I feel wealthy: a major determinant of Portuguese households' indebtedness?

This paper examines the relationship between household's house prices perception and the size of the household debt, using data from the first wave of the Household Finance and Consumption Survey. While the existing literature has focused mainly on the effects of housing wealth on consumption, we concentrate on debt levels, distinguishing mortgage debt from non-mortgage debt, and investigating over-indebtedness. Different measures of housing wealth appraisal are considered, controlling for tenure years. The findings reveal that housing wealth effects differ by type of loans and with the measure of housing wealth. Over-indebtedness is driven by the same factors that determine mortgage debt, suggesting a strong association between having outstanding liabilities from the primary residence and the risk of entering into default. Further estimations by different income and wealth levels revealed dissimilar housing wealth effects on the level of households' outstanding liabilities, the size of non-mortgage debt tending to raise with lower income and the level of accumulated over-debt tending to be larger among the wealthier.

Keywords: Household finance; housing wealth effects; debt; Portugal
Subject classification codes: C25; D14; R29

1. Introduction

Until the 2007-2008 global economic crisis, advanced economies experienced a period of increased liquidity and unprecedentedly low interest rates in which household debt accumulated at a rate faster than GDP growth. Alongside, house prices kept rising steadily, even achieving alarming levels in several countries, while new mortgage contracts made housing less prohibitive, inflating the share of homeowners among the total population. In the aftermath of the crisis, indebted households felt the pressure to sell their residential properties at low market values, several of them often incurring losses to avoid defaulting, contributing to a climate of instability that was to be heavily blamed on their former financial choices.

These occurrences and the acknowledgment that within developed countries housing wealth accounts for about half of households wealth, and that it tended to move together with aggregate consumption after the II World War (Iacoviello, 2005), motivated a surge of models that study the macroeconomic impacts of housing and the housing market (e.g. Kivedal, 2014; Kuang, 2014; Christensen et al., 2016; Rubio and Carrasco-Gallego, 2016; Guerrieri and Iacoviello, 2017; Lambertini et al, 2017). In the class of DSGE models, housing is included among households' preferences, the effects of credit shocks on households' decisions are tested, and the relationship between rising house prices expectations and their actual increase is checked. Often, an expansion of housing wealth from increases in housing prices is shown to smooth collateral constraints, and to fuel debt-driven consumption.

By placing households' choices at the heart of the mechanism that explains the business cycle, these models have ascertained the need to test their results with microdata. In tandem, empirical studies have been corroborating the impact that housing price changes can have on households' consumption, investment, and borrowing decisions (Case et al, 2005; Mian at al, 2013) and on their financial behaviours in general (Campbell, 2006). When homeowners face the house price appreciation as a permanent capital gain, they change their consumption levels responding to both the positive effect they perceive on their lifetime wealth and to the reduction of the real value of their outstanding liabilities (mostly with a

mortgage). Moreover, homeowners' borrowing constraints are relaxed with house prices increases, stimulating consumption (Campbell and Cocco, 2007; Mian and Sufi, 2014). In this framework, and given that the residential property is non-liquid, households confronted with their house price appreciation may be compelled to increase debt holdings as a way to smooth consumption over time, adjusting their expenditure levels to their new perceived wealth. In fact, to understand the drivers of households' indebtedness it is central to take into account the role played by households' house price perceptions on their decision to demand credit.

This paper studies the effects of a change in housing wealth, as perceived by its homeowner and compared with its acquisition cost, on the average amounts of debt held by Portuguese households. The study relies on microdata retrieved from the Household Finance and Consumption Survey (HFCN, 2013) and focus on the impact on the variation in debt accumulated by households from an increase in housing valuation, analysing total debt, mortgage debt, and non-mortgage debt. Given that the main residence represents at once the major share of homeowners' total assets and wealth and the major share of their total debt, it seems natural to inspect if perceived wealth from its valuation encourages taking debt up to risky levels. To this end, additional estimations are run to capture housing wealth effects on over-indebtedness relying on a measure of risk built from the combination of three standard thresholds for risky debt.

The paper is different from the existing literature in four aspects. First, by gauging housing wealth through household appraisal of house prices, distinguishing housing total appreciation from its average annual appreciation. Economic psychology has been emphasizing how perceptions are biased and mould household financial decisions implying that one should consider them to study households' behaviours. Second, by seizing housing wealth effects on debt rather than on consumption. Homeowners that are liquidity constrained from the residential property acquisition, face an opportunity to access other consumption goods through debt whenever the housing markets signal an upsurge. Third, by studying over-indebtedness, an issue often neglected in the literature. A household with high outstanding liabilities is most likely a homeowner that borrowed to buy the residential property and has a dwelling as a warranty.

Fourth, by refining the analysis taking into account households' distribution by income and wealth and performing estimations to perceive if there are significant differences in households' response to housing wealth across their economic distribution.

Findings indicate that households respond to housing wealth when deciding how much debt to accumulate, however with opposite sensibilities and different magnitudes given the measure of housing wealth. These suggest that the type of perception chosen to seizure housing wealth effects is not irrelevant. Moreover, households were shown to reverse their behaviours if their choice pertains mortgage debt or non-mortgage debt, meaning they take into account in their decisions which type of counter-part they are getting against their liabilities, if either a consumption good that is a reliable asset as well, or just a consumption good. Lastly, results by income and wealth indicated lower-income households more prone to use housing as collateral while wealthier households displayed relatively higher over-indebtedness ratios from housing wealth.

The paper unfolds as follows. Next section looks at the most relevant literature on this subject. Section 3 presents the model variables, the data and the methodology. Section 4 presents and discusses estimations results. Section 5 concludes.

2. Literature review

Within traditional economic theory, debt is a side-effect of households' consumption decisions, as in Modigliani and Brumberg (1954)'s life-cycle model and in Friedman (1957)'s permanent income hypothesis. Acting in complete markets, forward-looking consumers choose an even pattern of current and future consumption to maximize lifetime utility given their budget constraint. The life-cycle profile of savings resembles a characteristic hump-shaped curve with indebtedness occurring in an early lifetime, and retirement depleting individual savings. The more the household income flow is hump-shaped, the higher the level of debt needed to smooth out consumption. Lifetime wealth that comprises lifetime income, owned assets, and their value, is crucial for this intertemporal decision-making process.

The newer versions of these models introduced uncertainty together with a precautionary motive for saving (Skinner, 1987). In the buffer-stock savings model (Deaton, 1991; Carroll, 1992) consumers define a target wealth-to-income ratio and savings adjust given precautionary motives, impatience of consumers who heavily discount the future, and their borrowing constraints in imperfect credit markets. Consumers dissave whenever the wealth stock is above its target, which is typical of economic expansions, while along economic recessions savings increase due to prudent behaviours triggered by pessimism with respect to employment.

Relying on these micro-foundations, a special class of macroeconomic models performs simulations to test if there is symmetry on the housing wealth effects on consumption along the upward and downward trend of the business cycle. In these models, housing and consumption enter the households' utility, the housing can be used as collateral for new loans, and house prices fluctuations affect both households' borrowing capacity and the return from producing new houses (Iacoviello, 2005; Iacoviello and Neri, 2010). By loosening the collateral constraint of borrowers and by the associated wealth effect, increases in housing demand or housing prices boost credit, increasing their access to consumption (Lambertini et al, 2013; Christensen et al, 2016; Kim and Chung, 2016; Rubio and Carrasco-Gallego, 2016). The asymmetric effects of housing booms and busts may then be related to the extent of housing collateral constraints. Along the upward trend of the business cycle, the expansion of housing wealth from the increase in housing prices smooths households' collateral constraints, fuelling debt-driven consumption (Guerrieri and Iacoviello, 2017). As soon as the house prices start to decline, collateral constraints shrink consumption possibilities and accentuate the economic depression. In these frameworks, expectations of rising house prices produce a quantitative impact on macroeconomic fluctuations, changing mortgage credit and consumption. Kuang (2014) models the relation between housing and credit cycles, emphasizing the reinforcing role that seems to exist between house prices, optimism and credit, the later on its turn reinforcing the cycle of optimism and increasing house prices, creating a self-fulfilling prophecy. The possibility that the recent house price steep march represented a speculative bubble was approached by Burnside et al (2016) who explored the role of social

interactions among agents with heterogeneous beliefs. The housing market was shown to be sensitive to anticipated beliefs of macroeconomic developments and to generate business cycle fluctuations.

Shiller (2007) had highlighted the need to consider behavioural features to understand housing markets and interpret the origins of the US house bubble. According to this author, there is a feedback mechanism in which past price increases nurture future prices expectations until the first drop in prices makes the bubble burst. A story told by the public and by the media contaminates households' perceptions and generate what Shiller designates a social epidemic of optimism for real estate, wherein the impression of owning a unique property whose value is about to increase leads households to raise consumption, boosting up the economy. To focus on wealth effects the empirical analysis should rely on microdata keeping in mind that housing dominates households' portfolios. Engelhardt (1996) was a founder of these studies, showing that housing capital gains increase the propensity to consume, however without symmetry in households' responses to losses and gains, losses increasing other forms of non-housing savings but gains not changing consumers' savings behaviour. Campbell and Cocco (2007) estimated the house price elasticity of consumption, differentiating old homeowners whose elasticity was about 1.7 from young renters with a close to zero effect. In both cases, these effects were found to be more significant for credit-constrained households. Muellbauer and Murata (2009) focused on land prices in Japan and found negative wealth effects on consumption that they attributed to underdeveloped credit markets and to inheritance taxes favouring land and housing. Aron et al. (2012) comparing Japan, the UK, and the US confirmed this result and claimed that different degrees of credit market liberalization are responsible for different housing wealth effects for these countries, and namely for the negative effect in Japan's case. Mian et al (2013) estimated a positive housing wealth effect on consumption but with pronounced regional heterogeneity within the US, poorer regions or regions where households were more leveraged displaying a higher marginal propensity to consume out of housing. Arrondel et al (2015) found a wealth effect changing across the wealth distribution for both housing wealth and financial assets, being higher in the bottom of the wealth distribution and for financial assets.

A strand of the empirical literature has focused on the role of housing as collateral for new loans (Goodhart and Hofmann, 2007). Oikarinen (2009) shows that house prices cause consumption loans to increase, accentuating the business cycle and the fragility of the financial sector, while Gimeno and Martínez-Carrascal (2010) claim that on one hand the collateral from house prices determines households' borrowing capacity, and on the other hand fluctuations in house prices change housing wealth, defining the level of households' expenditures and borrowing, and even contribute to a sense of no over-indebtedness. For Cooper (2013), the additional collateral from changes in housing values impact consumption of borrowing constrained households, in line with Mian and Sufi (2014)'s results who sustain that borrowed constrained households are more prone to spend from housing wealth.

Common causes could also be explaining the correlation between house prices and consumption. A shock over an underlying variable, such as income expectations, would move house prices and consumption in the same direction (Attanasio et al, 2009). A permanent increase in factor productivity would affect together agents' current wages and future wages expectations causing a pro-cyclical movement of both consumption and house prices. A monetary policy shock could be an additional common cause (e.g. Robstad, 2017).

3. Data and methodology

3.1. The Household Finance and Consumption Survey

This paper builds on household-level data collected from the first wave of the Household Finance and Consumption Survey (HFCS), which took place during the second quarter of 2010. The HFCS is run by the European Central Bank and pretends to be representative of each country population. In the Portuguese case, 8800 households were interviewed and results were reported for 4404. The survey contains information on wealth, income, and socio-demographics such as the age of the household head and household composition, education, the region where the household lives, homeownership status, and total indebtedness,

distinguishing mortgage debt from non-mortgage debt. Households' financial constraints are also reported, along with negative past events.

The unit of observation of the empirical model is the household, but socio-economic data was collected at the individual level. For that purpose, the household representative was identified with the adult male whenever possible, eliminating heterogeneity through gender (e.g., Costa and Farinha, 2012). To capture housing wealth effects the analysis focus on the population of homeowners corresponding to 2986 households.

3.2. Dependent and explanatory variables

To examine the effect of perceived house prices on debt, this study considers the following dependent variables: total debt, mortgage debt, non-mortgage debt of households who also hold mortgage debt, non-mortgage debt of households who do not hold mortgage debt, and a ratio of over-indebtedness. The first four variables capture households total outstanding liabilities measured in euros as reported by the HFCS.

The measure of risky indebtedness is a composite variable built combining indicators of alerting indebtedness amounts. The first indicator considers extreme a level of debt greater than 3-fold the household annual income. The second indicator classifies as extreme a debt amount greater than 75 percent of the household wealth. The third measure compares debt service to household income and the alarming threshold is established at 40 percent. The following ratio was calculated for each of these thresholds:

$$r_{ij} = \left(R_{ij} - R_j\right)/\left(R_{maxj} - R_j\right),$$

where r_{ij} is the measure of over-indebtedness for indicator j and household i, R_{ij} is the ratio of type j over-indebtedness of household i, R_j is the threshold ratio defined for indicator j, and R_{maxj} is the maximum value observed for indicator j across the households distribution. The ratio of risky indebtedness of each household i, is the average value of the three indicators:

$$r_i = \left(\sum_{j=1}^{3} r_{ij}\right)/3.$$

This variable is positive for households displaying over-indebtedness.

The main explanatory variables appraise the valuation of the residential property along tenure years comparing the "property value at the time of its acquisition" with the "current price of household main residence" as reported by the household. Two variables were considered: the rate of housing valuation as the ratio between the main residence current price and at the time of its acquisition, and the average annual rate of housing valuation as the former ratio normalized by tenure years. Additional explanatory variables are tenure years and the dummy variable homeownership controlling for households who have bought or built their main residence. Lastly, housing initial equity measures the difference between housing acquisition price and the amount of credit borrowed to purchase it.

Age, marital status, and education refer to features of the reference person. Dummy variables are used to identify the marital status married, widow(er), and divorced (the reference group here being those that are single), and the highest complete education degree, distinguishing between secondary and tertiary education from the reference group of those who have up to a primary school diploma.

Household types are captured by dummy variables that distinguish households with only adults, households with adults and dependants, and those with only one adult and dependants. Dependants are individuals younger than 25 years old who do not receive income, cohabit with the household and are not the household reference person or his spouse/partner, or his parent/grandparent. The number of dependants, the total number of individuals and the number of employed adults in the household are further covariates.

Household income sums all incomes received by household members during 2009, the year that precedes the interview, and is converted into logarithms. It includes regular income, namely employee income, income from self-employment, income from pensions and other regular social transfers, and further income that is the outcome of household's assets portfolio, comprising private business and financial assets, real estate property and other sources, and from regular private transfers. To examine the extent to which the impact of income on the likelihood of having debt differed among those who have a high

school diploma and the others an interaction term between the two variables is considered. Total wealth sums up real and financial wealth abridging the value of real estates, vehicles, businesses, and valuables, the set of household deposits, bonds, pension plans, mutual funds and other financial assets and is also converted in logarithms.

To assess the impact of the household financial status, the model considers two dummy variables: credit constraints and past adverse change(s). Credit constraints follow the definitions from the HFCN (2013) by classifying as credit constrained respondents who have responded having applied for a loan in the previous three years and have been totally or partially turned down or have received a lower amount than what they had applied for. This dummy also comprises respondents who reported not having applied for a loan due to perceived credit constraints. Past adverse change(s) captures households who have reported that at least one of its members had unfavourable job changes, a substantial reduction in their net worth in the three years that precede the interview, an unusually low income during the year reported in the interview, or an increase in regular expenses.

3.3. Debt and housing valuation

The Portuguese housing market is noticeable for the prevalence of homeownership. According to the HFCS, about 72% of Portuguese households held a residential property in 2010, a fact that can be ascribed to a poorly legislated and incipient housing renting market. Table 1 displays descriptive statistics for the models' dependent and explanatory variables. The typical individual in this sample is a 56 years old married male with basic education, owning his residential property for 22 years during which the dwelling total valuation was 18.7 fold against an average annual valuation of 0.5. The household average annual income is 21956 euros while the average accumulated wealth makes a total of 224750 euros. Other points of interest are the report of odd events, the majority of these individuals recording past adverse changes but only 2.9% feeling liquidity constrained.

(Table 1 about here)

Table 2 reports summary statistics for positive levels of debt and over-debt as well as the percentage of the population that has reported holding debt. The average amount of outstanding liabilities from a residential property, held by 37% of the population, was higher than the average amount of total debt that belonged to 44.2% of the population. About 7.3% of the population of homeowners accumulated exclusively non-mortgage debt while a significant group of around 17.1% of Portuguese homeowners revealed being over-indebted given at least one of the three formerly defined criteria.

(Table 2 about here)

Table 3 displays average debt amounts against the quartiles for housing wealth variables and tenure years. The similarities between the distributions of the rate of housing valuation and tenure years are evident, the size of debt and of risky indebtedness decreasing when moving from the bottom to the top of the distribution. The amounts of pure non-mortgage debt are the exception, the distribution exhibiting an inverted U-shape with a peak at the third quartile. Debt by quartiles of the average annual rate of housing valuation describes an inverted U-shape with a peak at the second quartile. As a whole, the distributions suggest that the size of debt is associated with homeownership, that debt fades with time, and that the housing wealth effects on debt may differ. Buying a residential property represents a considerable financial effort for Portuguese households, felt mainly immediately after its acquisition, or when its valuation is low.

(Table 3 about here)

3.4. Methodology

In the next sections, housing wealth effects on debt are estimated by applying the Tobit model (Tobin, 1958) that regresses a dependent variable with many observations clustered at a certain limiting value. In these cases, to avoid biased and inconsistent estimates it is not possible to use linear regression models such as ordinary least squares that assume that the dependent variable is normally distributed. The full sample can be considered with the maximum likelihood estimation of the Tobit model, specified as follows:

$$y_i^* = \beta' x + \varepsilon_i, \quad (1)$$

where x is a vector of explanatory variables and ε_i is the normally and independently distributed error term. y_i^* is a latent variable that is observed for values greater than zero (positive values of debt, and over-indebtedness) and censored for the value zero. Its counterpart is the observed variable y_i defined as:

$$y_i = \begin{cases} y_i^* \; if \; y_i^* > 0 \\ 0 \; if \; y_i^* = 0 \end{cases}. \quad (2)$$

It is possible to calculate the unconditional and conditional marginal effects on the observed variable by considering or not the information that the observed variable is positive. These marginal effects are represented by the expressions:

$$\partial E(y)/\partial x_j = F(z)\beta_j, \quad (4)$$

$$\partial E(y_i|y_i^* > 0)/\partial x_j = \beta_j(1 - (z)\gamma - \gamma^2), \quad (5)$$

where $\gamma = f(z)/F(z)$ with f and F respectively the probability and the cumulative density functions, $z = \beta' x_i/\sigma$, and σ is the standard error of the error term.

4. Model estimations

4.1. Total debt and mortgage debt

The first step is to examine the overall relationship between housing wealth perception and the most common form of debt among homeowners as a baseline model. Table 4 exhibits the maximum likelihood estimation results of the Tobit model and the marginal effects conditional on positive values of the latent variable for both total debt and mortgage debt. Features of the population are held at mean values, and then changed one by one, to estimate a ceteris paribus effect on dependent variables of a variation in each attribute.

The set of results display significant resemblances, exposing debt as mostly the consequence of purchasing a residential property. The estimates for the marginal effects of the housing variables were all significant at least at the 1% level corroborating the strong connection between being a homeowner and holding debt. However, the two main variables that capture housing wealth perception revealed opposite effects on the variation of outstanding liabilities. The size of debt and mortgage debt were shown to increase with the rate of housing

valuation, and with having had the obligation of incurring costs to purchase housing, but to decrease with the average annual rate of housing valuation, with tenure years, and with initial equity. For those with positive debt, a unit increase in the rate of housing valuation was shown to expand debt and mortgage debt by respectively 166 and 197 euros. Yet, a unit increase in the average annual rate of housing valuation displayed conditional marginal effects of -7559 and -8367 euros on debt and mortgage debt, respectively. It seems that households change their housing wealth perception if doing straight comparisons between housing initial price and its apparent valuation, or if normalizing this increase by tenure years.

Two factors may be contributing to these findings. First, most valued houses may be those bought at a longer time at relatively lower prices, their owners have residual mortgage debt from the long-term contract celebrated at the moment of its purchase or have contracted new mortgage debt to refurbish it. Secondly, debt involves a planned financial effort that is assessed by households on an annual basis and compared to its annual valuation, a comparison that may incite paying off debt. A greater annual valuation on average may encourage homeowners to write off their outstanding liabilities with what might have been understood as a reliable and promising asset. If this is the case, then the housing wealth effect on mortgage debt is to incite moving from partial tenure to complete tenure in light of what is faced as a solid investment worth allocating wealth to.

The results on other variables that control for housing impact reinforce the contribution of homeownership to the size of debt and mortgage debt. The negative effect from tenure years validates homeowners planning their housing financial effort within a given lifetime period. Not surprisingly, a lower initial financial effort acted in the same direction. Overall, homeowners' debt is the reverse of being able to invest in housing as they simultaneously consume it.

Further control variables in the model displayed expected results. The most relevant finding is household composition moulding outstanding liabilities: debt/mortgage-debt amplified among households in which several adults and dependants cohabit, as with the number of dependants, and employed adults. One additional individual in the household decreased debt holdings, possibly indicating poorer households in which many elements are forced to cohabit. Generally, outstanding liabilities are higher among medium-size younger

households with dependants, especially if the reference person has become divorced.

Income and wealth were seen to increase debt and mortgage debt holdings, the magnitude of the wealth effect being greater than income, perhaps reflecting collateral reasons. Nevertheless, the highly educated income was negatively related to their liabilities, pointing to heterogeneous responses of the population to debt. The inversion of the coefficient suggests some form of financial literacy with higher education increasing risk-aversion.

Debt amounts are often related to credit constraints or unexpected and adverse events. Liquidity constraints were found to surge debt, suggesting reverse causality, namely households with higher outstanding liabilities reporting to be credit constrained. Another possible explanation, and since credit constraints are not statistically significant for mortgage debt, is this representing the use of credit cards and their high interest rates. The level of debt accumulated by households was also found directly related to unexpected odd events, discarding precautionary savings motives across the Portuguese population, instead placing debt as a buffer, assuring maintenance of past life patterns until income recovers.

4.2. Non-mortgage debt

Previous section estimations may be capturing causality and even endogeneity between house prices and especially mortgage debt. One cannot exclude the possibility that increases in house prices drive increased debt. However, if the model focus on non-mortgage debt it is possible to seizure housing wealth effects on consumption. The estimations for non-mortgage debt are displayed in Table 5, distinguishing two dependent variables: outstanding non-mortgage liabilities of households that also hold mortgage debt (non-mortgage debt) from non-mortgage debt levels when there is no outstanding liability related to housing acquisition possibly implying that mortgage debt has already been paid off (only non-mortgage debt). The loss of statistical significance of the coefficients that capture housing effects clearly stood out in the first model, indicating that the appraisal of housing wealth is not relevant for households deciding the amount of

non-mortgage loans to undertake when they still hold mortgage debt. A changed scenario was offered for only non-mortgage debt: across households with positive non-mortgage debt, a one unit increase in the rate of housing valuation contributed to decreasing its size in about 76 euros. The estimations showed symmetric effects with respect to the average annual rate of housing valuation, augmenting debt holdings by 2291 euros. Besides the inversion of the housing wealth coefficients, these are also symmetrical to those estimated for total debt and mortgage debt, revealing reverse housing wealth effects by type of debt. Findings suggest that homeowners without outstanding liabilities from a costly and indispensable consumption good (their residential property), respond positively to relatively higher annual valuations of what is most likely their main asset and borrow to increase consumption as if recording a backwards subjective impatience. If impatience dominates households' decisions it is natural to expect this confidence response, the perception of increased wealth increasing current outstanding liabilities for purchasing consumption goods. Moreover, results expose distinct perceived housing wealth effects on further loans depending if they are meant to invest in the main asset or to consume once the investment acquisition has been accomplished.

Home acquisition was found to limit households' additional financial decisions, dropping non-mortgage debt holdings by 1103 euros. One extra tenure year allows households to overcome these behavioural constraints inducing the increase of loans to fulfil consumption needs. Also contrary to the effect on mortgage debt, a higher initial housing equity displayed a positive effect on consumption debt. The inversion of the signs of the coefficients for the set of housing variables when compared to the estimations for mortgage debt disclosures housing as a special good for homeowners. They consume it by doing an investment that retains their largest wealth share, possibly decreasing their cash on hand and limiting the access to other consumption goods. When homeowners perceive the housing market signalling an increase in their lifetime savings they feel they can adjust their consumption levels upwards, but have to demand for credit to do it. By contracting new loans, these households react as if anticipating the wealth effects as permanent. The fact that these results are only confirmed for those that do not hold outstanding liabilities with a mortgage,

reveals precautionary behaviours among Portuguese homeowners, taking their chances with consumption based on housing wealth after finishing investing on their lifetime security. Another possibility for the increase in mortgage debt is a substitution effect from the increase in house prices pushing households to increase the consumption of consumption goods whose relative price has become cheaper and that is backed by the double nature of housing.

Liquidity constrained households were predicted to hold higher non-mortgage outstanding liabilities, a puzzling fact that may again relate to reverse causality on the one hand, and to the use of credit cards by those that have less access to credit, on the other.

Socio-economic variables seem to play a minor role in explaining the size of non-mortgage debt held by the Portuguese population that does not have mortgage liabilities. The exception was households with dependants and the number of employed adults that were found positively related to non-mortgage debt. However, the set of socio-economic variables becomes relevant to explain the size of non-mortgage debt for households holding mortgage liabilities, debt increasing with income, and decreasing with age. Across the households distribution, a 1% increase in income produced an increase of about 864 euros on non-mortgage debt, as if a relative position at the top of income distribution induced optimism about households' future income expectations, and incited an increase in consumption through debt.

4.3. Over-indebtedness estimation results

About 17.1% of Portuguese households exhibited very high outstanding liabilities and were classified as over-indebted. The results for the estimations of over-debt are displayed in Table 6. A first overall impression is the resemblance between the signs of the coefficients for these estimations and those found for debt and mortgage debt, even if given the loss of statistical significance of several variables, the new model contains fewer variables. The rate of housing valuation was shown to be positively related with the over-debt ratio, while the average annual rate of housing valuation were found to be negatively related, as were tenure years and housing initial equity. The statistical significance of these coefficients

corroborates the relevance of homeownership for over-indebtedness. Since the number of tenure years contributes to erode over-indebtedness, the risk of defaulting seems to be higher for households owning newer residential properties, implying impatience as a cause of over-debt.

(Table 6 about here)

If the perception of housing valuation irrespectively of tenure years increases the over-debt ratio, when perception is a relative concept – how much did the residential property valued per year –the same risk-aversion behaviour that was found in the models for debt and mortgage debt emerged, as if a relatively well annually valued residential property triggered precautionary behaviours among households. Again, this indicates a better control of closer information than of a time distant one, with households' perception becoming more accurate when comparing the mortgage debt annual interest costs to their annual housing valuation. Initial housing equity was estimated to decrease the ratio of risky indebtedness reaffirming housing contribution to households' liabilities and showing that risky behaviours are more likely in adverse contexts.

Control variables partially replicated the results found for debt and mortgage debt, such as age decreasing the magnitude of over-indebtedness, or the number of employed adults increasing it. Total wealth was positively related to this ratio, signalling that financial institutions demand a warranty in exchange for loans and indicating that it is somehow difficult for households to hold debt above 75% of their total wealth. On its turn, a one percent increase in income was seen to decrease the ratio of over-debt which is most likely the consequence of having built it from two income thresholds. It is worth noticing the replication of results for past adverse changes and liquidity constraints, both statistically significant at the 1% level, and displaying positive effects, suggesting that risky behaviours are not necessarily deliberate but rather the result of unpredicted detrimental events such as unemployment.

Even if over-debt is the joint result of outstanding liabilities from a mortgage and consumption goods, the estimations point to housing as the main driver of risky debt. Housing is highly valued by homeowners who consume it and assume it as their lifetime investment. Occasionally, to own it they nearly default.

4.4. High and low-income groups

The size of debt might be associated with socio-economic features of the population, namely their relative income or relative wealth. Poorer households can be more dependent on credit to smooth consumption, especially if they anticipate an increase in future income within a context of economic growth. Nevertheless, the poorer may be more credit constrained, the richer having easier access to debt since they have collateral. In each case, the relative levels of income and wealth could lead to different debt behaviours in response to housing valuation. To this end, further estimations were performed for different groups of households classified by their total annual income and by total wealth. Table 7 displays average debt levels and risky indebtedness for households located at the top and the bottom income and wealth distributions. For both variables, the top group is shown to hold higher amounts of debt, the disparities being greater for average mortgage liabilities than for non-mortgage. Higher income reduces over-indebtedness while higher wealth increases it.

(Table 7 about here)

The estimations for non-mortgage debt were performed for the 20th and 90th income percentile and can be found in Table 8. Additional estimations took into account extreme levels of households' wealth, however the model variables became mostly non-statistically significant. Except for homeownership, the two models exhibit equal signs for the coefficients of housing wealth and in line with those found for total population, and apart from tenure years, their magnitude is significantly higher for the bottom income population. It seems that those who earn less are relatively more impatient, recurring significantly more to loans to fulfil their consumption needs, the housing wealth effect tending to be more intensively felt by this spectrum of the population that is relatively income constrained in their access to consumption goods. The fact that homeownership contributes to increase the size of outstanding liabilities with consumption for this group but to decrease it for the richer reinforces the intuition that the residential property is used to smooth their consumption. In addition, wealth is shown to increase debt holdings among the poorer, while it has a negative effect on the

upper-income group, confirming that collateral effects are more relevant for poorer households.

(Table 8 about here)

Among the estimations for risky indebtedness by income and wealth, wealth disparities results are more statistically significant than income differences and are replicated in Table 9. The magnitude of the coefficients is the main difference detected between the two extreme wealth quartiles, the poorer displaying larger absolute values for the estimated coefficients and relatively larger than the baseline model. It seems that if impatience related to the valuation of the main asset is the driver of over-indebtedness, the poorer reveal more prudent behaviours than the richer given their average annual rate of housing valuation. The requirements imposed by financial institutions to lend may be contributing to these findings, being less demanding with those that exhibit warranties contributing as such to their risk of default.

(Table 9 about here)

5. Conclusion

This study tested at the household level the assumption that housing wealth as appraised by homeowners can mould their decision on how much debt to hold. Two different measures of wealth perception were built based on housing relative price changes, both showing to be strongly related to the amounts borrowed by households for mortgage and/or non-mortgage purposes, and significant in explaining over-indebtedness. Results proved to be conditioned to the variable chosen to proxy housing wealth effects and to the type of debt that is responding to these perceptions. Mortgage debt, which is a less secured form of debt, reacts positively to the average annual rate of housing valuation but negatively to its absolute value, suggesting that households that throughout time experience relatively higher housing valuations will tend to feel confident and contract new loans for consumption purposes with the housing market behaviour feeding their impatience. The estimations for risky indebtedness, on their turn, indicated that it mainly mirrors mortgage debt results suggesting that if over-debt is the outcome of a bad decision it will be mostly related to housing acquisition.

Noteworthy is the significance of past adverse changes to explain unsafe debt holdings revealing that these are most likely a consequence of the inability to predict decreases in income from hardship such as unemployment periods.

Estimations by classes of income and wealth, focusing on the extremes of these distributions, showed dissimilar debt responses to housing wealth from distinct population groups, even if both groups exhibit a significant housing wealth effect. Low-income homeowners were predicted to be relatively more indebted than high-income ones and to apparently recur more to housing as collateral for consumption. The wealthier displayed higher levels of over-indebtedness suggesting that the perception of a valuable collateral can lead to insecure behaviours nurtured by financial institutions.

This paper has several practical implications. First, households that face a relatively rapid valuation of their main residence will tend to contract additional loans to increase consumption, revealing that homeowners update the information on their intertemporal human wealth in response to perceived movements in the housing market. This optimistic effect from house prices appreciation will be felt stronger within the lower income group possibly more liquidity constrained. Second, if over-debt is related to owning a house and having contracted long-run debt to purchase it, being richer tends to increase the relative amount of risky loans, those with lower real and financial wealth displaying lower risky ratios most likely since their collateral imposes upper limits to indebtedness. In this case, the optimism may belong to the financial institutions that grant loans and that face as riskier those with lower wealth, being willing to lend relatively higher amounts to richer houses as if facing their risk of default as lower.

The policy implications of this work are mainly two. First, it is important to establish rules for housing evaluation by financial institutions when the purpose is to accept it as collateral for credit lending. Since it is not easy to monitor the housing market, a better alternative could be to consider the valuations that are recorded by the fiscal authorities for mortgage tax purposes. Secondly, since over-indebtedness seems to be related with the constraints imposed from housing acquisition, to decrease the likelihood of default credit market conditions for housing purchase should be reconsidered. This would imply a tightening of the existing requirements for granting loans against declared wealth and should be

especially more pronounced with respect to what has been practised within the group of wealthier households. Nevertheless, since the largest share of Portuguese households are homeowners, these credit regulation measures will need to be compensated by policy measures to enlarge the housing rental market as for instance the public supply of housing for rental purposes.

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Appendix: Tables

Table 1. Dependent and explanatory variables summary statistics

Variable	Median	Mean	SD	Min	Max
Debt	0	23456.84	43141.84	0	610000
Mortgage debt	0	22102.14	42209.84	0	610000
Non-mortgage debt	0	1354.7	6611.608	0	150846
Only non-mortgage debt	0	675.4471	5372.886	0	150846
Over-indebtedness	0	0.0062031	0.0292451	0	0.708996
Home ownership	1	0.8640048	0.3427854	0	1
Rate of housing valuation	2.42	18.6618	52.71915	.03	771.6
Average annual rate of housing valuation	0.2	0.5352323	1.020472	.000833	13.3035
Tenure years	20	22.34875	14.30494	1	81
Housing initial equity	14900	34325.79	56000.7	-352600	750000
Age	56	56.48692	14.98011	18	85
Married	1	0.7118003	0.452927	0	1
Widow(er)	0	0.1459909	0.353099	0	1
Divorced	0	0.0687811	0.2530828	0	1
Secondary education	0	0.1235682	0.32909	0	1
Higher education	0	0.0888265	0.284496	0	1
Adults and dependants	0	0.4468878	0.4971738	0	1
One adult and dependants	0	0.0226929	0.1489233	0	1
Only adults	0	0.382051	0.4858915	0	1
Number of dependants	0	0.6186514	0.8638262	0	8
Total individuals	3	2.775773	1.240738	1	11
Employed adults	1	1.251675	1.047343	0	6
Income (log)	9.646011	9.630224	0.8654713	4.65396	13.31232
Income (log)*Higher education	0	0.9387536	3.016379	0	12.95217
Total wealth (log)	11.75508	11.78667	0.9439676	6.214608	17.127
Credit constraints	0	0.0290145	0.167848	0	1
Past adverse changes	1	0.5132915	0.499826	0	1

Source: HFCS, Authors' own calculations, HFCS 2013

Table 2. Households debt and over-debt summary statistics

	Participation rate (%)	Mean
Total debt	44.2	53040.84
Mortgage debt	37.0	59813.79
Non-mortgage debt	17.4	7766.32
Only non-mortgage debt	7.3	9287.649
Over-indebtedness	17.1	0.0362692

Note: All values are in euros. Participation rates are the fraction of all households with non-zero debt or over-debt and were calculated using population weights. The mean statistics are for those with positive debt and risky debt.

Table 3. Average debt by quartiles of the rate of housing valuation, of the average annual rate of housing valuation distribution, and of tenure years

Variable	Rate of housing valuation			
	Q1	Q2	Q3	Q4
Total debt	48866.63	28683.14	9561.12	2478.53
Mortgage debt	47394.91	26804.54	7987.86	2044.70
Non-mortgage debt	1471.725	1878.608	1573.26	433.83
Only non-mortgage debt	365.109	1045.445	1004.669	302.614
Over-indebtedness	0.01638	0.00513	0.00131	0.00054
	Average annual rate of housing valuation			
	Q1	Q2	Q3	Q4
Total debt	19855.85	33870.2	25609.66	13688.44
Mortgage debt	18339.05	32014.3	24153.65	13129.89
Non-mortgage debt	1516.792	1855.896	1456.019	558.552
Only non-mortgage debt	635.341	854.546	860.997	336.289
Over-indebtedness	0. .00565	0 .0076	0. 00793	0. 00351
	Tenure years			
	Q1	Q2	Q3	Q4
Total debt	54603.16	18229.57	6105.9	1900.994
Mortgage debt	52923.47	16383.32	4872.12	1315.411
Non-mortgage debt	1679.688	1846.257	1233.78	585.5834
Only non-mortgage debt	583.129	668.4589	988.898	513.2394
Over-indebtedness	0. 0157	0. 00348	0. 00119	0.00039

Note: All values are in euros.

Table 4. Debt and mortgage debt regression results

	Total debt		Mortgage debt	
	Coefficients	Marginal effects	Coefficients	Marginal effects
Home ownership	18522.236**	4753.6844***	31289.74***	6437.2446***
	(5875.4308)	(1379.6504)	(8519.0112)	(1509.7874)
Rate of housing valuation	598.05908***	165.72116***	852.85956***	196.82064***
	(136.57246)	(37.188958)	(169.51546)	(37.720008)
Average annual rate of housing valuation	-27278.744***	-7558.8764***	-36254.388***	-8366.689***
	(6904.805)	(1889.5994)	(9161.5294)	(2062.7968)
Tenure years	-2741.9936***	-759.79438***	-3650.0168***	-842.33494***
	(230.95894)	(56.198914)	(298.34822)	(55.653418)
Housing initial equity	-0.2171789***	-0.0601783***	-0.26383066***	-0.0608847***
	(0.03221046)	(0.00877752)	(0.03703592)	(0.00840408)
Age	-1517.8568***	-420.59106***	-1602.1728***	-369.7413***
	(178.52114)	(51.033894)	(205.82338)	(49.383634)
Married	-4884.2388	-1322.0592	-487.62238	-111.057556
	(6919.8524)	(1912.3464)	(8221.0944)	(1868.178)
Widow(er)	14210.214†	4300.4972†	4375.0086	1017.6812
	(7755.974)	(2332.0602)	(9915.463)	(2310.893)
Divorced	14691.436*	4459.1142*	16078.398†	3985.972†
	(7476.8176)	(2242.5128)	(8688.0034)	(2128.6352)
Secondary education	1526.20782	367.11327	-1373.36608	-277.91118
	(4397.179)	(1069.355)	(5007.3874)	(1002.21736)
Higher education	140227.12*	76389.192	137348.1*	61201
	(61477.298)	(50344.864)	(66612.368)	(46863.334)
Adults and dependants	14672.042*	3955.3278*	12274.288	2736.978
	(6842.5248)	(1766.9868)	(8406.3812)	(1817.5444)
One adult and dependants	-6779.2908	-1612.6302	-7658.5198	-1538.477
	(8748.6438)	(2056.1238)	(10005.3156)	(1984.3236)
Only adults	8908.78	2320.5286	10897.9134	2412.1598
	(7927.3216)	(2032.7784)	(9361.74)	(2037.1726)
Number of dependants	13134.466**	3639.4154**	15585.918**	3596.82**
	(4137.7298)	(1144.2806)	(5128.3668)	(1182.4968)
Total individuals	-6154.553*	-1705.3208*	-11711.486**	-2702.6946**
	(2787.9088)	(769.96284)	(3734.7606)	(856.01322)
Employed adults	8018.435***	2221.8482***	9277.3858***	2140.9962***
	(2288.168)	(632.3185)	(2798.9136)	(648.20024)
Income (log)	14092.678***	3905.005***	13257.262***	3059.5254***
	(2771.0738)	(749.48798)	(3325.342)	(750.40174)
Income (log)*Higher education	-13269.836*	-3676.9948*	-13135.904*	-3031.4196*
	(5906.2116)	(1627.817)	(6417.3164)	(1473.4912)
Total wealth (log)	19058.894***	5281.0958***	23276.994***	5371.698***
	(2498.5772)	(679.05508)	(2890.1008)	(658.36496)
Credit constraints	19578.81**	5425.1754*	10135.2414	2339.009
	(7595.7852)	(2106.2266)	(9276.6962)	(2145.4244)
Past adverse changes	6257.7722†	1732.6192†	7038.029†	1622.952†
	(3222.4536)	(887.07132)	(3805.7092)	(874.88856)
Constant	-255857.56***		-289806.28***	
	(34707.144)		(39898.97)	
	Number of obs 2986		Number of obs 2986	
	F(22, 2964) 35.788		F(22, 2964) 32.778	
	Prob > F 0		Prob > F 0	
	Log pseudolikelihood -15404153.8		Log pseudolikelihood -13024231.8	
	Pseudo R2 0.005712		Pseudo R2 0.06516	
	$\hat{\sigma}$ 52024.812		$\hat{\sigma}$ 56601.178	

Note: t-statistics within parentheses. ***, **, * and † indicate that the variable is statistically significant at respectively 0.1%, 1%, 5% and 10%

Table 5. Non-mortgage debt and only non-mortgage debt regression results

	Non-mortgage debt		Only non-mortgage debt	
	Coefficients	Marginal effects	Coefficients	Marginal effects
Home ownership	-2244.9268 (1861.8128)	-409.67196 (347.86034)	-7611.2374* (3155.648)	-1103.087* (476.60392)
Rate of housing valuation	-18.8877612 (95.000776)	-3.35836104 (16.89263)	-556.81756** (204.0103)	-76.143882** (27.25841)
Average annual rate of housing valuation	-3282.9418 (3870.2474)	-584.3495 (689.45816)	16755.456* (7095.1654)	2291.236* (954.5156)
Tenure years	-97.391808 (82.28806)	-17.332848 (14.674712)	412.12168** (146.30172)	56.359084** (19.5798)
Housing initial equity	-0.01982456† (0.01134756)	-0.00352808† (0.00201724)	0.07342518*** (0.01944848)	0.01004202*** (0.00263886)
Age	-153.26778* (67.283614)	-27.276744* (11.985038)	23.447836 (121.44194)	3.207168 (16.607882)
Married	-756.7603 (2282.789)	-130.1169 (395.52392)	-3563.697 (4255.44)	-480.95648 (588.00066)
Widow(er)	6249.5944† (3267.3148)	1197.3482† (640.55182)	7217.53 (5530.7524)	1088.3194 (837.97666)
Divorced	5565.8782* (2721.0242)	1054.8668* (515.1808)	5447.9506 (5141.0056)	806.15198 (760.24162)
Secondary education	3696.2168† (2057.7936)	608.53724† (351.85828)	2690.592 (3796.2154)	367.50294 (527.715)
Higher education	44590.336* (22289.992)	15073.234 (12306.828)	12409.7562 (42632.592)	1904.36496 (7197.383)
Adults and dependants	5363.653† (3076.8886)	916.79812† (506.94426)	10283.616† (5711.5444)	1363.5192† (718.8391)
One adult and dependants	5926.2326 (3725.015)	1021.84922 (668.6906)	16791.226* (6986.677)	2387.5124* (1054.9436)
Only adults	4016.4842 (3225.0502)	672.40214 (526.97586)	4704.269 (5998.1838)	588.84472 (737.00528)
Number of dependants	2779.484† (1589.355)	494.68436† (282.50426)	2194.9864 (2608.7716)	300.191 (356.38276)
Total individuals	69.822832 (1122.6742)	12.4121868 (199.81242)	2892.2488 (1918.289)	395.55828 (262.39352)
Employed adults	2297.0996* (956.57996)	408.81198* (170.21516)	3468.173* (1764.1068)	474.3236* (241.93104)
Income (log)	4853.1638*** (1235.4564)	863.7305*** (214.67246)	3469.0354† (2035.0904)	474.45558† (275.09734)
Income (log)*Higher education	-4358.903* (2138.3876)	-775.7733* (378.4605)	-1935.0268 (4007.1936)	-264.67722 (547.48222)
Total wealth (log)	516.45024 (911.02888)	91.910318 (162.01566)	434.68258 (1383.0266)	59.4479 (189.10634)
Credit constraints	17447.074*** (3154.1978)	3105.0452*** (546.65822)	14039.466** (5401.4174)	1920.0832** (729.78986)
Past adverse changes	2935.4992* (1417.8216)	521.98354* (250.12186)	1255.1152 (2455.3956)	171.62148 (335.4469)
Constant	-71846.524*** (17785.148)		-108183.5*** (32299.96)	
	Number of obs 2986 F(22, 2964) 4.82 Prob > F 0 Log pseudolikelihood -6002531.88 Pseudo R2 0.02812 $\hat{\sigma}$ 19028.194		Number of obs 2986 F(22, 2964) 2.22 Prob > F 0.00098 Log pseudolikelihood -2722947.62 Pseudo R2 0.02536 $\hat{\sigma}$ 26833.736	

Note: t-statistics within parentheses. ***, **, * and † indicate that the variable is statistically significant at respectively 0.1%, 1%, 5% and 10%

Table 6. Over-indebtedness regression results

	Over - indebtedness	
	Coefficients	Marginal effects
Rate of housing valuation	0.00106138*** (0.00025792)	0.00014608*** (0.0000325)
Average annual rate of housing valuation	-0.0534015*** (0.01515066)	-0.00734848*** (0.00194712)
Tenure years	-0.00416616*** (0.0006703)	-0.00057336*** (0.0000768)
Housing initial equity	-0.000000315*** (0.00000006222)	-0.00000004334*** (0.000000008382)
Age	-0.00197052*** (0.00029872)	-0.0002712*** (0.00004186)
Secondary education	-0.01086756 (0.00742028)	-0.0011921 (0.00079422)
Higher education	0.28463316** (0.109453)	0.12257328 (0.09116198)
Employed adults	0.00972004* (0.00477012)	0.00133682* (0.00065866)
Income (log)	-0.0428538*** (0.00814416)	-0.00589592*** (0.00104974)
Income (log)*Higher education	-0.02853228** (0.01079548)	-0.00392868** (0.00151768)
Total wealth (log)	0.02354394*** (0.00515372)	0.00323984*** (0.00067446)
Credit constraints	0.04422858** (0.01429094)	0.00608806** (0.00196652)
Past adverse changes	0.01917968** (0.00621296)	0.00263648** (0.00083802)
Constant	0.22364046*** (0.06710128)	
	Number of obs	2986
	F(13, 2973)	8.626
	Prob > F	0
	Log pseudolikelihood	178754.3
	Pseudo R2	1.66632
	$\hat{\sigma}$	0.070114

Note: t-statistics within parentheses. ***, ** and * indicate that the variable is statistically significant at respectively 0.1%, 1% and 5%.

Table 7. Debt by income percentiles and wealth quartiles

	Income		Total wealth	
	P20	P90	Q1	Q4
Total debt	5712.815	50098.24	5947.533	42288.15
Mortgage debt	5119.69	47284.16	5353.003	40355.86
Non-mortgage debt	593.1248	2814.08	594.53	1932.29
Only non-mortgage debt	490.0386	910.8762	400.9575	935.4024
Over-indebtedness	0. 010577	0. 001556	0. 005934	0. 003767

Note: All values are in euros.

Table 8. Only non-mortgage debt regression results for income percentiles 20 and 90

	P20		P90	
	Coefficients	Marginal effects	Coefficients	Marginal effects
Home ownership	136211.46*** 3166.6526	3874.8718* 1971.8252	-13597.814*** 2685.2802	-1853.831* 781.05516
Rate of housing valuation	-1729.1882*** 68.701434	-70.10115* 34.302042	-822.64984*** 52.492496	-99.96013† 58.292792
Average annual rate of housing valuation	60682.398*** 2777.9206	2460.4902† 1395.0652	27018.474*** 2266.7796	3284.9012 2288.0356
Tenure years	602.30176*** 86.651116	24.417406 16.198866	1454.4638*** 94.72003	176.70576 121.62846
Housing initial equity	0.16848538*** 0.03050208	0.00684216 0.00476022	0.10564172*** 0.01146144	0.01283298 0.0093928
Age	-405.38758*** 50.2776	-16.458858* 6.6033046	55.7416106 49.55525	6.8522409 10.2554692
Married	129740.4*** 3549.4226	2938.81* 1401.3646	139132.9*** 2932.606	7298.2418† 3913.843
Widow(er)	139987.6*** 2240.8962	3454.3276* 1613.0406	152956.56*** 2167.7728	9353.2214† 5006.727
Divorced	139657.4*** 2505.774	3437.0154* 1594.1954	165708.06*** 1667.2632	11827.8† 6558.909
Secondary education	-5017.9486* 2473.5552	-188.09424** 65.922286	-5835.1552* 2437.2302	-64.322616*** 15.152234
Higher education	-- --	37267.168* 17251.55	479412.54*** 2571.6478	219335.82*** 31545.812
Adults and dependants	-8941.459*** 2307.5396	-371.33426** 121.61709	-14132.012*** 2454.828	-1571.3034* 710.53234
One adult and dependants	-335.73172 2576.4446	-15.184046 118.36938	68712.232*** 3044.0464	19071.054 12198.718
Only adults	-15090.7206*** 3965.558	-603.49732** 205.53392	6938.4112* 2872.0844	931.10958 946.90698
Number of dependants	147.23494 1397.345	7.003218 66.85964	-3468.6206** 1231.0128	-421.9679** 157.409436
Total individuals	5915.7876*** 1030.33184	240.47266 166.03774	7350.7704*** 733.5057	894.96306 648.22814
Employed adults	5743.267** 1821.2472	232.22676 192.10324	-3100.0598** 1118.7962	-377.80272*** 103.540138
Income (log)	28024.79*** 365.8078	1140.80374† 613.41434	35261.984*** 257.95504	4293.9598 2718.8326
Income (log)*Higher education	-- --	-1339.3658† 702.08128	-43284.666*** 228.08832	-5266.6746 3271.4082
Total wealth (log)	3365.7394*** 277.68902	136.928306† 82.878704	-8254.9682*** 225.0255	-1004.34712† 601.22652
Credit constraints	15159.828*** 2437.0404	616.41266 403.11656	47483.662*** 2159.0922	5780.8708 3864.7248
Past adverse changes	5420.2028* 2560.2116	224.267378 222.88958	-8060.221*** 2411.1208	-985.37096** 330.0103
Constant	-603755.76*** 3166.6526		-506399.1*** 2913.8052	
	Number of obs 598 F(20, 600) -- Prob > F -- Log pseudolikelihood -251473.88 Pseudo R2 0.09914 $\hat{\sigma}$ 24688.194		Number of obs 298 F(22, 296) 994400000 Prob > F 0 Log pseudolikelihood -257573.46 Pseudo R2 0.05922 $\hat{\sigma}$ 28226.428	

Note: t-statistics within parentheses. ***, **, * and † indicate that the variable is statistically significant at respectively 0.1%, 1%, 5% and 10%

Table 9. Over-indebtedness regression results for wealth quartiles 1 and 4

	Q1		Q4	
	Coefficients	Marginal effects	Coefficients	Marginal effects
Rate of housing valuation	0.00292496* 0.00120274	0.00028168** 0.00009278	0.0009443* 0.00038902	0.00014524** 0.000056
Average annual rate of housing valuation	-0.19057656* 0.09005266	-0.0183635* 0.00719198	-0.0477725* 0.02138614	-0.0073492* 0.00311216
Tenure years	-0.00692128*** 0.0020936	-0.0006656*** 0.00015852	-0.0027563*** 0.00069714	-0.0004235*** 0.00009232
Housing initial equity	-0.000001676** 5.214E-07	-0.0000001614** 5.18E-08	- 0.00000010868* 4.496E-08	-0.0000000167* 6.752E-09
Age	-0.00392262*** 0.0009676	-0.0003779*** 0.00009746	-0.00082626* 0.00034502	-0.00012712* 0.00005286
Secondary education	-0.0916795* 0.04610802	-0.0075697* 0.00337674	-0.01580856† 0.0093147	-0.00087776 0.00053588
Higher education	-0.03166216 0.44124278	0.00017964 0.04501726	0.3675965* 0.18402364	0.19733902 0.1315641
Employed adults	0.0183207 0.01790276	0.00174032 0.00176886	0.00737102† 0.00427088	0.00113092† 0.00064184
Income (log)	-0.04226658 0.02810402	-0.00403052 0.00262742	-0.02229414** 0.00737618	-0.0034262** 0.00110192
Income (log)*Higher education	0.01510962 0.04668572	0.00142832 0.00445738	-0.03680208* 0.01769984	-0.005647* 0.00265628
Total wealth (log)	0.0361653 0.02712228	0.0034594 0.00257954	0.01404958* 0.00670446	0.0021579* 0.00100788
Credit constraints	0.106222* 0.05357236	0.01018314† 0.00523368	0.01756218 0.01981548	0.00269662 0.00303338
Past adverse changes	0.01986162 0.02159356	0.00191886 0.0021279	0.0086619 0.00724984	0.00133158 0.0011096
Constant	0.2032933 0.2935016		0.08867942 0.08793032	
	Number of obs 748 F(13. 735) 3.688 Prob > F 0.00004 Log pseudolikel. -24930.167 Pseudo R2 0.07949 $\hat{\sigma}$ 0.121578		Number of obs 746 F(13. 733) 2.464 Prob > F 0 Log pseudolikel. 85449.43 Pseudo R2 1.5155 $\hat{\sigma}$ 0.02755	