where the marginal propensity to consume out of wealth is also important -see Guiso et al (2005), Carroll et al (2011), Christelis et al (2015), Disney et al (2010) or Bover (2006), suggesting that there may be other drivers of the link between wealth and consumption.[1]

Closer in spirit to our paper is Besley et al (2008), who estimate the response of aggregate and cohort-specific consumption to changes in interest rates charged to new

[1]Disney et al. (2010) stress the importance of unobserved expectations about future income. Using the fact that only unanticipated changes in house value have an impact on consumption, they estimate that the reaction of young households does not differ significantly from older households. Using the same dataset as ours, Bover (2006) finds that the marginal propensity to consume out of changes in the house value is heterogeneous across households, in particular being greater for prime age households; what is consistent with a precautionary saving motive.

mortgages. We emphasize instead heterogeneity in the response of borrowing to the availability of longer maturities. Another highly related article is the study of Jappelli and Pistaferri (2011) about the consumption response to financial liberalization. These authors document an extremely low sensitivity of consumption to financial liberalization after 1999, although this credit expansion helps individuals to bring future income resources to finance consumption. We think that this mild consumption response is due to the fact that they focus on a full sample of consumers instead of restricting the analysis to the subsample of credit-constrained individuals, as we do in our paper, since it is only the latter group of households whose consumption reacts to changes in credit conditions. We make use of the studies of Jappelli (1990), Meghir and Weber (1996) and Attanasio et al (2008) to characterize who are credit constrained and to know their borrowing and consumption behaviour after exogenous changes in credit conditions.

Another body of empirical literature closely related to our paper is the study of the response of borrowing and housing decisions to changes in macroprudential policies, such as a variation in the legal loan-to-value ratio that banks may finance on the house acquisition value, see De Araujo et al (2016), Tzur-Ilan (2018), and Van Bekkum et al (2019), among others. Our contribution to this line of research is that we focus on a different credit condition, namely the length of the loan maturity; moreover, we attempt to estimate its causal impact on household borrowing decisions in a sample of credit-constrained households, who mostly respond to changes in loan maturities.

In particular, our study uses the theoretical insights from Attanasio et al. (2008) to argue that, in the presence of liquidity constraints, different dimensions of the development of credit markets can have a lasting impact on the consumption and borrowing of different groups of homeowners over the life of a mortgage. In this way, we illustrate that the consumption of households with unrestricted access to credit is determined by the discounted stream of payments and reacts mostly to changes in the interest rate to borrow. Their liabilities and loan payments do not respond to increases in maturities. Conversely, the borrowing and consumption path of credit-constrained households react mostly to the size and timing of the debt payments during the first years of the life of a mortgage (determined by loan maturity) and less to interest rates. Hence, examining only a particular dimension of credit market development, such as drops in interest rates, on borrowing and contemporaneous expenditure may lead to an underestimation of the consumption response to changes in the access to credit.

This paper examines the heterogeneity of the borrowing response to mortgage conditions by households that differ in their possibilities to access to longer maturities. In this sense, Spain is an interesting case to analyze for two reasons. First, in the period between 1996 and 2008, the access to mortgage credit became much easier. Average maturity in-

creased from 18 to 25 years, the average interest rate spread fell by 110 pp, which reduced the amount of the down payment of the households. Parallel to such changes in credit markets, there was a drop in the aggregate household saving rate that fell from 16% in 1995 to 11% in 2005. In Spain 80% of the households are homeowners, and among them almost 80% took out a loan to finance the purchase of the owner-occupied house. This is the group of households who are the most likely to be credit constrained. Therefore, changes in their credit conditions can have a lasting impact on household borrowing and consumption.

The second reason is the possibility of using joint information on borrowing, housing consumption and credit conditions in the 2002-2014 waves of the *Spanish Survey of Household Finances* (EFF by its Spanish initials). This survey contains information on actual consumption, income, assets, liabilities and a rich set of retrospective information on mortgage conditions and housing. Consequently, the EFF provides a unique setup to understand the impact of changes in loan maturity on household borrowing and consumption. A drawback of the survey is that we cannot observe consumption just at the moment of the house purchase, but we only know this information on housing.

In contrast, there are several challenges that our paper attempts to address. Our main contribution to the existing literature is to study the causal response of borrowing decisions of credit-constrained households to changes in the timing of loan payments, an aspect of credit conditions not usually considered in the literature. As observed maturity and interest rates are the result of a match between the demand for mortgages of families and the supply of loans from banks, this paper also endeavours to disentangle the causal impact of exogenous variation in maturities on household liabilities. Both maturity and interest rate variables are likely to be correlated with unobserved characteristics of the household.

Therefore, in order to avoid this problem of endogeneity and to obtain causal estimates, we exploit two facts: first, increases in loan maturity do not affect all potential purchasers equally because banks are reluctant to offer mortgages expiring after the loan applicant's age of 65. Secondly, banks typically offer mortgage maturities ending in round numbers -0 or 5. As we document below, both rules generate substantial discontinuities in granted maturities. For example, a person applying for a mortgage at the age of 40 is likely to get a maturity of 25 years, as the age at loan expiration is just the retirement age of 65. However, a borrower applying for a mortgage at the age 41 will be much less likely to be granted a 25-year maturity (the age at maturity would be 66), but would get a 20-year maturity instead. Thus, differences of one year in the age when applying for a mortgage may result in differences of about 5 years in the maturity granted.

Our results suggest a great heterogeneity in the household borrowing responses to

mortgage maturity. After the financial liberalization in 1999, young households aged under 45 at the time of purchase increased their loan maturities in two years on average. The availability of longer maturities after 1999 seems not to increase on average the loan liabilities and payments (measured by the loan-to-value ratio at purchase (LTV) and the ratio of loan payments to income) of young households who can benefit from longer maturities, i.e. of those who have more than 20 years to repay the mortgage before entering retirement. However, our evidence indicates that 12% of young households increase their loan liabilities by taking LTV exceeding 80% and even 90% after 1999.

The impact on loan payments is more heterogeneous due to two reasons. On the one hand, we observe that the 9% of households aged under 45 at time of purchase reduce the earnings devoted to repay loans in a fraction lower than 30%, consistent with the idea of consumption smoothing. On the other hand, an undesirable consequence of longer maturities arises, as the 5% of the youngest households aged under 35 at the moment of purchase increase dramatically the fraction of income to repay loans in excess of 40%, entering a situation of financial distress.

The paper is organized as follows. Section 2 provides a description of the evolution of the market of mortgages in Spain in the last two decades and summarizes a theoretical model that motivates our estimation strategy. Section 3 presents the data and the empirical strategy. Section 4 discusses the results, and Section 5 gives the main conclusions.

2 The evolution of credit market conditions in Spain

Access to credit and, specially, access to mortgage debt became easier in many European countries between 1995 and 2007. Using data from the 2002-2014 waves of the Spanish Survey of Household Finances (*Encuesta Financiera de las Familias*, EFF, in Spanish), Table 1 shows the evolution of mortgage conditions at purchase in Spain -as recollected by the reference person in the household. The percentage of fixed-rate mortgages decreased between 1992 and 2015 by almost a half. The median loan to value ratio increased from 80% - for mortgages signed between 1992 and 1998- to 92% – mortgages signed after 2005. Loan maturity increased on average from 18 to 29 years and the interest rate conditional on adjustable mortgages fell from 4.43% to 2.91%. Together with those changes, the saving ratio fell to historical lows.

To give a sense of the magnitudes involved, assume a 90,000 euro loan signed in 1995 at 4% interest rate, to be repaid in 15 years. Considering constant installments, the yearly installment would be 7,989 euro. The same loan at a loan maturity of 25 years would involve paying 5,701 euro per year. Using the median level of gross household income of 31,000 euro and an income tax of 25%, the reduction in the yearly installment would be

about (7,989-5,701)/(.75*31,000)=10% of yearly net earnings.

2.1 A model

We use a simple model of durable purchases to illustrate how variation in access to credit among households results in different responses of consumption to changes in the cost of borrowing (interest rates) and in the installment size (mortgage maturities). We build on Attanasio et al. (2008).[2]

Preferences. Agents live for three periods: the initial period when purchases take place and two additional periods when the loan can be repaid. Agents derive utility from the flow of non-durable consumption in each of the three periods (c_1, c_2, c_3) and from the stock of housing purchased, h. The utility function is time separable and isoelastic with $\rho < 1$. The stock of housing cannot be resold or augmented and does not depreciate over time.

Endowments: Individuals receive an exogenous stream of earnings (y_1, y_2, y_3). There is a set of agents who receive most of their lifetime earnings in the third period of life -i.e. for whom income growth is high relative to their intertemporal discount rate, β.[3]

Timing of purchases: The agents choose the amount of housing consumed in the first period, as well as non-durable consumption in the rest of the periods. The price of housing is assumed to be 1.

Credit markets: There is a single asset and a single liability. The interest rate on the asset r_a is smaller or equal than the cost of borrowing, r_b. We assume that, for a set of agents - credit-constrained households- interest rates on saving are strictly smaller than the cost of borrowing r_b. The only way to obtain credit in this economy for credit-constrained households is by getting a mortgage during the first period. In particular, agents choose to borrow the amount ϕh, where $0 \leq \phi \leq 1$. $\phi = 1$ implies that the agent does not make a down payment at the time of the purchase. Finally, loan maturities, M, are exogenously set by banks as either 1 (the full amount is repaid in the second period) or 2 (the amount borrowed is repaid in the second and third periods).

The problem of the household is the following:

[2]That model was originally intended to understand the loans in the market of cars. See Alessie et al. (1997) for a similar set up. We extend some of the insights in that work to the housing market.

[3]The exact condition is

$$\frac{\beta^{\frac{2}{\rho}}(1+r_b)^{\frac{2}{\rho}-2}}{1+\eta^{\frac{1}{\rho}}+\beta^{\frac{1}{\rho}}(1+r_b)^{\frac{1}{\rho}-1}} < \frac{\frac{y_3}{(1+r_b)^2}}{y_1+\frac{y_2}{1+r_b}+\frac{y_3}{(1+r_b)^2}}$$

where β is the intertemporal discount rate, r_b is the cost of borrowing, η the weight of housing in the utility function, ρ the risk-aversion parameter and y_1, y_2, y_3 the stream of earnings.

$$\max_{\{c_1,c_2,c_3,h,\phi,P\}} \frac{(c_1)^{1-\rho}}{1-\rho} + \beta\frac{(c_2)^{1-\rho}}{1-\rho} + \beta^2\frac{(c_3)^{1-\rho}}{1-\rho} + \eta\frac{h^{1-\rho}}{1-\rho}$$

s.t.

$$c_1 + h(1-\phi) \leq y_1 \tag{1}$$

$$c_2 + P - (1+r_a)[y_1 - c_1 - h(1-\phi)] \leq y_2 \tag{2}$$

$$c_3 + [\phi h(1+r_b) - P](1+r_b) - (1+r_a)[y_2 - c_2 - P + (1+r_b)(y_1 - c_1 - h(1-\phi)] \leq y_3 \tag{3}$$

$$0 \leq \phi \leq 1$$

$$0 \leq P \leq h(1+r_b)$$

The term, c_i, is the consumption of non-housing goods for each period i=1,2,3 and h is the value of the amount of housing purchased. The parameter, β, is the intertemporal discount rate and η is the weight of housing in the utility of the agent. The term y_i is the amount of disposable income for each period, P is the amount of the repayment on the mortgage. The parameter ϕ is the loan to value ratio, i.e. the proportion of the house value that is financed with a mortgage, and r_b and r_a are the interest rates on loans and lending, respectively.

The first constraint implies that the first period income must be at least as large as the sum of non-housing consumption and the amount of the down payment for the purchase of a house. The second constraint implies that income in the second period plus any savings from the first period $(1+r_a)[y_1 - c_1 - h(1-\phi)]$ must finance consumption in the second period and the corresponding part of the mortgage installment. Finally, the third period restriction states that the final period income plus any remaining savings must be at least as large as the sum of final period consumption c_3 and the final installment of the mortgage $[\phi h(1+r_b) - P](1+r_b)$.

A short (one period) mortgage maturity implies a contract in which $P = \phi h(1+r_b)$. A two-period maturity implies a contract where the agent can choose the amount P in the second period and the remaining debt in the third one. In what follows, we discuss the implications of changes in mortgage length and interest rates. The analytical results are presented in Appendix A.

The allocation of consumption and housing depends on the level of maturity set by the bank. We use the shorthand notation $c_1(m), c_2(m), h(m)$ and $\phi(m)$ when m=1,2 for the

optimal consumption and borrowing stream with maturity equals 1 and 2, respectively. Result 1 compares both allocations.

Result 1: Under the previous assumptions, a consumer who is allowed to repay the mortgage during the second and third periods chooses a level of c_1, c_2, *and* h *that is not lower than the optimal one if required to repay during one period.*

When consumers can only obtain one-period mortgages and the income in the third period is high enough with respect to lifetime incomes (see Footnote 3), consumption in the first period, $c_1(1)$, equals:[4]

$$c_1^c(1) = \frac{1}{1 + \eta^{\frac{1}{\rho}} + \beta^{\frac{1}{\rho}}(1+r_b)^{\frac{1}{\rho}-1}}[y_1 + \frac{y_2}{1+r_b}]$$

The kind of consumer is denoted by an upper index, "c" for a credit-constrained consumer and "u" for unconstrained ones. The corresponding expression for $c_1(2)$, i.e. the level of first-period consumption when maturity equals two periods is:

$$c_1^c(2) = \frac{1}{1 + \eta^{\frac{1}{\rho}} + \beta^{\frac{1}{\rho}}(1+r_b)^{\frac{1}{\rho}-1} + \beta^{\frac{2}{\rho}}(1+r_b)^{\frac{2}{\rho}-2}}[y_1 + \frac{y_2}{1+r_b} + \frac{y_3}{(1+r_b)^2}]$$

When maturity equals 2, the level of consumption in the first period is proportional to the value of the stream of income in periods 1, 2 and 3, discounted at the interest rate r_b. When maturity equals 1, and the consumer has preferences for consumption that result in zero wealth holdings at the end of the second period, first-period non-housing consumption is a function of the discounted stream of earnings during the first two periods only. Hence, if income in the third period, y_3, is large enough relative to income in the first two periods of life, y_1 and y_2, allowing the consumer to repay in two rather than in one period only results in a higher level of consumption: $c_1(2)$ is not lower than $c_1(1)$. An additional repayment period allows a credit constrained consumer to increase first-period consumption by borrowing against the whole future earnings stream rather than against the earnings during the first two periods. Clearly, the result hinges on two assumptions: income during the third period is relatively large and interest rates of borrowing exceed those of saving -which guarantees that some consumers end up with zero wealth in the second period of life.[5]

Result 2: Credit-constrained agents who are allowed to repay over two periods choose a higher level of ϕ *than the one if required to pay during 1 period:* $\phi^c(2) \geq \phi^c(1)$

[4]The result arises if consumers end up period 2 with no assets. Given the assumption of $r_a < r_b$, there will be a positive mass of those consumers.

[5]Similarly, one can show that an expansion in maturity allows credit-constrained consumers to expand the consumption of housing h, $h^c(2) > h^c(1)$, and of second-period non-housing expenditure, $c_2^c(2) > c_2^c(1)$.

Using the first-period budget constraint, one notices that, holding interest rates and the discounted earnings stream constant, the increase in the level of non-housing consumption during period 1 must be financed by a higher level of borrowing during the first period of life of the mortgage. When allowed to repay the mortgage in two periods the credit-constrained consumer increases both h and c_1, but the total outlay on housing expenses during the first period falls because $\phi^c(2) \geq \phi^c(1)$. Concerning the size of the installment (P), the model predicts an ambiguous effect, since the reduction of payments to smooth consumption depends on the relative increase in the loan-to-value ratio, $\phi^c(2) - \phi^c(1)$.

2.1.1 A benchmark: perfect access to credit markets

A natural benchmark to understand the impact of mortgage maturities on the allocation of consumption is to assume that agents can access credit markets perfectly, or $r_a = r_b$. Under the assumption of perfect access to credit markets at an interest rate that is the same for saving and borrowing, the main determinant of consumption is the sum of lifetime earnings discounted by the interest rate -for example, the unconstrained consumer could always borrow in period 2 against income in period 3. In that case, $\phi^u(2) = \phi^u(1)$ and $c_1^u = c_1^u(2) = c_1^u(1)$, i.e. loan liabilities and consumption of unconstrained consumers do not depend on the mortgage maturity. Non-durable consumption of unconstrained agents in first period (and subsequent periods) is equal to:

$$c_1^u = \frac{1}{1 + \eta^{\frac{1}{\rho}} + \beta^{\frac{1}{\rho}}(1 + r_b)^{\frac{1}{\rho}-1} + \beta^{\frac{2}{\rho}}(1 + r_b)^{\frac{2}{\rho}-2}}[y_1 + \frac{y_2}{1 + r_b} + \frac{y_3}{(1 + r_b)^2}]$$

Finally, after comparing c_1^u, $c_1^c(1)$ and $c_1^c(2)$ we obtain an additional testable result.

Result 3: A fall in the interest rate increases relatively more the first-period non-housing consumption of non-credit constrained consumers than that of credit-constrained consumers.

The result is proven in Appendix 1 and is driven by the larger wealth effect of an increase in interest rates when the whole lifetime earnings stream is discounted than when discounting applies only to the first two periods.

2.1.2 Testable implications

The discussion above highlights two testable implications. In the presence of credit constraints (i.e., $r_b > r_a$), the effects of changes in mortgage maturity and mortgage interest rates on consumption differ among consumers.

- For unconstrained households, increases in mortgage maturity have no impact on either the level of consumption of homeowners or the loan-to-value ratio.

$\frac{\partial c_1^u}{\partial r} < 0, \frac{\partial c_1^u}{\partial M} = 0, \frac{\partial \phi^u}{\partial M} = 0.$

- Within the set of credit constrained homeowners, those who have high income growth late in life react to increases in maturity by expanding the level of consumption. The consumption response of such subset of households to the interest rates is negative, but weaker in absolute value than that of unconstrained households: $|\frac{\partial c_1^c}{\partial r}| < |\frac{\partial c_1^u}{\partial r}|, \frac{\partial c_1^c}{\partial M} > 0, \frac{\partial \phi^c}{\partial M} > 0$.[6]

  In the empirical analysis we attempt to identify causally the variation in loan liabilities of credit-constrained households due to an exogenous increase in maturities. This change in the loan-to-value ratio measures indirectly the rise in the household welfare, as it is proportional to the increase of housing in our model $(\phi^c(2) - \phi^c(1) = y_1 \left[\frac{h^c(2)-h^c(1)}{h^c(1)h^c(2)}\right])$.

3 Data and empirical strategy

This section describes the data used for the analysis and the empirical strategy.

3.1 Data

We use data from the five waves of the triennial *Spanish Survey of Household Finances* (EFF, by its Spanish initials): 2002, 2005, 2008, 2011 and 2014. The EFF is a tri-yearly survey of 5,143 households (in 2002), 5,962 households (in 2005), 6192 households (in 2008), 6107 (in 2011) and 6120 (in 2014). We use information about the real assets held by the households and, in particular, the information about the mortgages that financed the purchase of only the main residence. The EFF collects information about up to 4 mortgages taken out for the purchase of the owner-occupied house. The EFF also collects information up to 3 loans taken out for the purchase of the three most important real estate properties other than the main residence. We only focus on mortgages for home ownership because the group of households indebted for buying other real estate properties are very different in multiple dimensions (income, wealth, credit constraints, etc.).

[6] Two notes are in order. We are not allowing for re-sale and we do not model the timing of the purchase decision. Nevertheless, credit conditions could potentially affect the timing of the purchase. We will address this issue in a future draft of this paper.

Second, we characterize credit-constrained consumers as those for whom r_b is greater than r_a (the rate at which one can save). However, one may think of alternative definitions, like a constraint that imposes a maximum ratio of the debt service to current household earnings. While we have not proved the result analytically, we strongly suspect that such alternative modelling device would deliver the same testable predictions. The reason is that an increase in mortgage maturity would result in a reduction of the amount that must be paid during the early years of a loan, possibly allowing those consumers who are close to the credit limit to expand consumption and to increase their leverage. Hence, the consumption of credit constrained households should still react more to changes in mortgage maturity than to changes in the interest rate.

Consumption measures: The EFF contains broad questions about food expenditures, non-durable consumption and about purchases (and holdings) of vehicles and housing equipment in the year of the survey interview.

Credit conditions at purchase: The EFF collects retrospective information about the year and purchase price of up to 4 real estate properties. For each mortgage, households are asked to report the initial value of the mortgage, its initial duration (or maturity), whether the interest rate is fixed or variable and its current level.

Permanent income: We proxy permanent income with an average of the income observations normalized to the household head's age of 50. Respondents report at least two measures of income: the sum of income components of all members during the year prior to the interview (2001 for the 2002 wave, 2004 for the 2005 wave and so on) as well as a measure of annual current income obtained by multiplying by 12 the current monthly income minus rainfall income of all household members, and by adding the extraordinary income received in the survey year. For panel households we have up to eight income observations (two per survey wave in which the household participates). Appendix B gives the details of how we standardize by age and household size.

Sample selection: We use a sample of homeowners who purchased their house of residence before the age of 65 and have at least one mortgage outstanding - we do not know the credit conditions if the loan is already repaid. To minimize possible sample selection biases arising from the fact that it is more likely to observe owners who purchased a house with long mortgages, we only consider observations on households that have purchased their home after 1992. The average maturity in the beginning of the nineties was about 15 years, so the restriction eliminates unusually long mortgages signed during periods when the typical maturity was short.[7]

The average final sample size is 2,821 households in the OLS specification.[8] Table 2 provides a description of the main variables considered in the paper, broken down by the time period before and after that the financial liberalization in Spain occurred in 1999. The average age at purchase is 34 years of age in all subperiods. The interest rate charged falls after the financial liberalization from an average of 4.66% to 3.44%, and maturities increases from 19 years to 26 years on average. In the period prior to the introduction of euro in 1999, the percentage of mortgages with maturities under 20 years was 78%

[7]We assume that the longest maturity mortgage has the largest impact on consumption.

[8]The EFF imputes the variables that households do not answer using multiple imputation techniques, so there are five datasets for each wave. All the estimates shown below are the average of the estimates in each of the five different samples, with standard errors corrected for the uncertainty across implicates. Namely, the standard errors are estimated as the average of the standard errors computed for each one of the five implicates plus a term that reflects the variability of estimates across implicates. As the imputed information varies across samples, some of the restrictions we apply to the data vary across samples. Thus, we document the minimum sample size in the five data sets imputed multiply. See http://www.bde.es/webbde/es/estadis/eff/userguide.pdf

and this percentage decreases to 32% after 1999. Moreover, the percentage of loans with maturities over 25 years increases by three times to 68% after 1999, and five times in case of maturities exceeding 30 years, which reaches the 44% of all outstanding mortgages in 1999-2015.

3.2 The empirical strategy

The kind of regression we would wish to estimate is as follows:

$$Y_i = \alpha_0 + \alpha_1 M_i + \alpha_2 M_i \cdot Post99 + \beta W_i + \varepsilon_i \tag{4}$$

We regress our outcome variable, Y_i, for household i on the loan maturity, M_i, the interaction of maturity with an indicator of time period after 1999 ($Post99$), and other covariates W_i; α and β denote the model parameters and ε_i the error term. Our parameter of interest is α_2, which captures the impact of the availability of longer maturities after the financial liberalization on our outcome variables. In this draft, we focus on the household borrowing behaviour, and our variables of interest are the loan-to-value ratio (LTV) at the moment of purchase (i.e. the initial capital of the loan relative to the acquisition value of the house), the loan-to-income ratio and the ratio of loan payments to current household income. To facilitate interpretation, we subtract 15 from maturity M_i (the original level in the late nineties). Hence, the linear term in maturity can be interpreted as the local effect of one year maturity extension from 15 to 16 years on borrowing.

The vector of other covariates, W_i, includes a set of controls aimed at capturing demographic expenditure and borrowing shifters as well as proxies of lifetime resources and credit conditions. The first is a set of variables aimed to pick up the life-cycle pattern of consumption. It contains the gender of the family head, the marital status, a second-degree polynomial of household size, and indicators of whether the children's age is between 0 and 5, between 6 and 13 and between 14 and 17. We also include another indicator of whether there is another adult member in the household different from both members of the couple.

Among the proxies of lifetime resources we include a second-degree polynomial of the logarithm of the total household income received in the previous period, indicators of the family head's attained education level, namely less than first stage of secondary education, second stage of secondary education and tertiary education (the latter is the omitted category), and a third-degree polynomial of the family head's current age.

Concerning the credit conditions at purchase, we include as covariates the year of purchase of the house (one dummy for each year of purchase, where the reference group is purchases in 1999), fixed effects of time calendar years and the kind of institution that grants the mortgage. Controlling for year of purchase, current age and current year

precludes us from estimating life-cycle effects associated to the age of the household head at purchase. Finally, the main problem that arises from estimating equation (4) is the endogeneity of mortgage maturity. We discuss this issue below.

3.3 Endogeneity

The endogeneity problem occurs due to the fact that mortgage maturity is likely to be correlated with unobservable factors that also affect borrowing and consumption decisions.[9] To obtain exogenous variation in mortgage maturity, we exploit the fact that banks are reluctant to award a maturity at origin such that the household head is still repaying the mortgage after the age 65 -the statutory retirement age mainly before 1998 (see the histogram of the expected age when the mortgage expires in Figure 1). After age 65 income is expected to fall (due to retirement) and, in addition, mortality (and the bank expected loss) increases. Secondly, and crucially for our purposes, banks tend to offer mortgage maturities that are often rounded to a 0-5 multiple (see the histogram of mortgages by maturity length in Figure 2).[10] Both rules generate arguably exogenous variation in mortgage maturity at origination.

Figure 3 illustrates the source of variation we exploit. There we show the average maturity at origin by the number of years that takes until the family head reaches the age of 65 at the time of buying the house. This average is obtained from a regression of all mortgage maturities originated in the survey between 1992 and 2015 on dummies for each age at purchase, a full set of year dummies of purchase and an indicator of time period after 1999. The blue points denote average maturities before the financial liberalization period and the red ones for the period after. Before 1998, all the average maturities are below 20 years, and banks only seem to grant maturities of 20 years to individuals aged under 40 at time of purchase, i.e. to individuals who take at least 25 years until the retirement age of 65. After the financial liberalization period, maturities longer than 20 were usually provided among individuals that could repay fully the loan before entering retirement, as the higher the number of years is until the age of 65 at the moment of purchase, the higher the average maturity is.

This fact is consistent with the simple rule described above: at age 40, a 25-year maturity involves age at termination of 65 years, just before retirement. However, granting

[9] Credit conditions are the result of a match between banks and customers. Households that are better at financial planning could spend more time looking for better deals and sustain a higher level of consumption and borrowing. On the other hand, banks screen customers using characteristics that we do not observe in the data, but they positively correlate with consumption and borrowing, such as the assets held by the household at the moment of the signing the mortgage.

[10] Using administrative data from the *Instituto Nacional de Estadistica* (INE) for year 2003, we plot the number of all the mortgages signed in Spain in that year, and their maturities. Figure 2 shows that there is a sizeable accumulation at durations like 10, 15, 20, 25 and 30 years.

a 25 year maturity to a household at the age of 41 implies that the repayment is finished at the age of 66. As Spanish banks do not offer mortgages with 24 years maturity, it is more likely that the consumer will be granted a 20-year maturity mortgage instead. Similar considerations occur at the age of 45 or 50, when the average maturity seems to be 15 years before 1998 and 20 years after 1999.

Thus, our instrument for mortgage maturity at origination is the number of years that takes until the family head is aged 65 at the moment of the house purchase. This instrument works mainly for purchases after 1999, when maturities longer than 20 were usually granted. As maturities usually take very few values with a great probability mass points in the multiples of 5 years (15, 20, 25, 30, etc.), we cannot treat maturity as a continuous variable. Instead, we analyze the impact of different thresholds in the maturity length on borrowing decisions, i.e. the effect of holding a maturity below 20 years on household loan liabilities and loan payments, and, similarly, the corresponding effects of holding maturities longer than 25 and 30. For this reason, our instrument is also based on three cut-offs or thresholds in the number of years until the age of 65 at the moment of purchase. We consider the cut-offs of 20 years or more until the retirement age of 65, in excess of 25 years and of 30.

In order to assess the validity of our instrument, first we illustrate how our instruments affect thresholds of maturities by analyzing Regression Discontinuity Design (RDD) estimates of the proportion of mortgages with different lengths of maturity. Second, we analyze first-stage estimates of the impact of our instruments, different thresholds of the distance to the age of 65, on maturity, i.e. on the probability of being granted with a maturity shorter than 20, and the corresponding ones for maturities in excess of 25 and 30 years. Note that the identification is achieved through changes in the age profile of maturities according to the year of purchase (the 65-age-at-mortgage maturity rule seems not to be implemented prior to 1999, as maturities longer than 20 years were not available). Finally, we estimate reduced-form equations to study the impact of our exogenous measures of maturity on household borrowing decisions (i.e. the intention-to-treat estimates).

3.3.1 Regression Discontinuity Design estimates

To illustrate how the instrument explains maturity, we estimate some Regression Discontinuity Design (RDD) models as follows:

$$\begin{aligned} Y_i &= \beta_0 + \beta_1 1\left(X_i \geq X_0\right) + f(X_i) + g\left(X_i\right) 1\left(X_i \geq X_0\right) + \beta_2 \text{Post99} + \\ &\quad \beta_3 1\left(X_i \geq X_0\right) \cdot \text{Post99} + h\left(X_i\right) 1\left(X_i \geq X_0\right) \cdot \text{Post99} + u_i \end{aligned} \tag{5}$$

Our outcome variables, Y_i, are three indicators of whether the maturities are below or equal to 20 years, 25 or more and 30 or more, respectively. The running variable denoted by X_i is the distance in years until the age of 65 at the time of purchase (see Lee and Card, 2008, for RDD estimates when the running variable is discrete). The cut-off, X_0, is set at 20 years; and, alternatively, the cut-off is changed to 25 and 30 years in different specifications of this equation depending on the threshold of maturity we are studying. The variable Post99 indicates whether the year of purchase of the owner-occupied house is 1999 or later. The model parameters are denoted by β, and u_i is the error term. The parameter β_1 measures the impact on maturity of taking at least X_0 years to repay completely the loan before the family head arrives at the age of 65 (at moment of purchase). In some specifications, we interact the indicator of this cut-off with a polynomial of the distance to the age of 65 in order to allow for a specific and smooth trend of the impact of the number of years until retirement on maturities when the distance exceeds this cut-off. In order to allow for different trends and impacts during the financial liberalization period, we interact all the regressors with the dummy Post99. Our parameter of interest in equation (5) is β_3, which measures the impact of our instrument (the cut-off in the distance of years until retirement) on the length of the loan maturity. We select the specification of $f(X_i)$ that best fits the data for each outcome variable, among a linear function or a third-degree polynomial.

3.3.2 First-stage Estimates and Intention-to-treat estimates

Once we illustrate the validity of our instrument using RDD estimates, in the first-stage we estimate the impact of different thresholds of the distance until the age of 65 at the time of purchase on several indicators of maturity length, and in the second-stage we estimate reduced-form models to analyze the intention-to-treat estimates of exogenous measures of maturities on household borrowing decisions. The kinds of regressions we estimate are as follows:

$$Y_i = \delta_0 + \delta_1 1(X_i \geq X_0) + \delta_2 1(X_i \geq X_0) \cdot D_{99,i} + \delta_4 W_i + u_i \tag{6}$$

$$\begin{aligned} Y_i = \alpha_0 + \alpha_1 1(X_i \geq 20) + \alpha_2 1(X_i \geq 25) + \alpha_3 1(X_i \geq 30) + \\ \alpha_4 1(X_i \geq 20) \cdot D_{99,i} + \alpha_5 1(X_i \geq 25) \cdot D_{99,i} + \alpha_6 1(X_i \geq 30) \cdot D_{99,i} + \alpha_7 W_i + v_i \end{aligned} \tag{7}$$

The variable $D_{99,i}$ denotes the post 1999 dummy, δ and α are the model parameters; u_i and v_i are the error terms associated with each equation; X_i is the number of years that takes until the family head arrives at the age of 65 at the moment of buying the owner-occupied house; X_0 is the cut-off we consider as instrument, whether it is 20, 25

or 30, separately in each regression shown in equation (6). The covariates included in W_i are already mentioned at the beginning of this Section: family head gender, household size, children age, indicator of more than two adult household members, marital status, attained education level, polynomials of the family head age, polynomials of the logarithm of the previous household total income and of current age, kind of financial institution providing the loan, and fixed effects of calendar years and years of purchase.

As maturities longer than 20 years are mainly widespread in the financial liberalization period that came after the introduction of euro in 1999, our parameters of interests are δ_2 in equation (6) and α_4, α_5 and α_6 in equation (7). The parameter δ_2 measures the additional impact of taking at least X_0 years to repay the loan until the age of 65 at the moment of purchase on maturities after 1999. In equation (7), all the thresholds of the distance to 65 ($X_i \geq 20$, $X_i \geq 25$ and $X_i \geq 30$) are included jointly as covariates of the model. These thresholds are not disjoint subsets, as the cut-off of 20 years include both the households that satisfy the cut-off of 25 and the cut-off of 30, and so on. Thus, the parameters of interest in equation (7), α_4, α_5 and α_6, capture a cumulative effect of the distance in years to the age of 65 on loan maturities. In this way, the impact of having at least 20 years to repay a loan before the age of 65 is measured by α_4; the impact of having at least 25 years before retirement is $\alpha_4 + \alpha_5$, and the effect of having a distance to retirement of more than 30 years on loan maturities after 1999 is estimated by $\alpha_4 + \alpha_5 + \alpha_6$.

In the first-stage, our dependent variables, Y_i, in different model specifications are both the length of the mortgage maturity and indicators of whether the maturity is below 20, over 25 and 30 years. Concerning the intention-to-treat estimates, we regress our instruments on the loan-to-value ratio at the time of house purchase (LTV), on the loan to permanent income ratio and on indicators of different thresholds of the LTV (in excess of 80%, 90% and 100%, respectively). We also analyze the ratio of loan payments to household total income and different thresholds of the fraction of earnings devoted to repay loans, in order to study changes in the household financial fragility after 1999 (if the ratio exceeds the thresholds of 30% and 40%).

4 Empirical Results

This section provides the results for different estimation strategies. First, we illustrate how our instrument, the distance in years to the age of 65, helps to explain the maturity of a mortgage after the post-period of financial liberalization. Next, we provide first-stage estimates of the causal impact of the number of years until the retirement age of 65 on loan maturities. Finally, we examine the household borrowing response to exogenous changes in maturities exploiting variations in the distance to the age of 65 at the time of the house

purchase.

4.1 The impact of the number of years until retirement on the mortgage maturity

4.1.1 Regression Discontinuity Design Estimates

To illustrate our identification strategy for exogenous changes in maturity, Table 3 shows RDD estimates of equation (5), i.e. the estimated impact of the distance to the age of 65 at purchase on the probability of whether the length of the loan maturity granted is below 20 years in column (1), over 25 years in column (2) and a maturity longer than 30 years in column (3). The cut-off of 20 years is significant at the 1% and 5% significance levels to explain the probabilities of different maturity lengths, i.e. the fact of taking more than 20 years until the age of 65 at the moment of purchase decreases the probability of being granted with a maturity shorter than 20 years after the financial liberalization period in 15.9% (a decrease of 20% (15.9/77.8) relative to the mean proportion of maturities below 20 granted before 1998, see Table 2). At the same time, a distance of 20 years until the age of retirement at 65 increases the probability of being granted a maturity longer than 25 and 30 years in 16.5% and 9.4%, respectively (a relative increase of 76% and 127% with respect to the tiny proportions of maturities longer than 25 and 30 granted before 1998, mainly in the latter case). Interestingly, we do not observe significant effects of this threshold of 20 years in the distance to the age of 65 in the time period earlier than 1998, when only maturities shorter than 20 were usually offered by banks.

In the estimated models of Table 3 we have allowed for specific continuous linear trends of the impact on maturities of the number of years until the expected retirement age of 65 for those households that exceed the cut-off point. Linear trends are those which best fit the data (not shown in Table 3). A linear trend of the distance to the age of 65 centered at the cut-off point is also interacted with both the indicator of the cut-off and the interaction of the cut-off with the dummy of post 1999, in order to allow for different trends across time periods ($g(X_i)$ and $h(X_i)$, respectively, in equation (5)).

Figure 4 shows the graphs with the RDD estimated trends of the impact of the number of years that takes until the family heads are aged 65 on the probability of being granted with a maturity shorter than 20, and with another ones longer than 25 and 30 years, respectively. Before 1998, we do not observe any breaks in the probability of being granted with maturities of different lengths after the cut-off of at least 20 years to repay the loan before the age of 65. Instead, after 1999 we find statistically significant breaks of the trend just before and after the cut-off point at the 95% confidence level. For instance, in the case of mortgages with maturities longer than 25, the probability of holding such a mortgage is 57.2% after 1999 for a family head aged 45, i.e. with at least 20 years until the

age of 65. Meanwhile, this probability is 41% for a family head aged 46 (with a distance of 19 years until the age of 65), and this estimated probability is outside the confidence interval of the estimate of 57.2% at the cut-off of 20 years. Similarly, the probabilities of being granted with a mortgage maturity longer than 30 years just before and after the cut-off of 20 years of distance to the age of 65 are 22.2% and 31.4%, respectively, and both estimates are statistically significantly different between each other.

As banks do not know for certain at which age individuals become retired and given that some employees can retire at the age of 70 in some jobs, mainly in the public sector, banks may not strictly follow this rule of having fully repaid the loan before the age of 65. Instead, banks may consider another limit age at mortgage expiration, such as the age of 70 and 75. It seems that this is the case in models (2) and (3) of Table 3, where the cut-off of 20 years of distance to the age of 65 is significant to explain increases in the probabilities of holding mortgages with maturities longer than 25 and 30 years, respectively, as if the limit ages to the mortgage expiration that the banks consider were 70 and 75 years, respectively.

Instead, if banks follow strictly the rule of a loan completely repaid before the age of 65, in the case of maturities longer than 25 and 30 years, we should consider the cut-off point of 25 and 30 years of distance, respectively. Columns (4) and (5) of Table 3 shows the estimates of these alternative specifications, in which the thresholds of 25 and 30 years of distance are also statistically significant to explain these maturity lengths at the 10% significant level. Therefore, it seems that at least a significant proportion of banks follows this rule, although the estimates are more imprecise due to the small sample sizes of young enough households with outstanding mortgages exceeding these cut-offs.

Figure 5 plots the RDD estimated trends of the impact of the distance to the age of 65 using the cut-off of 30 years for maturities longer than 30 (from estimates in column (5) of Table 3). The break just before and after the cut-off of 30 years until the age of 65 (i.e. the fact of having the age of 35 vs 36 at the time of purchase) is statistically significant to explain the probability of being granted with a maturity longer than 30 years after 1999 (an estimated probability of 43.9% vs 32.5%).

4.1.2 Evidence from First-stage Estimates

In order to estimate the causal response of household borrowing to the availability of longer maturities on account of the financial liberalization produced in Spain after the introduction of euro in 1999, we provide first-stage estimates of the impact of the distance to the age of 65 at the time of purchase on mortgage maturities to assess the validity of this instrument. Table 4 shows the first-stage estimates of the impact of different thresholds of distance to the age of 65 on different lengths of loan maturities by exploiting the rule that

the banks are reluctant to offer maturities in which the loan applicant is still repaying the loan after the age of 65 (see equation (6)). In this way, row (1) in column (1) of Table 4 shows the estimate of the effect on the probability of being granted with a maturity below 20 years when the family head exceeds the distance of 20 years until the age of 65, i.e. when individuals are aged under 45 at the time of purchase. After 1999 their probability of taking out a mortgage maturity shorter than 20 is 18% statistically significantly smaller than before 1998.

On the contrary, column (2) shows that the probability of being granted with a maturity longer than 25 years increases significantly in 15% among individuals aged under 40 at time of purchase after 1999 (i.e. when they have at least 25 years to repay the loan before the age of 65). The increase in the probability of being offered a mortgage with a maturity over 30 years being fully repaid before the age of 65 (i.e. among individuals aged under 35 at time of purchase) is 13.9% higher after 1999 than the one before 1998.

The estimates of the impacts on the probabilities of different maturities are significant at the 1% level of significance, and the values of the F-test statistics that test the null hypothesis of the absence of economic significance of the instruments (the thresholds of the distance to the age of 65) exceed or are near the value of 10. Moreover, the first-stage estimates are similar in magnitude to the RDD estimates of Table 3. Therefore, our identification strategy for exogenous variation in mortgages given by the distance to the age until retirement at the time of purchase seems to be valid.

Table 5 shows the first-stage estimates of equation (7) when we pool together all the thresholds considered about the number of years that takes to repay the loan before the family head is aged 65 at the time of home purchase, in order to explain their impact on maturities. Column (1) indicates that the maturity increases in two years on average after 1999 among individuals that have at least 20 years to repay completely the loan before entering retirement, mainly among individuals aged under 45 and under 35 at the time of purchase. After 1999, the probability of being granted with a maturity shorter than 20 years decrease in 18% among individuals aged under 45 at the time of purchase (see column (2)). At the same time, their probability of taking out a mortgage with a maturity longer than 25 years increases almost in the same amount, in 17% after 1999 (see row 3 and column 3). Similarly, their probability of being granted with a maturity exceeding 30 years increases in 11% after 1999. This probability increases in 20% $[(0.107+0.030+0.072)\cdot 100$ in column (3)] among individuals aged under 35 at the time of purchase.

4.1.3 Evidence from Intention-to-treat estimates

Once we have assessed the validity of the distance to the age of 65 as a good instrument of maturities granted after the financial liberalization in 1999, we start analyzing the house-

hold borrowing decisions to bring higher future income resources to the time at purchase of the owner-occupied house, in order to finance consumption and housing arrangements in the earlier periods of the individuals' lifetime.

Loan to value ratio at the time of house purchase Table 6 shows the impact of our exogenous measure of longer maturities on the household decision of taking loan liabilities at the time of home purchase. Column (1) shows that the financial liberalization period does not seem to bring higher loan-to-value ratios at the time of purchase on average. However, after 1999 we observe a shift of young households towards the upper tails of the distribution of the loan-to-value ratios. In particular, the proportion of households aged under 45 at the time of purchase that arrange for a loan-to-value ratio in excess of 80% and 90% increases in 13.4% and 11.5%, respectively, after 1999 [see columns (2) and (3)]. We do not find a significant impact on the proportion of young households that were granted with loan-to-value ratios over 100% after 1999.

When we define the household loan liabilities as the ratio of the initial loan capital to the household permanent income, we observe that the proportion of young individuals (except those aged between 35 and 40) that raise their loan liabilities increases in 6%. However, this estimate is only significant at the 10% of significance level. We measure loan liabilities relative to permanent income instead of current total income, because we estimate the loan liabilities at time of purchase, not at the time of survey interview, as income is collected by the EFF. Permanent income is invariable by definition across individuals' lifetime periods (see Appendix B for a description about the estimation of the household permanent income).

Ratio of loan payments to household total income The EFF collects information about loan payments at the time of the survey interview, so that we measure the loan payments relative to current income (the earnings that the household receives in the same reference period). Table 7 shows the estimates of the impact of our exogenous measure of the availability of longer maturities on the household loan payments after the financial liberalization in 1999. Similarly to the loan-to-value ratios, we do not find any significant impacts of different thresholds in the distance to the age of 65 on the ratio of loan payments to current income on average. However, we find a great heterogeneity of the household loan payment responses to the availability of longer maturities after 1999. On the one hand, we find a decrease of 9% in the proportion of young households aged under 45 at the moment of purchase who devote a fraction higher than 30% of their income to repay the loan with the longest maturity for the purchase of the owner-occupied house [see column (2)].

On the other hand, column (3) indicates that the percentage of the youngest individuals, aged under 35 at the time of purchase, that use more than 40% of their earnings to repay the loan has increased in 5% at the 1% of significance level after 1999. When we consider the payments of all outstanding debts (possibly using as collateral the owner-occupied house), the proportion of individuals aged under 35 that enter a situation of financial fragility increases in almost 12% after 1999 at the 1% of significance level (see column (6)), as they devote more than 40% of their income to repay outstanding debts.

Liquidity constraints, financial difficulties and delays to repay loans Finally, we also analyze if there are significant differences in household liquidity constraints, and financial difficulties and delays in loan repayments among young individuals that took out longer loan maturities after the financial liberalization period. We define liquidity constraints as done in Jappelli (1990). We consider that a household is liquidity constrained if the household encounters one of these three situations in the last two years: first, the household did not ask for a loan for fear of being rejected; second, the household asked for a loan and this was rejected; and third, the household asked for a loan and this was accepted with an initial loan capital lower than the one requested for. Finally, a data limitation is that we do not have information about financial difficulties and delays in the repayment of financial debts separately from other debts, such as utility services. Table 8 shows the estimates of the impact of longer maturities on liquidity constraints, financial difficulties and delays in debt repayments.

As financial difficulties and delays in debt repayment mainly occur among the youngest group of households, in Table 8 we split this group by also including an additional threshold of the distance to the age of 65 at 40 years since the time of purchase. Column (1) of Table 8 shows the first-stage estimate of the impact of the cut-off of 40 years on maturities longer than 35 years (a very low proportion of maturities is longer than 40 in the sample). The estimate is significant at the 5% significance level, having at least 40 years for repaying the loan before the age of 65 increases the probability of being granted a mortgage maturity over 35 years in 4.8% after 1999. The precision of the estimate is lower than those in Tables 4 and 5 due to the small sample sizes of both households younger than 30 years old at the time of purchase and loan maturities longer than 35 years.

Columns (2) and (3) show that the way in which young individuals experience liquidity constraints depends highly on the age at which they bought the owner-occupied house after 1999. Individuals aged under 40 at the time of purchase are 4.3% more likely not to ask for a loan due to their fear of being rejected because of their economic situation, indebtedness, etc. (see column 2). Young households (except those aged between 35 and 40) at the time of purchase after 1999 are 3% more likely to have asked for a loan that

was accepted with a loan capital lower than the one requested (see column 3). Finally, column (4) shows the estimates of the impact of longer maturities on the household financial difficulties and delays in repaying debts. After 1999, these financial difficulties and delays have increased in 14.5% at the 1% significant level among households aged under 30 at the moment of buying the house. This is a subset of the group of households that are mostly indebted after 1999 (see Tables 6 and 7).

5 Concluding remarks

The Permanent Income Theory predicts that changes in mortgage market conditions, like longer periods to repay or lower interest rates, have a heterogeneous impact on the consumption and borrowing decisions of homeowners, and that such heterogeneity in the responses is informative on the share of liquidity-constrained households among house owners. In particular, the consumption of groups of the population who are exposed to higher borrowing rates and who expect higher income growth late in life should be specially responsive to mortgage maturity. Alternatively, the consumption and borrowing of other unconstrained groups should react mainly to changes in interest rates and is unrelated to the size of mortgage installments. In this study, we use the 2002-2014 waves of the Spanish Survey of Household Finances (EFF), which collects retrospective information about mortgage conditions, to estimate the response of household borrowing to cross-sectional changes in maturity. After 1999, individuals aged under 45 at time of purchase have increased their loan maturities in 2 years on average. However, this figure hides a shift in the distribution of mortgage maturities among different groups of households according to their age at time of purchase. In particular, 18% of households aged under 45 have given up taking out loans with maturities below 20 years after 1999. Instead, 17% of them hold maturities longer than 25 years and even 11% of them hold a maturity longer than 30 years. The increase in the length of loan maturities has been substantial after the financial liberalization period which occurred after the introduction of euro in 1999.

We document a great heterogeneity in household borrowing response to the availability of longer maturities after the financial liberalization. The access to loans with longer maturities has brought the following consequences: first, household loan liabilities seem not to increase on average after 1999. However, we detect an increase of 9% of households aged under 45 at the time of buying their owner-occupied house who have increased their initial loan liabilities in terms of loan-to-value ratios (LTV) to values exceeding 80% and even 90% after 1999.

Second, the response of loan payments to longer maturities is more ambiguous and

heterogenous. On the one hand, 9% of households aged under 45 at time of purchase reduce their loan payments relative to income in a fraction lower than 30% of their earnings. On the other hand, after 1999, we observe an increase of 5% in the proportion of the youngest households, aged under 35 at time of purchase, who devote more than the 40% of their earnings to repay the mortgage. This increase is 12% when we consider all the outstanding loans (surely, in most of them the household must have used their house as collateral of the loans).

Finally, after the financial liberalization period, an increase of 3-4% of the young households that can benefit from longer maturities declare to have experienced some problems of liquidity constraints and also financial difficulties and delays in debt repayments. The latter inconveniences are located among the youngest households, aged under 30 at time of purchase, i.e. among those households who have mostly increased their loan liabilities (LTV in excess of 90%) and whose loan payments relative to income exceed 40%, entering in a situation of financial distress.

To conclude, the availability of longer maturities after the financial liberalization has contributed to the rise of household welfare by smoothing consumption and also by increasing their consumption and housing in the early stages of the individuals' lifetime, as longer maturities have brought the possibility of reducing the size of installments relative to earnings and increasing loan liabilities. However, the negative consequence of a broader access to long-term debt has also exposed highly indebted households to a growing financial vulnerability and distress.

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This appendix gives details about the results in Section 2.

A Theoretical Model

A.1 Consumption when mortgage maturity equals 1.

We focus on the case that the consumer ends the second period with no savings. In that case,

$$c_1(1) = \frac{1}{1+\eta^{\frac{1}{\rho}}+\beta^{\frac{1}{\rho}}(1+r_b)^{\frac{1}{\rho}-1}}[y_1+\frac{y_2}{1+r_b}]$$

$$h(1) = \frac{\eta^{\frac{1}{\rho}}}{1+\eta^{\frac{1}{\rho}}+\beta^{\frac{1}{\rho}}(1+r_b)^{\frac{1}{\rho}-1}}[y_1+\frac{y_2}{1+r_b}]$$

and

$$c_2(1) = \frac{\beta^{\frac{1}{\rho}}(1+r_b)^{\frac{1}{\rho}}}{1+\eta^{\frac{1}{\rho}}+\beta^{\frac{1}{\rho}}(1+r_b)^{\frac{1}{\rho}-1}}[y_1+\frac{y_2}{1+r_b}]$$

while $c_3(1) = y_3$. The terms $h(T)$ and $c_i(T)$, $i = 1, 2, 3$, denote the expenditure on housing and non-durable goods in each period when the mortgage maturity is equal to T (in this case $T = 1$). In such allocation, one can show the following results:

Lemma 1 $\frac{\partial c_1}{\partial(1+r_b)} < 0$ *if* $\rho < 1$ *and* $\frac{y_2-y_1}{y_1}$ *is sufficiently large.*

Taking derivatives with respect to $1 + r_b$, one can obtain

$$\frac{\partial c_1}{\partial(1+r_b)} = -\frac{1}{\Omega(r_b)}[\frac{y_2}{(1+r_b)^2}] - \frac{\Omega^{'}(r_b)}{[\Omega(r_b)]^2}[y_1 + \frac{y_2}{1+r_b}]$$

Where $\Omega(r_b) = 1 + \eta^{\frac{1}{\rho}} + \beta^{\frac{1}{\rho}}(1+r_b)^{\frac{1}{\rho}-1}$. Operating, we get

$$\begin{aligned} \frac{\partial c_1}{\partial(1+r_b)} &< 0 \qquad if \\ \frac{1}{\Omega(r_b)}[\frac{y_2}{(1+r_b)^2}] &> \frac{[-\Omega^{'}(r_b)]}{[\Omega(r_b)]^2}[y_1 + \frac{y_2}{1+r_b}] \end{aligned}$$

Dividing both sides of the inequality by $[y_1 + \frac{y_2}{1+r_b}]$ and rearranging, one obtains that $\frac{\partial c_1}{\partial(1+r_b)} < 0$ whenever parameters satisfy equation (8)

$$\frac{1+\Delta y}{2+\Delta y+r_b} > \frac{1}{\rho}[\frac{\beta^{\frac{1}{\rho}}(1+r_b)^{\frac{1}{\rho}-1}(\rho-1)}{1+\eta^{\frac{1}{\rho}}+\beta^{\frac{1}{\rho}}(1+r_b)^{\frac{1}{\rho}-1}}] \tag{8}$$

Where $\Delta y = \frac{y_2-y_1}{y_1}$. The left-hand side of (7) is 1 at most, increases with second period income and falls with the borrowing rate r_b. The right-hand side (RHS) of (8) is the product of two terms, $\frac{1}{\rho}$ and a second term that increases with ρ. Thus, an increase in r_b diminishes consumption in the first period if Δy is sufficiently large.

Lemma 2 *An increase in interest rates makes* $\phi(1)$ *fall.*

Using the first period budget constraint, one can recover the expression for the optimal loan-to-value ϕ_1 :

$$\frac{[\eta^{\frac{1}{\rho}}+1]y_2 - \beta^{\frac{1}{\rho}}(1+r_b)^{\frac{1}{\rho}}y_1}{\eta^{\frac{1}{\rho}}[y_1(1+r_b)+y_2]} = \phi(1)$$

Taking derivatives with respect to $(1 + r_b)$ one obtains

$$\frac{-\frac{1}{\rho}\beta^{\frac{1}{\rho}}(1+r_b)^{\frac{1}{\rho}-1}y_1}{\eta^{\frac{1}{\rho}}[y_1(1+r_b)+y_2]} - \phi_1\frac{\eta^{\frac{1}{\rho}}y_1}{\eta^{\frac{1}{\rho}}[y_1(1+r_b)+y_2]} = \frac{\partial\phi(1)}{\partial(1+r_b)}$$

Both terms are negative. Hence, an increase in $1 + r_b$ leads to a drop in both housing and non-housing consumption among buyers through both income and substitution effects if $\rho < 1$ and the income profile sufficiently steep. Still, as the fraction of housing financed through a mortgage drops unambiguously with the interest rate, a home buyer still needs to spend more on housing upfront (1-ϕ)h, thus consuming less on the rest of (non-housing) goods.

A.2 Case 2: Consumption when mortgage maturity equals 2.

With two periods to repay the loan, the allocations of non-housing consumption, $c_1(2), c_2(2)$ and $c_3(2)$, and housing, $h(2)$, can be written as follows:

$$c_1(2) = \frac{1}{1+\eta^{\frac{1}{\rho}}+\beta^{\frac{1}{\rho}}(1+r_b)^{\frac{1}{\rho}-1}+\beta^{\frac{2}{\rho}}(1+r_b)^{\frac{2}{\rho}-2}}[y_1+\frac{y_2}{1+r_b}+\frac{y_3}{(1+r_b)^2}]$$

$$c_2(2) = \frac{\beta^{\frac{1}{\rho}}(1+r_b)^{\frac{1}{\rho}}}{1+\eta^{\frac{1}{\rho}}+\beta^{\frac{1}{\rho}}(1+r_b)^{\frac{1}{\rho}-1}+\beta^{\frac{2}{\rho}}(1+r_b)^{\frac{2}{\rho}-2}}[y_1+\frac{y_2}{1+r_b}+\frac{y_3}{(1+r_b)^2}]$$

$$c_3(2) = \frac{\beta^{\frac{2}{\rho}}(1+r_b)^{\frac{2}{\rho}}}{1+\eta^{\frac{1}{\rho}}+\beta^{\frac{1}{\rho}}(1+r_b)^{\frac{1}{\rho}-1}+\beta^{\frac{2}{\rho}}(1+r_b)^{\frac{2}{\rho}-2}}[y_1+\frac{y_2}{1+r_b}+\frac{y_3}{(1+r_b)^2}]$$

$$h(2) = \frac{\eta^{\frac{1}{\rho}}}{1+\eta^{\frac{1}{\rho}}+\beta^{\frac{1}{\rho}}(1+r_b)^{\frac{1}{\rho}-1}+\beta^{\frac{2}{\rho}}(1+r_b)^{\frac{2}{\rho}-2}}[y_1+\frac{y_2}{1+r_b}+\frac{y_3}{(1+r_b)^2}]$$

Lemma 3 *Maturity extensions increase $c_1(2)$ relative to $c_1(1)$ and $c_2(2)$ relative to $c_2(1)$ when y_3 sufficiently large relative to the borrowing rate r_b.*

$$c_1(2) = \frac{1}{1+\eta^{\frac{1}{\rho}}+\beta^{\frac{1}{\rho}}(1+r_b)^{\frac{1}{\rho}-1}+\beta^{\frac{2}{\rho}}(1+r_b)^{\frac{2}{\rho}-2}}[y_1+\frac{y_2}{1+r_b}+\frac{y_3}{(1+r_b)^2}] = \Omega_2(r_b)E_3(r_b)$$

Where we have used the notation $\Omega_2(r_b) = \frac{1}{1+\eta^{\frac{1}{\rho}}+\beta^{\frac{1}{\rho}}(1+r_b)^{\frac{1}{\rho}-1}+\beta^{\frac{2}{\rho}}(1+r_b)^{\frac{2}{\rho}-2}}$ and $E_3(r_b) = [y_1+\frac{y_2}{1+r_b}+\frac{y_3}{(1+r_b)^2}]$

$$c_1(1) = \frac{1}{1+\eta^{\frac{1}{\rho}}+\beta^{\frac{1}{\rho}}(1+r_b)^{\frac{1}{\rho}-1}}[y_1+\frac{y_2}{1+r_b}] = \Omega_1(r_b)E_2(r_b)$$

To establish the result, one needs to prove that $\frac{c_1(1)}{c_1(2)} < 1$, or $\frac{\Omega_1(r_b)y_2(r_b)}{\Omega_2(r_b)y_3(r_b)} < 1$. A similar condition is that

$$\frac{\Omega_2(r_b)}{\Omega_1(r_b)} > \frac{y_2(r_b)}{y_3(r_b)} \tag{9}$$

Equation (9) can be expressed in terms of parameters as follows:

$$\frac{\Omega_2(r_b)}{\Omega_1(r_b)} = 1 + \frac{\beta^{\frac{2}{\rho}}(1+r_b)^{\frac{2}{\rho}-2}}{1+\eta^{\frac{1}{\rho}}+\beta^{\frac{1}{\rho}}(1+r_b)^{\frac{1}{\rho}-1}}$$

$$\frac{y_2(r_b)}{y_3(r_b)} = \frac{1}{1+\frac{\frac{y_3}{(1+r_b)^2}}{y_1+\frac{y_2}{1+r_b}+\frac{y_3}{(1+r_b)^2}}}$$

Hence, $\frac{c_1(1)}{c_1(2)} < 1$ if

$$\frac{\beta^{\frac{2}{\rho}}(1+r_b)^{\frac{2}{\rho}-2}}{1+\eta^{\frac{1}{\rho}}+\beta^{\frac{1}{\rho}}(1+r_b)^{\frac{1}{\rho}-1}} < \frac{\frac{y_3}{(1+r_b)^2}}{y_1+\frac{y_2}{1+r_b}+\frac{y_3}{(1+r_b)^2}}$$

This condition is more likely to hold when y_3 sufficiently large relative to the interest rate r_b. The condition also guarantees that $\frac{c_2(1)}{c_2(2)} < 1$.

Lemma 4 *An extension in maturity increases the loan-to-value ratio of homeowners.*

The loan-to-value ratio can be obtained from the first-period budget constraint:

$$(1-\phi(2))h = y_1 - c_1(2)$$

Evaluating the expression at $h(2)$ and $h(1)$, one gets the result.

$$1-\phi(2) = \frac{y_1}{h(2)} - \frac{(1+r_b)^{\frac{1}{\rho}}}{\eta^{\frac{1}{\rho}}}$$

$$1-\phi(1) = \frac{y_1}{h(1)} - \frac{(1+r_b)^{\frac{1}{\rho}}}{\eta^{\frac{1}{\rho}}}$$

The fact that an increase in mortgage maturity leads to an increase of both the expenditure on housing and non-housing goods together with the fulfilment of the budget constrained implies that $1-\phi_2 < 1-\phi_1$, then $\phi_1 < \phi_2$. The higher level of non-housing consumption is financed with a higher loan-to-value ratio.

Lemma 5 *The response of consumption to the interest rate is higher among non-constrained households than among constrained households:* $|\frac{\partial c_1(1)}{\partial(1+r_b)}| < |\frac{\partial c_1(2)}{\partial(1+r_b)}|$

$$c_1(1) = \frac{1}{1+\eta^{\frac{1}{\rho}}+\beta^{\frac{1}{\rho}}(1+r_b)^{\frac{1}{\rho}-1}}[y_1+\frac{y_2}{1+r_b}]$$

$$c_1(2) = \frac{1}{1+\eta^{\frac{1}{\rho}}+\beta^{\frac{1}{\rho}}(1+r_b)^{\frac{1}{\rho}-1}+\beta^{\frac{2}{\rho}}(1+r_b)^{\frac{2}{\rho}-2}}[y_1+\frac{y_2}{1+r_b}+\frac{y_3}{(1+r_b)^2}]$$

The responses are:

$$\frac{\partial c_1(1)}{\partial(1+r_b)} = -\frac{(\frac{1}{\rho}-1)\beta^{\frac{1}{\rho}}(1+r_b)^{\frac{1}{\rho}-2}}{[1+\eta^{\frac{1}{\rho}}+\beta^{\frac{1}{\rho}}(1+r_b)^{\frac{1}{\rho}-1}]^2}[y_1+\frac{y_2}{1+r_b}] - \frac{1}{1+\eta^{\frac{1}{\rho}}+\beta^{\frac{1}{\rho}}(1+r_b)^{\frac{1}{\rho}-1}}[\frac{y_2}{(1+r_b)^2}]$$

For long maturities ($T=2$), $\frac{\partial c_1(2)}{\partial(1+r_b)}$ equals:

$$\frac{\partial c_1(2)}{\partial(1+r_b)} = -\frac{(\frac{1}{\rho}-1)\beta^{\frac{1}{\rho}}(1+r_b)^{\frac{1}{\rho}-2}[1+2\beta^{\frac{1}{\rho}}(1+r_b)^{\frac{1}{\rho}-2}]}{[1+\eta^{\frac{1}{\rho}}+\beta^{\frac{1}{\rho}}(1+r_b)^{\frac{1}{\rho}-1}+\beta^{\frac{2}{\rho}}(1+r_b)^{\frac{2}{\rho}-2}]^2}[y_1+\frac{y_2}{1+r_b}+\frac{y_3}{(1+r_b)^2}]$$
$$-\frac{1}{1+\eta^{\frac{1}{\rho}}+\beta^{\frac{1}{\rho}}(1+r_b)^{\frac{1}{\rho}-1}+\beta^{\frac{2}{\rho}}(1+r_b)^{\frac{2}{\rho}-2}}[\frac{y_2}{(1+r_b)^2}+\frac{y_3}{(1+r_b)^3}]$$

Both derivatives are always negative, i.e. consumption in period 1 decreases with the interest rate to borrow irrespective of the maturity, if $\rho < 1$ and condition in equation (8) holds, $|\frac{\partial c_1(1)}{\partial(1+r_b)}| < |\frac{\partial c_1(2)}{\partial(1+r_b)}|$.

B The construction of permanent income

The measure of permanent income we use is an average of total income during the years we observe the household, normalized for a household composed by 2 adult members whose head is 50 years of age in 2002. For 55% of households we have two consecutive yearly observations. The EFF provides two constructed measures of total household income in each survey wave. The first measure of income is the total amount of earnings reported during the fiscal year prior to the year of the interviews, 2001 for the EFF2002, 2004 for EFF2005, and so on. The second measure of income constructed by the EFF refers to an imputation of monthly household income during the period of the interview, based on direct questions on current income to all household members. We multiply by 12 that income reported, once we have discounted the rainfall earnings received during the period of interview. This amount of rainfall earnings is added later to our measure of current income (in order to avoid the inclusion of this income source twelve times). For panel households, we have two extra data points per survey wave in which the household participates. We use the sample of households whose head is aged at most 80. This procedure is implemented with all available waves of the EFF (2002-2014).

To normalize permanent income, we regress current earnings on a 3rd-order polynomial of household head age, education, indicators of marital status, the number of adults in the household, and the number of children broken down into three different age bands (0-5, 6-13 and 14-17). The point of including schooling is that there is a substantial cross-cohort variation in earnings. We make the hypothesis that education captures part of the variation in the intercepts of those cohort profiles, so including them as regressors permits us to identify the coefficients of the age polynomial as measuring an average life-cycle income profile.

$$\log y_{ht} = \delta_0 + f(age_{\text{head,ht}} - 50) + \sum_{i=1}^{i=3} \delta_{1,i} School^i_{head,ht} + \delta_2 X_{ht} + \sum_{s=2001}^{2014} \delta_{3,s} Year_s + u_h + \varepsilon_{ht}$$

where the error component has two elements: one that does not vary over time and a second one that we assume to be independent and identically distributed (iid). The measure of permanent income is the following:

$$Y_h = \exp(\delta_0 + \delta_1 School_{head} + u_h)$$

Table 1: Evolution of credit conditions in Spain for period 1992-2015

	1992-1998	1999-2004	2005-2015
Fixed Rate Mortgages (%)	24	13	13
Loan-to-Value (median)	0.80	0.90	0.92
Interest rate (%)) (if adjustable)	4.43	3.64	2.91
Maturity at origination	18.5	23.8	29.0
Sample size	939	1,199	668

Source: The 2002-2014 waves of the Spanish Survey of Household Finances (EFF).

Table 2: Weighted averages in a sample of mortgaged homeowners aged between 25 and 64 at the time of purchase (EFF2002-EFF2014)

	Total sample	Period 1992-1998	Period 1999-2015
Current interest rate (%)	3.82	4.66	3.44
% mortgages with fixed interest rates	16.6	23.9	13.3
Maturity at origin	23.5	18.5	25.7
% maturities $\leq$ 20 years	45.9	77.8	31.6
% maturities $\geq$ 25 years	53.3	21.6	67.7
% maturities $\geq$ 30 years	32.7	7.4	44.0
Age at purchase (ref. person)	34.1	33.6	34.3
Loan to Value, origination	0.88	0.89	0.88
Monthly loan payments to income	0.21	0.16	0.24
Household income (2009 eur)	39,457	42,217	37,873
Current age (ref. person)	40.7	42.9	38.1
Non-durable/income	0.23	0.22	0.23
Food consumption/income	0.21	0.22	0.20
Total consumption/income	0.38	0.36	0.38
Applied for loan	0.38	0.29	0.43
Rejected	0.06	0.04	0.07
% wave 2002	24.25	52.90	11.33
% wave 2005	23.00	22.56	23.20
% wave 2008	14.48	8.80	17.04
% wave 2011	15.93	8.06	19.48
% wave 2014	22.34	7.69	28.95
Sample size	2,821	939	1,882

Table 3: Regression Discontinuity Design (RDD) estimates of the impact of the distance in years until the age of 65 on mortgage maturities for the purchase of the owner-occupied house

Dependent variable:	Indicator of the length of mortgages (in years):				
	Maturity≤20	Maturity≥25	Maturity≥30	Maturity≥25	Maturity≥30
	(1)	(2)	(3)	(4)	(5)
(Dist. to 65≥20)·Post99	-0.159	0.165	0.094	–	–
	(.062)***	(.061)***	(.044)**		
(Dist. to 65≥25)·Post99	–	–	–	0.091	–
				(.054)*	
(Dist. to 65≥30)·Post99	–	–	–	–	0.081
					(.043)*
Distance to 65≥20	-0.004	-0.004	-0.002	–	–
	(.045)	(.044)	(.021)		
Distance to 65≥25	–	–	–	0.064	–
				(.041)	
Distance to 65≥30	–	–	–	–	0.032
					(.025)
Post99	-0.305	0.290	0.205	0.376	0.292
	(.045)***	(.045)***	(.030)***	(.032)***	(.019)***
Constant	0.878	0.120	0.017	0.112	0.033
	(.032)***	(.031)***	(.012)	(.023)***	(.010)***
Sample size	2821	2821	2821	2821	2821

Source: The 2002-2014 waves of the Spanish Survey of Household Finances.
Specific trends of the distance (dist.) to 65 that fit best the data in each model equation are: in models (1) to (3) a linear trend of distance to 65 centered at 20 years, also interacted with both the cut-off of 20 years and the interaction of this cut-off with the dummy of post 1999.
In model (4), a linear trend of distance to 65 centered at 25 years, also interacted with both the cut-off of 25 years and the interaction of this cut-off with the dummy of post 1999.
In model (5), a linear trend of distance to 65 centered at 30 years, also interacted with both the cut-off of 30 years and the interaction of this cut-off with the dummy of post 1999.
Standard errors robust to heteroscedasticity and combined across 5 implicates.

Table 4: Impact of the distance in years until the age of 65 on maturity of mortgages for the purchase of the owner-occupied house.

Dependent variable:	Indicator of the length of mortgages (in years):		
	Maturity≤20	Maturity≥25	Maturity≥30
(Dist. to 65≥20)·Post99	-0.180	–	–
	(.059)***		
(Dist. to 65≥25)·Post99	–	0.147	–
		(.047)***	
(Dist. to 65≥30)·Post99	–	–	0.139
			(.025)***
Distance to 65≥20	0.028	–	–
	(.034)		
Distance to 65≥25	–	-0.031	–
		(.032)	
Distance to 65≥30	–	–	-0.101
			(.027)***
Constant	0.843	0.206	0.051
	(.072)***	(.051)***	(.025)**
F-test	9.93	9.45	30.19
Sample size	2821	2821	2821

Source: The 2002-2014 waves of the Spanish Survey of Household Finances.
Other covariates included and not shown here are: family head gender, household size, children age, indicator of more than two adult household members, marital status, education level, polynomials on both the family head age and the logarithm of previous household total income, kind of financial institution, fixed effects of calendar years and years of purchase.
Standard errors are robust to heteroscedasticity and arbitrary correlation within age of purchase, and combined across 5 implicates.

Table 5: Impact of the distance in years until the age of 65 on maturity of mortgages for the purchase of the owner-occupied house.

Estimation method: First-stage estimates by Ordinary Least Square (OLS)				
Dependent variable:	Loan	Indicator of the length of mortgages (in years):		
	maturity	Maturity≤20	Maturity≥25	Maturity≥30
	(1)	(2)	(3)	(4)
(Dist. to 65≥30)·Post99	1.219	-0.035	0.031	0.072
	(0.562)**	(0.034)	(0.039)	(0.025)***
(Dist. to 65≥25)·Post99	-0.847	0.017	0.015	0.030
	(0.551)	(0.038)	(0.042)	(0.03)
(Dist. to 65≥20)·Post99	2.097	-0.180	0.169	0.107
	(0.841)**	(0.069)***	(0.07)**	(0.039)***
Distance to 65≥30	-0.839	0.013	-0.008	-0.047
	(0.468)*	(0.035)	(0.037)	(0.027)*
Distance to 65≥25	1.395	-0.074	0.051	0.007
	(0.451)***	(0.033)**	(0.036)	(0.021)
Distance to 65≥20	-0.104	0.044	-0.046	-0.039
	(0.433)	(0.033)	(0.034)	(0.024)
F-test	4.00	3.47	3.97	14.08
Sample size	2821	2821	2821	2821

Source: The 2002-2014 waves of the Spanish Survey of Household Finances (EFF). Other covariates included and not shown here are: family head gender, household size, children age, indicator of more than two adult household members, marital status, education level, polynomials on both the family head age and the logarithm of previous household total income, kind of financial institution, fixed effects of calendar years and years of purchase. Standard errors are robust to heteroscedasticity and arbitrary correlation within age of purchase, and combined across 5 implicates.

Table 6: Impact of the maturity rule of the distance to the age of 65 on the initial mortgage liabilities by homeowners aged 25-64.

Estimation method: Intention-to-treat estimates by OLS

Sample: Mortgages for the purchase of the owner-occupied house

Dependent variable:	Loan-to-value ratio	Indicator of whether:			Loan to permanent
	at purchase (LTV)	LTV>0.80	LTV≥0.90	LTV≥1	income
(Dist. to 65≥30)·Post99	0.319	0.102	0.057	0.100	0.112
	(0.321)	(0.072)	(0.078)	(0.075)	(0.298)
(Dist. to 65≥25)·Post99	-0.218	-0.034	-0.024	-0.056	-0.570
	(0.25)	(0.081)	(0.083)	(0.084)	(0.283)**
(Dist. to 65≥20)·Post99	0.957	0.134	0.115	0.059	0.589
	(0.92)	(0.059)**	(0.052)**	(0.062)	(0.338)*
Distance to 65≥30	-1.029	0.011	0.029	-0.042	0.086
	(0.888)	(0.064)	(0.048)	(0.046)	(0.226)
Distance to 65≥25	-0.469	-0.015	-0.010	0.022	0.250
	(0.461)	(0.068)	(0.063)	(0.064)	(0.245)
Distance to 65≥20	-0.396	-0.083	-0.068	-0.054	-0.299
	(0.534)	(0.065)	(0.067)	(0.065)	(0.263)
Sample size	2821	2821	2821	2821	2821

Source: EFF2002-EFF2014. The remaining covariates are identical to those in Table 5. Other covariates included and not shown here here: family head gender, household size, children age, indicator of more than two adult household members, marital status, education level, polynomials on both the family head age and the logarithm of previous household total income, kind of financial institution, fixed effects of calendar years and years of purchase. Standard errors are robust to heteroscedasticity and arbitrary correlation within age of purchase, and combined across 5 implicates.

Table 7: Impact of the maturity rule of the distance to the age of 65 on the homeowners' current loan payments.

Estimation method: Intention-to-treat estimates by OLS						
Sample: Mortgages for the purchase of the owner-occupied house of homeowners aged between 25 and 64						
Dependent variable:	Mortgage payments over income ($\frac{b}{Y}$)	Indicator of whether: $\frac{b}{Y} \geq 0.30$	Indicator of whether: $\frac{b}{Y} \geq 0.40$	All loan payments over income ($\frac{B}{Y}$)	Indicator of whether: $\frac{B}{Y} \geq 0.30$	Indicator of whether: $\frac{B}{Y} \geq 0.40$
	(1)	(2)	(3)	(4)	(5)	(6)
(Dist. to 65≥30)·Post99	-0.043	0.024	0.052	-0.051	0.072	0.115
	(0.562)	(0.031)	(0.018)***	(0.807)	(0.046)	(0.028)***
(Dist. to 65≥25)·Post99	0.274	0.057	-0.032	0.370	0.000	-0.038
	(1.052)	(0.046)	(0.038)	(1.521)	(0.044)	(0.063)
(Dist. to 65≥20)·Post99	-1.950	-0.090	-0.032	-2.801	-0.089	-0.058
	(1.463)	(0.046)*	(0.04)	(2.113)	(0.045)**	(0.065)
Distance to 65≥30	-0.009	-0.026	-0.030	-0.041	-0.098	-0.079
	(0.578)	(0.024)	(0.018)*	(0.838)	(0.041)	(0.025)***
Distance to 65≥25	1.056	-0.065	0.009	1.518	-0.006	0.030
	(1.003)	(0.043)	(0.027)	(1.452)	(0.037)	(0.034)
Distance to 65≥20	0.719	0.077	0.041	1.030	0.038	0.055
	(1.12)	(0.04)*	(0.028)	(1.616)	(0.041)	(0.028)*
Sample size	2821	2821	2821	2821	2821	2821

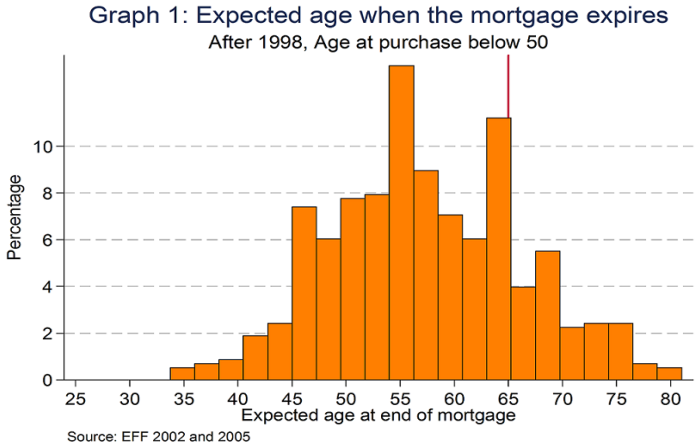
Source: EFF2002-EFF2014. The remaining covariates are identical to those in Table 5. Other covariates included and not shown here are: family head gender, household size, children age, indicator of more than two adult household members, marital status, education level, polynomials on both the family head age and the logarithm of previous household total income, kind of financial institution, fixed effects of calendar years and years of purchase. Standard errors are robust to heteroscedasticity and arbitrary correlation within age of purchase, and combined across 5 implicates.

Table 8: Impact of the maturity rule of the distance to the age of 65 on the homeowners' liquidity constraints, financial difficulties and delays in repaying debts.

Estimation method: Ordinary Least Square (OLS) Estimates Sample: Mortgages for the purchase of the owner-occupied house among homeowners aged between 25 and 64				
Dependent variable:		Liquidity constraints		
	Maturity≥35 years	Fear and loan rejections	Accepted with a lower capital	Financial difficulties and delays in repaying
	(1)	(2)	(3)	(4)
(Dist. to 65≥40)·Post99	0.048	0.002	0.001	0.145
	(.024)**	(0.04)	(0.024)	(0.041)***
(Dist. to 65≥30)·Post99	–	-0.031	0.005	0.002
		(0.02)	(0.023)	(0.026)
(Dist. to 65≥25)·Post99	–	0.043	-0.039	0.008
		(0.021)**	(0.023)*	(0.049)
(Dist. to 65≥20)·Post99	–	0.006	0.030	-0.029
		(0.021)	(0.013)**	(0.05)
Distance to 65≥40	-0.049	-0.009	0.010	-0.062
	(.017)***	(0.019)	(0.017)	(0.038)
Distance to 65≥30	–	-0.005	-0.009	-0.026
		(0.01)	(0.019)	(0.023)
Distance to 65≥25	–	-0.026	0.028	-0.033
		(0.013)**	(0.019)	(0.041)
Distance to 65≥20	–	0.002	0.004	0.043
		(0.018)	(0.006)	(0.046)
Sample size	2821	2821	2821	2821

Source: EFF2002-EFF2014. The remaining covariates are identical to those in Table 5. Other covariates included and not shown here are: family head gender, household size, children age, indicator of more than two adult household members, marital status, education level, polynomials on both the family head age and the logarithm of previous household total income, kind of financial institution, fixed effects of calendar years and years of purchase. Standard errors are robust to heteroscedasticity and arbitrary correlation within age of purchase, and combined across 5 implicates.

Figure 1: Histogram of the expected age of the family head at the moment the mortgage is expected to be fully repaid.



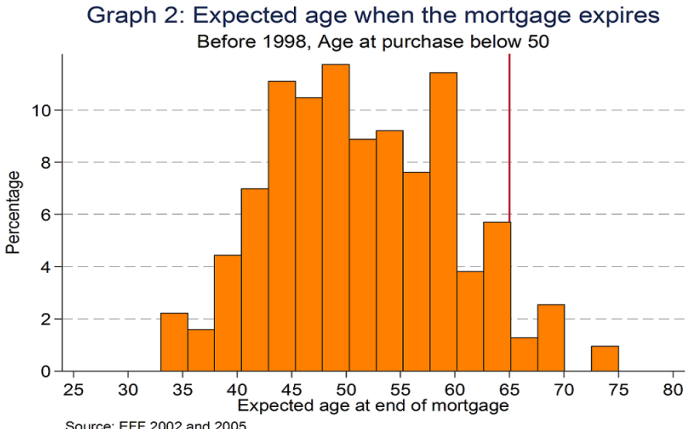


Figure 2: Histogram of mortgages broken down by maturity length.

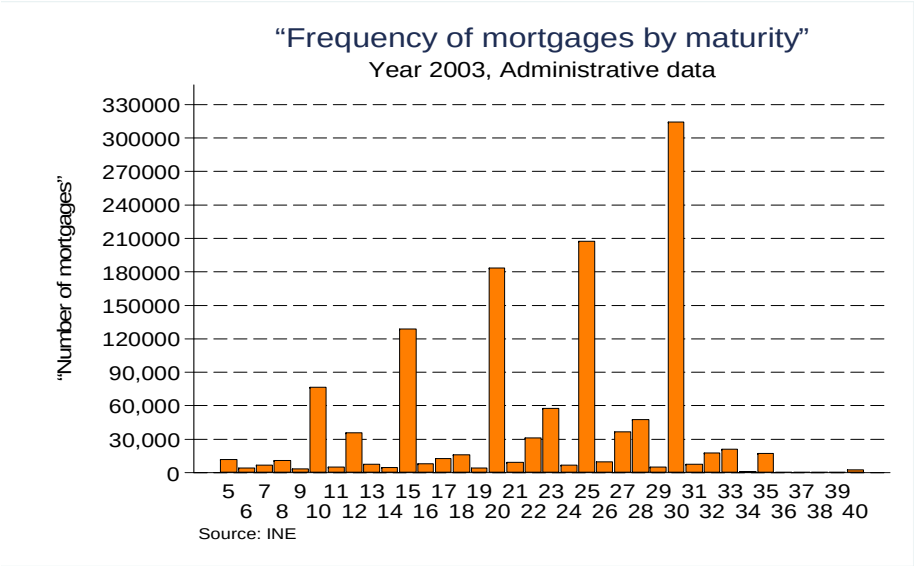


Figure 3: Average maturity broken down by the number of years until the age of retirement.

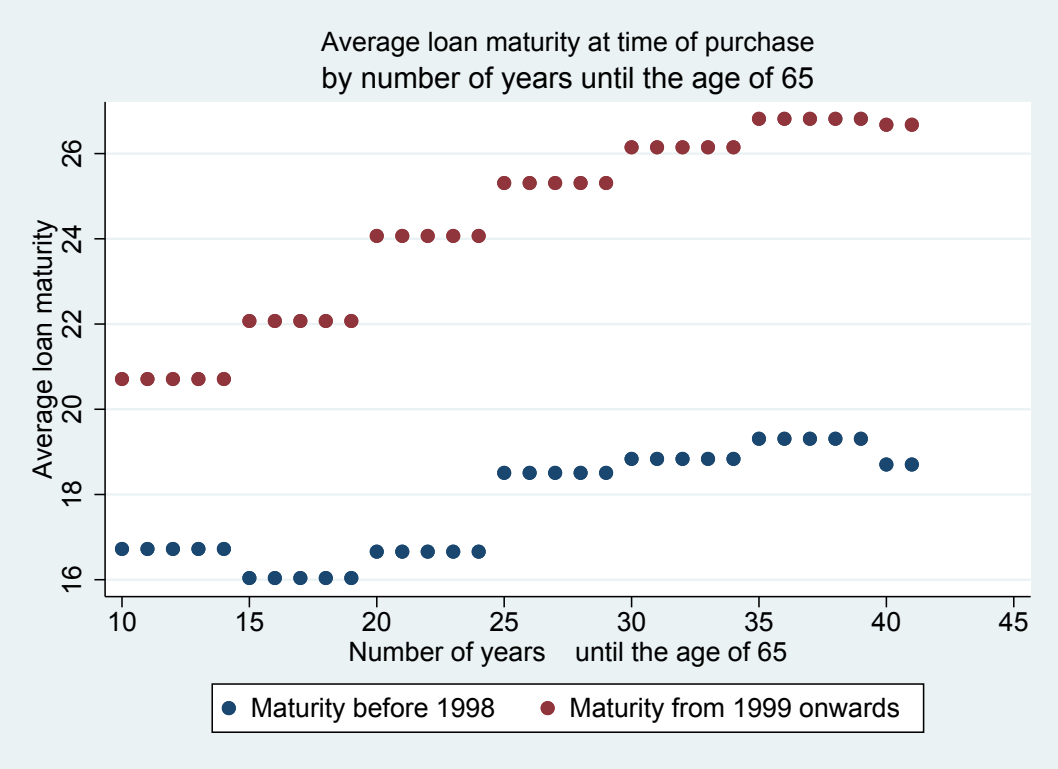
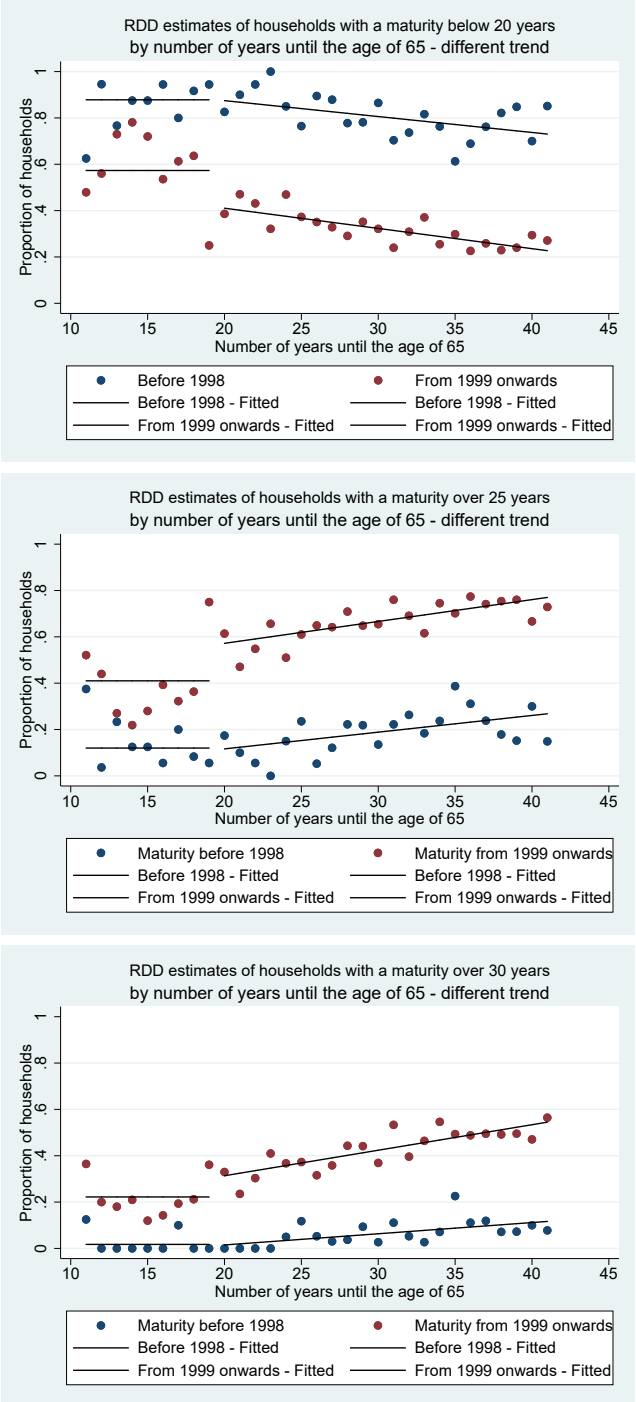
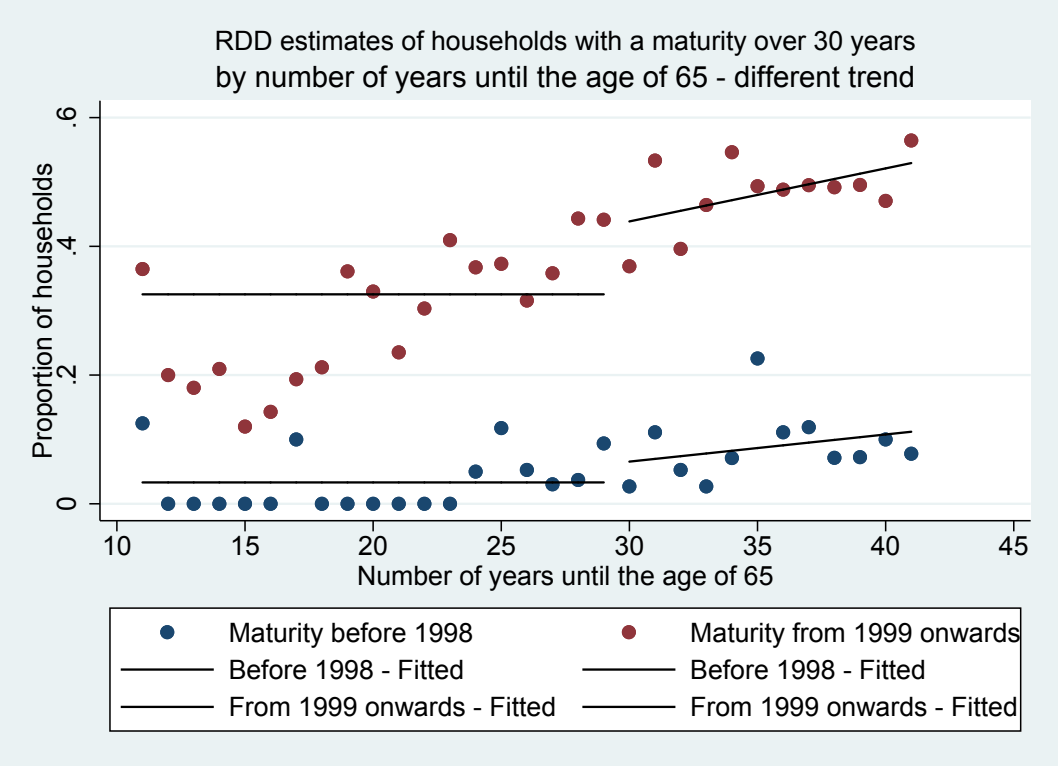


Figure 4: Regression Discontinuity Design (RDD) estimates of the impact of the distance in years to the age of 65 on maturities with different lengths.



Source: 2002-2014 waves of the EFF. The treatment is the cut-off of 20 years until the age of 65 at time of purchase and a linear trend of distance in years until the age of 65 is specified centered at 20 years.

Figure 5: Regression Discontinuity Design (RDD) estimates of the impact of the distance in years to the age of 65 on loan maturities over 30 years.



Source: 2002-2014 waves of the EFF. The treatment is the cut-off of 30 years until the age of 65 at time of purchase and a linear trend of distance in years until the age of 65 is specified centered at 30 years.