The vulnerability of indebted households during the crisis: some evidence from the euro area

*by L.Bartiloro, V.Michelangeli and C.Rampazzi**

November 2015

Abstract

Taking advantage of the first harmonised euro area survey on households' income and wealth, we analyse indebted households' vulnerability across the euro area countries. We investigate the role played by socio-demographic and mortgage characteristics on households' vulnerability, measured by a debt service ratio (DSR) greater than 40 per cent and income below the median. Among the former factors, having a self-employed head of household increases to a large extent the probability of being vulnerable. Among mortgage characteristics, only LTV ratios play a role. These results are overall confirmed when other indicators of financial vulnerability are considered, suggesting that our benchmark measure based on DSR and income may be a good synthetic indicator to monitor the financial conditions of indebted households for financial stability purposes.

Contents

* Financial Stability Directorate, Bank of Italy. We thank participants to the Lisbon HFCN meeting held in June 2014 for their useful comments. The analysis and conclusions expressed herein are those of the authors and should not be attributed to the Bank of Italy.

1. Introduction

The financial crisis has shown that households' vulnerability plays a pivotal role for financial stability: the rise in the indebtedness among American households and the ensuing difficulty to repay their debts has been a trigger to an unprecedented financial turmoil. From 2007 on, economists all over the world increased their focus on the role of private debt and its implications for financial stability.

In this paper we focus on the households' ability to repay their debt during a financial turmoil. The "ability to pay" is at the core of the borrowers' decision to default: mortgagors choose not to default on their loan as long as their income flow is sufficient to meet their periodic payments without causing an excessive financial burden (Campbell and Cocco, 2011). To this end, the most widely used indicator in the household finance literature is the debt service ratio (DSR) defined as the ratio between the debt service payments (inclusive of interests and capital repayments) and the household income. As this indicator treats equally all households regardless of the income quartile they belong to, it may fail to completely capture the overall ability to meet the debt obligations of the household sector. We therefore complement the DSR indicator with a threshold on the level of income, defining as vulnerable any indebted household with DSR equal or greater than 40 per cent and income below the median of the population.[1]

Using the data of the first harmonised euro area survey on households' income and wealth (Household Finance and Consumption Survey, HFCS), we examine, by means of logistic regressions, the relationship between households' vulnerability and the socio-demographic and mortgage characteristics, controlling for country-specific dummies, macroeconomics environments and banking system features, in order to clearly identify the main households' variables that are regularly associated with vulnerability. In particular, we find that households whose head is self-employed are 2.67 times more likely to be vulnerable than those with an employee as head of the household: this result reflects their higher income volatility and also the counter-cyclicality of self-employment, which expands during downturns as a way to avoid unemployment (Shapiro, 2014; Svaleryd, 2015). Among the mortgage characteristics, the only relevant feature for vulnerability is the ratio between the residual value of the loan and that of the house (loan-to-value; LTV). Large LTVs may reflect the absence of a sufficient amount of accumulated financial wealth at the time of loan origination or the fact that the household is at the beginning of its working life, with a low level of current income but with an expectation of positive income growth. Given the high housing transaction cost, a household may optimally choose to take a large initial debt that, in absence of negative economic shocks, could be repaid over the life-time. The fact that a financial turmoil has indeed occur, has led to an increase of the probability of being vulnerable for these households. In addition high LTV may reflect the banks' lending policies, indeed in the years just before the beginning of the crisis the supply of credit was quite loose across many countries. The other mortgage characteristics (recourse to refinancing, type of interest on the mortgage, number of mortgages held and their length) are not associated with an increase in vulnerability. For robustness analysis, we estimate the same regressions with others indicators of debt sustainability. All the main

[1] This definition of vulnerability is based on the equivalent income for the calculation of the median value. See Appendix for a detailed description of the variables included in the indicator.

results are confirmed, suggesting that the DSR is a simple and powerful indicator that conveys all the main information about the vulnerability of indebted households.

The paper relates to a wide strand of literature. Many studies concentrate on a specific country, measuring households' vulnerability across time and groups of households (IMF, 2011, 2012, 2013; ECB 2013b; Magri and Pico, 2012; Michelangeli and Pietrunti, 2014), or evaluating the determinants of the vulnerability itself (Brunetti et al., 2012), or discussing different indicators of financial fragility or over-indebtedness (Bartiloro and Rampazzi; 2013, D'Alessio et al., 2013, among others). Differently than those studies, our analysis extends to almost all euro area countries. In that sense, it is more in line with Bover et al. (2013) but, differently from this latter paper that focuses on indebtedness and not on vulnerability, it concentrates on indicators that are specifically relevant for financial stability analyses. Finally, we account for both macro and financial variables; Ehrmann and Ziegelmeyer (2013) use a similar approach but limit their analysis to the choice between fixed interest rate mortgages and adjustable interest rate ones.

The paper is organized as follows: section 2 shows some statistics on households' indebtedness across the euro area countries; section 3 introduces the economic model and the benchmark results; section 4 presents alternative indicators of vulnerability and robustness checks of the main results; section 5 concludes.

2. Indebted households' vulnerability in euro-area countries

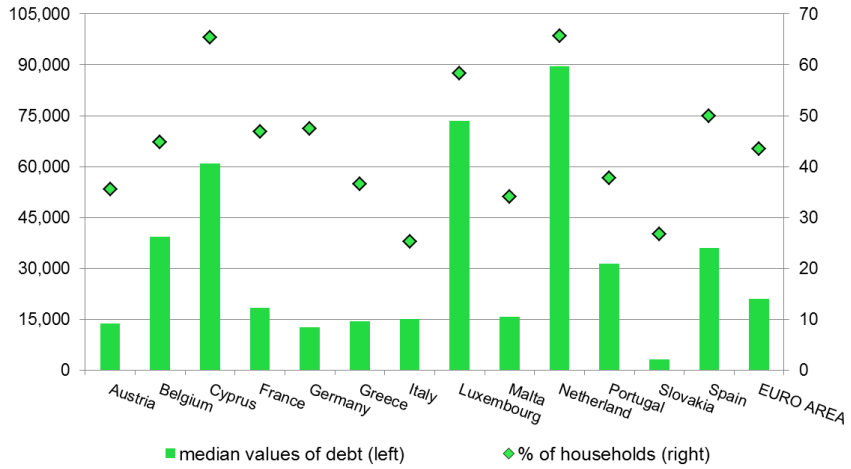
2.1 Data description

The analysis is based on the first wave of the Household Finance and Consumption Survey (HFCS), a harmonized survey on households' wealth, debt, income and consumption in the euro area, voluntary conducted by national central banks of the euro area member states and coordinated by the ECB.[2] The total sample of the first edition consists of about 62,000 households and covers 15 euro area countries; however, we excluded Finland from our sample because of lack of information on debt service and Slovenia because of the very limited sample size. Therefore, our euro area aggregate includes 13 countries (Table 1). Data are so far available for just one wave and they mostly refer to year 2010. Debt is defined as the sum of mortgages (on both household main residence mortgages and other real estate property mortgages), loans for consumption purposes (consumer credit), credit cards balances, credit lines/bank overdrafts, including loans held for business purposes.[3] The euro area is characterized by considerable cross-country differences with respect to both the percentage of indebted households and the median debt values (Figure 1). This heterogeneity may reflect differences in housing ownership rates and in the importance of small unincorporated businesses across euro area countries. Age, income and education level of household members could also matter, as differences in these demographic profiles across euro area borrowers are large (Bover et al., 2013). Another source of heterogeneity is the length of repossession periods: in countries with longer repossession procedures, the fraction of borrowers is smaller, as well as the amount borrowed by the youngest set of households.

[2] See Gambacorta et al. (2013) for a description of the main evidence resulting from HFCS. Estonia and Ireland will collect data only from the second edition onwards.

[3] See the Methodological notes in the Appendix for detailed information about the definition of variables.

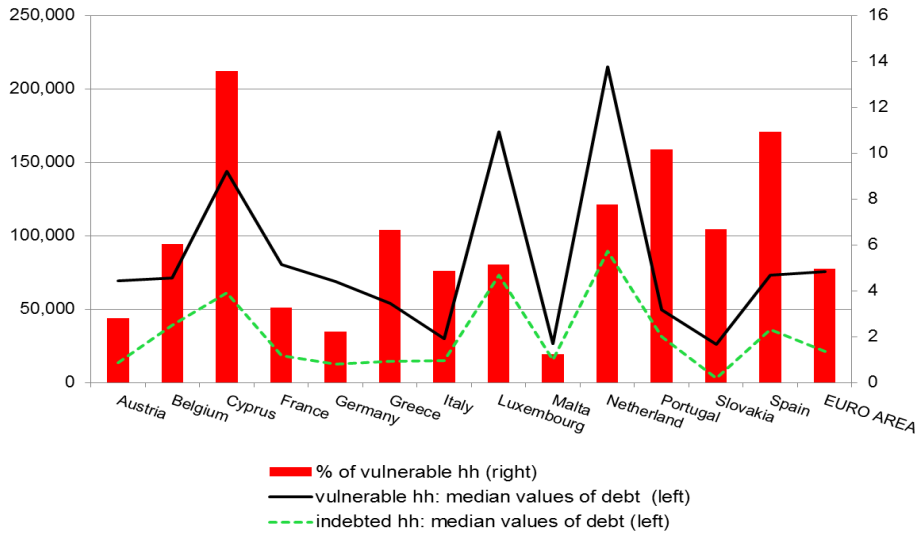
Figure 1. Indebted households (*euros and percentages on total population*)



2.2 The debt service ratio

In the household finance literature the standard indicator of household vulnerability is the DSR, which we adjust in order to account for household income characteristics: we define a household to be vulnerable if its DSR equals or exceeds 40 per cent and its income is below the median of the population.[4] Since a large share of current income is already used for repaying their debt, low income households may find it difficult to face other general expenses and to accumulate savings in order to offset unexpected negative economic shocks. Instead, richer households, even with DSR $\geq$ 40 per cent, can still rely on a large share of financial resources to save and smooth out their consumption and debt payments across adverse events. Therefore, in our analysis, we restrict our attention only to low income households (belonging to the first two quartiles of income).

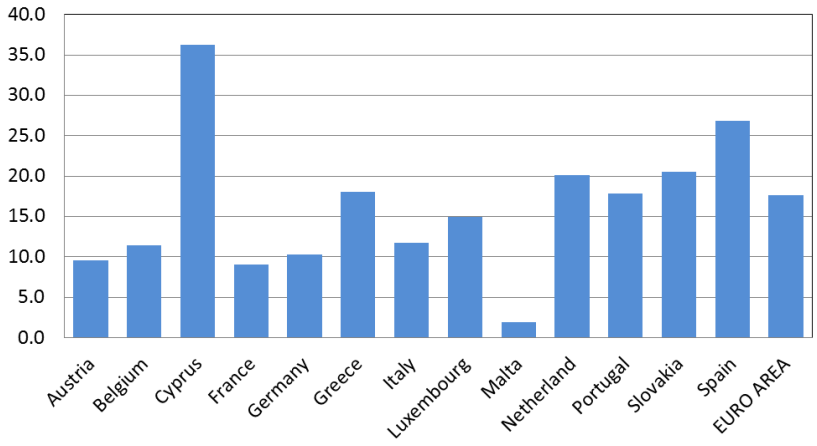
Figure 2. Vulnerable households (*euros and percentages on indebted households*)



[4] In HFCS income is gross, i.e. before tax payments. For some countries, like Italy, this definition differs from the one adopted by national surveys (see Methodological notes in the Appendix). Income and financial wealth quintiles are computed on national distributions.

About 5.0 per cent of euro area indebted households have DSR≥ 40 per cent and income below the median (Figure 2 and Table 2). The heterogeneity across countries is quite high, even if in each euro area country the median value of debt held by vulnerable households is usually much larger than the median value of debt held by all indebted households.

Figure 3. Share of debt held by vulnerable households (*percentages*)



To assess the potential risk for the financial system, we compute the total amount of debt held by vulnerable households as a share of the total debt (Figure 3). For the euro area as a whole about 18 per cent of the total debt of the household sector belongs to vulnerable households. Nevertheless, for some countries this percentage is higher: in Cyprus and in Spain more than one fourth of country's household debt is held by the vulnerable ones. Indeed, vulnerable households represent a non-trivial risk for financial stability in the euro area, in particular for some countries.

3. The multivariate analysis

3.1 The model

The "ability to pay" (also called "cash flow approach"), here represented by the DSR together with the income level, is one of the determinants of borrowers defaults (Wong et al., 2004): as long as income flows are sufficient to meet the periodic payment defaults can be avoided. However, unexpected shocks to income or interest rates may affect the households' ability to meet their debt obligations (see, among others, Campbell and Cocco, 2011; Burcu and Grant, 2009; Elul et al., 2010; Campbell and Dietrich, 1983). Indeed a decrease in household income, driven by either an idiosyncratic or a macroeconomic shock, may reduce the resources available for servicing the debt and thus cause a delay in debt repayment or, in the worst case scenario, a default. While negative income shocks have a similar impact on all indebted households, an unexpected interest rate increase affects the ability to pay only of those households with adjustable rate mortgages, whose instalment is linked to a reference rate.

As follows, we examine quantitatively which households' and mortgage loans' features are more likely to be associated with vulnerability; we exploit the cross-section dimension of the data for the year 2010 and, using alternative specifications, we control for country dummies, or for the

characteristics of the macro and financial environment. In our benchmark logistic regressions the dependent variable is equal to 1 if the household has a DSR≥40 per cent and income below the median, 0 otherwise; we then perform robustness checks using other indicators of financial fragility (see Section 4). The logistic model is defined as follows:

$$\Pr(\text{vuln} = 1) = \beta_0 + \beta_1 sex + \beta_2 HMR + \beta_3 age + \beta_4 educ + \beta_5 Nchild +$$

$$\beta_6 Nearners + \beta_7 work + \beta_8 finass + \beta_9 mortg + \beta_{10} conscred + \beta_{11} Y_j + \beta_{12} L_{ij}$$

where *sex* is the gender of the head of the household, *HMR* is a dummy variable equal to 1 if the household owns her main residence, *age* is the head of the household age class (<35, 35-44, 45-54, 55-64, >=65), *educ* is education level (low if primary education or lower secondary or second stage of basic education, middle if upper or post-secondary, high if first stage tertiary or higher) of the head of the household, *Nchild* is the number of dependent, i.e. non-income earners, children (equal to 0, 1, 2, or greater than 2), *Nearners* is the number of income earners (equal to 0, 1, 2, or greater than 2), *work* is the work status (employee, self-employed, unemployed, retired, other), *finass* is the quintile of financial assets based on each country distribution, *mortg* is a dummy equal to 1 if the household has only mortgage debt and 0 otherwise, *conscred* is a dummy equal to 1 if the household has only a loan for consumption purposes and 0 otherwise, Y_j includes all controls introduced in alternative specifications of the model (country dummies, macroeconomic variables – inflation, GDP growth, unemployment rate – and banking sector variables – concentration, size, profitability, growth rate of bank loans – at a country level; Table 3), L_{ji} includes the variables related to mortgages on the home main residence (LTV, number of mortgage loans, refinancing, mortgage length, type of interest rate) hence restricting our sample size.

The estimated coefficients capture how the odds of being vulnerable (i.e. the ratio of the probability of being vulnerable to the probability of not being vulnerable) change according to the values taken by the explanatory variables with respect to a baseline. Odds values higher than 1 imply that the probability is higher for the category defined by the explanatory variable under evaluation with respect to the baseline. The baseline demographic characteristics are those of the median euro area vulnerable household: the head of the household is aged between 35 and 44; he is an employee, with a level of education classified as 3 or 4 in the ISCED definition (upper secondary and post-secondary non-tertiary education); there are two income earners in the household and no dependent children; the household belongs to the first quintile of financial assets and has both a mortgage and loans for consumption purposes.

We first consider all indebted households (Table 4) presenting four regression models, where we include, among the independent variables, respectively country dummies,[5] only macroeconomics variables, only banking sector variables, macroeconomics and banking sector variables, in addition to household's characteristics. In order to evaluate the role of mortgage characteristics, we then focus only on households with mortgage debt (Table 5).

[5] Excluding Germany.

3.2 Main results

In the first regression (Table 4, model 1) we include households' characteristics and control for the country dummies that capture all country differences, either observable or not-observable. One of the characteristics mainly related to household vulnerability is the job type. Self-employed heads of household are 2.67 times more likely to be vulnerable than those who are employee. This effect is explained by the higher income volatility associated to this kind of job type relative to other types of employment. This is specifically true given that our exercise refers to 2010, the period that just followed the beginning of the most recent economic crisis. Indeed, the higher income volatility is likely to be more pronounced during economic downturns, reflecting both the income change for the "long-lasting" self-employed and a change in the composition of the self-employed. With respect to the first change, a large number of studies support the pro-cyclicality of real wage, so that wages rise in economic booms and decrease in economic downturns (Keane, Moffitt and Runkle, 1988; Raisian, 1983; Greenwal and Stiglitz, 1988). This effect is more pronounced for the self-employed, whose income is not constant and relies on any other household willingness to consume. Second, while unemployment is procyclical, self-employment could be countercyclical, as it expands during downturns following the higher transition rates out of unemployment and into self-employment (Shapiro, 2014; Svaleryd, 2015). A change in the composition of the self-employed with an inclusion of the unemployed may enlarge the share of those with low income, and thus vulnerable. Those households are thus more exposed to income risk and, as a consequence, are also more likely to default (Diaz-Serrano, 2004). This effect is also common to all the euro area countries, regardless of the significant differences across labour markets (for example, see Brandolini et al. (2014) for the differences across the euro area countries in the qualifying period, the replacement rate and the duration for the unemployment insurance scheme). The coefficients associated to other job types, such as unemployed, retired or other, are not statistically significant, meaning that their probability of being vulnerability is the same of that of the employees.

While the job type affects income volatility, the number of income earners has a direct impact on the income level. The number of income earners is associated with a decrease in the likelihood of being vulnerable up to a certain threshold: households with zero or one income earner are respectively 3.95 and 1.93 times more likely to be vulnerable than a two-income earner households, but the coefficient associated with the category "three or more income earners" is not statistically significant, suggesting that increasing the number of earners above two has no effect on the likelihood of becoming vulnerable. Furthermore, vulnerability decreases with higher financial assets:[6] for households belonging to the second quintile and to the fifth quintile the odds of being vulnerable are respectively 0.72 and 0.36 those of a household in the first quintile of financial assets. This result suggests that households able to accumulate more savings, probably perceive a higher income and are then further away from being liquidity constrained. Having more dependent kids increases the likelihood of being vulnerable, as a larger house size is needed and thus higher debt and mortgage instalments are to be paid. In particular, households with three or more kids are 2.11 times more likely to be vulnerable than a household without kids. Age is not significant because the characteristics that banks consider the most in their decision to grant a loan (income

[6] From the multivariate analysis the financial assets distribution refers to the euro area.

level, job type) are already present in the model (Michelangeli and Sette, 2015). Having only one type of loan (either mortgage or non-mortgage debt) decreases the likelihood of vulnerability compared with the baseline condition of having both mortgage and non-mortgage debt, because for the latter the median value of debt is much higher than the sum of the median values of the former two. Among the country fixed effects, only those for Belgium, Cyprus, Spain, Luxembourg, Netherland, Portugal and Slovakia are statistically significant. In particular, for households living Cyprus, Spain and Netherland the odds of being vulnerable are higher than for those living in Germany (baseline for country fixed effects).

In the second regression (Table 4, model 2), we control for the main macroeconomic variables: inflation, GDP growth and unemployment rate. We choose to include those variables as measured in the same year, 2010 since they have a direct effect on real income and thus on the household ability to service the debt. One could argue that there can be some endogeneity issue as vulnerable households may have an effect on the same macroeconomic variables. Nevertheless, we believe that this effect, if present, would likely be minor, given the small percentage of vulnerable households in the population. All the main results associated with the household socio-demographics are confirmed: the coefficients for the odds ratios are significant and take similar values as in the model 1. The coefficients for most of the macroeconomic variables are significant and take the expected sign. A higher inflation is usually associated with an increase in nominal income, without affecting the nominal debt and hence it indirectly reduces the burden associated with the debt repayment, lowering the odds of vulnerability. Similarly, higher GDP growth is associated with some positive disposable income trends, lowering the likelihood of becoming vulnerable. With an increase by one percentage point in the GDP growth rate the odds of vulnerability are 0.76 times those in the baseline scenario (the average GDP growth in the sample is 1.75 per cent). The unemployment rate is not significant in this model.

In the third regression (Table 4, model 3), we control for the key characteristics of the national banking sector, i.e. cyclical effects (computed as the growth rate of bank loans granted to the household sector), concentration (measured by the assets of the five largest banks as a share of the assets of all commercial banks), and size (proxied by deposits-to-GDP). The variables are averaged over a ten-year period (2000-2010) in order to better capture the influence of the characteristics of the banking system on the debt at the time of its origination and to include the long run trend.[7] All the main results associated with the household socio-demographics are confirmed. The coefficients of the banking variables are significant and have the expected sign. In particular, during a credit booming phase the probability of granting loans to less solvent households increases thereby rising vulnerability. Indeed, credit booms typically anticipate financial crisis (Jordà et al., 2011; Schularick and Taylor, 2009), suggesting that during years of positive and large lending growth rates, credit is granted also to more vulnerable counterparts, as it has been observed for the United States (Dell'Ariccia et al., 2012). The coefficient for the growth in bank loans is greater than 1 but overall quite small: with an increase by one percentage point in loans growth, the odds of being vulnerable are 1.03 times higher (the average loans growth in the sample is 10 per cent). Concentration is, to a minor extent, positively related to vulnerability. That may

[7] We tested alternative specifications, such as an average of the banking variables pre and post financial crisis (2000-2006, 2007-2010), a five-year period (2006-2010), a single year (2010), and the main results with respect to the socio-demographic variables are confirmed.

reflect the fact that more concentrated banks, protected by a government safety net, have the incentive to assume a greater risks than they otherwise would and the depositors have a little incentive to monitor the banks to make sure that they are not assuming too much risk (Mishkin, 1999). More concentrated banks also have a larger buffer of capital that allows them to better absorb losses (Holmstrom and Tirole, 1997; Thakor, 2014).

In the fourth regression (Table 4, model 4), we jointly consider the socio-demographic, macroeconomic and banking variables. All the results for the socio-demographics are confirmed, as well as those for the macro and banking variables with two exceptions: the unemployment rate is significant in this specification and positively related to the likelihood of being vulnerable, while loans growth is not significant anymore.

3.3 The role of mortgage characteristics

In the second set of regressions (Table 5) we restrict the sample to households with a mortgage debt on the home main residence for which we have some information about the loan characteristics. In model 1 we control for country fixed effects, in model 2 for the macroeconomic variables, in model 3 for the banking variables and in model 4 for both macro and banking variables. Most of the previous results are confirmed. In particular, across the different specifications, the most important determinants remain the self-employed work status of the head of the household and the number of income earners. In particular, the coefficient associated with a self-employed head of the household is 2.32 (2.67 in the benchmark regression with all indebted households)[8]. As far as mortgage characteristics are concerned, the only variable affecting in a relevant way household vulnerability is the LTV, while the other features tested (number of loans, having refinanced a previous loan, mortgage length, and interest rate type) are not statistically significant. A high LTV is associated with an increase in vulnerability. In model 1, the odds of being vulnerable for a household with a LTV greater than 50 per cent and smaller than 80 per cent are 2.43 times those of the baseline household with a LTV smaller than 10 per cent. Similarly, for a household with a LTV greater than 80 per cent, the odds are almost 3 times those of the baseline household. Residual LTV is high either because LTV at origination is high and/or because the household is at the beginning of the working life with a low income level but expected income growth; as our data refer to 2010, the high LTV may also reflect the loose banks' lending policies during the years preceding the financial crisis. In this specification where only mortgagors are included and mortgage characteristics are accounted for, the macro variables are no longer significant with the exception of the unemployment rate (model 2 and 4), while some banking variables still exert a minor effect on vulnerability (model 3 and 4).

4. Other indicators of vulnerability

So far the analysis concentrated on the DSR, in line with the usual focus taken in the literature. However, it may be worth looking at the consistency of the results when other indicators are taken into account (see, for instance, Lusardi et al., 2011; Bartiloro and Rampazzi, 2013;

[8] The coefficient associated with zero income earners is much larger and equal to 5.25 when we restrict the analysis to mortgagors (3.95 in the benchmark regression with all indebted households).

D'Alessio and Iezzi, 2013; Brunetti et al., 2012; ECB, 2013b; Zeldes, 1989). We select four indicators and for each of them we define a specific threshold: households below (above) the threshold are defined as vulnerable. [9]

i. debt to income ≥3
ii. net wealth < 0
iii. income - debt payments < food expenses
iv. financial assets < 2 months of income

The first and second indicators consider the liability side of the household balance sheet, and its interaction with income and total assets in the long-run.[10] These indicators have been used in the past to identify households with a heavy debt burden, which could be related either to consumer debt or to mortgage debt; the selected thresholds have been used in related studies and by the ECB (ECB, 2013b). The first indicator measures the long-run ability of repaying the total accumulated debt given the future stream of income; specifically it provides an indication of the number of years before the debt would be completely extinguished if total income could be devoted to its repayment. Similarly, the second indicator focuses on the long-run ability to repay debt using accumulated savings (i.e. real and financial assets). It elicits those households that, in the case of a total income loss, would not have enough financial or real resources to fulfil their debt obligations; the threshold has been chosen to capture this extreme case.

The remaining two indicators account for the ability of a household to offset an expected or unexpected expense with its income or financial wealth in the short run: the focus is on the liquidity of the household portfolio, pointing to the short run ability to face expected (indicator iii) and/or unexpected expenses (indicator iv). We consider the role of the household structure by choosing household-specific thresholds. Specifically, the third indicator implies that a household is vulnerable if its disposable income after debt service is less than the value of food expenses as defined by the same household.[11] Similarly, for the fourth indicator we do not choose a unique threshold for all households, but we define it according to the amount of resources needed by the single household to sustain expenses of an extraordinary amount, that we measure as two months of households' income;[12] this indicator, as well as the threshold, has been used in the related literature to identify liquidity constraints (Zeldes, 1989).

Table 6 shows that regardless of the indicator that we select to analyse vulnerability, the countries for which three to four indicators are higher than the euro average are the same as those that have a higher percentage of vulnerable households according to the benchmark indicator (Cyprus, Greece, Netherlands, Slovakia, Portugal and Spain). That suggests that the DSR indicator augmented to account for the household's income quartile is a good proxy of the vulnerability of indebted households.

[9] For the detailed composition of the different indicators see the Methodological Notes in the Appendix.
[10] Financial assets include: deposits, bonds, managed accounts, shares and other equity.
[11] Here food expenses are used as a synonym of minimum consumption.
[12] Other papers (Lusardi et al., 2011, Brunetti et al., 2012) chose a fixed amount (2,000-1,500$ monthly), but we wanted an indicator that could deal with different households' compositions and national price levels.

Using those alternative definitions of vulnerability, we evaluate the likelihood of being vulnerable as a function of households' characteristics, controlling for national characteristics. The results are reported in Tables 7-13. The main results obtained for our benchmark indicator are overall confirmed: variables representing the number of income earners, the work status of the head of the household, financial assets, and having only mortgage or non-mortgage debt do remain statistically significant, maintaining the sign, in almost any case. The role of national characteristics is overall confirmed too. Still some exceptions are detectable, in particular for negative net wealth likely because of limited data.[13]

We also built a vulnerability index that accounts for the different indicators that we have evaluated. To assign weights to the indicators, we use the principal component analysis (Table 14).[14] The index takes continues values, hence we use an OLS regression to analyse the main determinants. The results overall mimic the ones we got with our benchmark indicator and also provide more information: some potential determinants of vulnerability that previously did not appear significant have instead an effect when all indicators are simultaneously accounted for (Tables 15 and 16). In particular having a young (<35 years) head of the household increases the likelihood of being vulnerable, while being over-55 or retired reduces it.

5. Conclusions

The analysis on indebted households' vulnerability during the crisis has pointed to some interesting features that it would be important to consider on a financial stability perspective. A first important result for financial stability is the relevance of loan to value, while no effect has been detected for the type of interest rate, the number of mortgages or their duration. High LTV ratios are associated with increasing vulnerability. The importance of LTV is not new to macro-prudential authorities, as it is positive correlated with borrowers' default, for which vulnerability is a leading indicator. Our study supports the importance of setting limits to the LTV, as to affect the borrowers' incentives and ability to repay their loan, especially in face of negative economic shocks. Limits to the LTV would have a further positive effect on the financial system, as they may reduce the banks' incentives to take excessive risks. This result is also reinforced by the positive correlation that we found between the growth rate of bank loans and vulnerability. We therefore obtained an empirical support for the recent orientation of macro-prudential authorities to monitor both the LTV ratios[15] but also the amount outstanding and the growth rate of loans granted to the private sector.[16]

Another interesting result is the strong correlation between self-employment and vulnerability, which may suggest the implementation of some policy initiatives to support the liquidity of self-employers: first of all, these households, with a more volatile income, should optimally accumulate more precautionary savings in good times to meet the mortgage payments in case a negative income shock arises. Indeed, vulnerability is negatively correlated with the level of financial assets, thus more savings would preserve the ability to repay their debt. This goal could be

[13] For the indicator negative net wealth, due to limited data, we only run a logistic regression for all households.
[14] See Appendix for further details. The PCA confirms that the importance of the indicator DSR≥40 per cent, as a matter of fact that indicator is assigned the highest weight.
[15] Included for example in the ESRB Risk Dashboard, among others.
[16] See the Macroeconomic Imbalances Procedure of the European Commission.

simply achieved by means of financial education, aimed at teaching to self-employers in particular, but to all households in general, to accumulate savings in good times that serve as a buffer for the rainy days. More space for policies initiatives concerns the development of an efficient mortgage insurance market, through which self-employers should voluntary obtain an adequate coverage of the income risk.

In sum, our indicator based on the DSR and on income level is a good measure of financial distress in the household sector, as it allows identifying which socio-demographic and mortgage characteristics affect the most the vulnerability of indebted households. The results based on our benchmark indicator are also in line with those obtained using other indicators of financial fragility evaluated in the related literature. This supports the inclusion of indicators based on the DSR in any risk dashboard that displays the financial stability risk, while less need seems to emerge for the simultaneous presence of other indicators. It is therefore crucial that macro-prudential authorities work on a unique, correct and exhaustive way of using the DSR in order to identify vulnerable households.

Tables

Table 1 - Characteristics of the HFCS sample and of the reference population (*units*)

	Size of the sample	Number of households
Austria	2,380	3,773,956
Belgium	2,327	4,692,601
Cyprus	1,237	303,242
France	15,006	27,860,408
Germany	3,565	39,673,000
Greece	2,971	4,114,150
Italy	7,951	23,817,962
Luxembourg	950	186,440
Malta	843	143,677
Netherland	1,301	7,386,144
Portugal	4,404	3,932,010
Slovakia	2,057	1,911,664
Spain	6,197	17,017,706
EURO AREA	**51,189**	**134,812,960**

Table 2 - Descriptive statitistics of households with DSR>=40 per cent& income<median (*percentages of indebted households*)

	Austria	Belgium	Cyprus	France	Germany	Greece	Italy	Luxembourg	Malta	Netherland	Portugal	Slovakia	Spain	*Euro Area*
Vulnerable households	2.8	6.0	13.6	3.3	2.2	6.7	4.9	5.1	1.2	7.8	10.2	6.7	10.9	*5.0*
EDUCATION														
Low *(ISCED 1-2)*	5.7	7.2	24.5	3.5	3.8	7.6	6.9	5.3	0.5	8.1	13.0	20.2	15.0	*8.4*
Medium *(ISCED 3-4)*	2.8	6.4	19.1	3.7	2.1	7.1	4.0	7.6	3.5	6.0	6.8	6.9	11.8	*4.1*
High *(ISCED 5-6)*	1.4	5.4	6.9	2.4	2.0	4.8	2.1	2.0	n.c.	9.0	3.4	4.8	5.1	*3.5*
AGE CLASS														
<35	2.4	6.1	14.3	2.5	3.2	6.7	6.9	6.5	0.4	8.3	13.2	6.8	14.2	*5.7*
35-44	3.4	4.4	14.7	4.4	0.7	5.9	5.5	6.2	2.2	8.5	11.2	9.3	12.2	*5.4*
45-54	2.7	8.3	11.9	3.7	1.3	6.9	5.0	5.1	0.9	10.6	10.3	6.0	9.5	*4.7*
55-64	1.9	5.9	15.4	2.5	4.4	10.0	3.4	2.9	1.1	5.7	6.6	1.0	6.4	*4.4*
>=65	4.4	3.6	8.6	2.4	2.5	2.1	2.7	n.c.	n.c.	4.3	6.3	n.c.	10.2	*3.9*
Working status														
Employee	1.9	3.3	9.5	2.3	1.5	2.3	2.6	5.2	1.2	6.2	7.8	7.7	9.2	*3.6*
Self-employed	3.5	12.3	22.3	8.9	4.2	8.0	5.8	9.0	2.4	23.2	16.6	n.c.	12.3	*8.0*
Unemployed	7.6	15.6	35.6	6.9	2.6	15.2	18.4	9.3	n.c.	16.2	17.2	7.8	15.6	*10.1*
Retired	3.8	5.9	11.6	1.9	3.0	7.2	5.0	2.8	n.c.	3.6	8.8	n.c.	6.9	*3.7*
Other	3.4	11.9	23.6	8.2	3.2	13.3	11.5	3.7	1.8	11.5	18.2	11.3	15.4	*9.3*
Quintile of net wealth														
1°	3.9	3.3	17.4	1.3	2.7	8.1	8.3	8.6	1.4	10.9	12.7	9.5	16.9	*4.7*
2°	1.2	3.2	18.0	2.1	1.1	4.8	6.9	7.3	0.9	5.7	16.6	6.2	13.2	*4.4*
3°	2.6	2.2	10.6	3.3	2.1	6.4	2.4	2.7	0.6	6.9	8.8	5.1	10.9	*5.8*
4°	2.1	2.1	12.6	4.2	1.8	9.2	4.5	3.5	0.4	6.3	9.1	7.0	6.0	*5.1*
5°	3.7	1.8	11.1	4.8	3.1	5.0	3.2	4.0	2.9	8.0	5.7	4.9	7.7	*4.7*

Due to data limitation, in some subsets we choose not to use multiple imputation to compute the statistics of this Table. We still employ the survey household weights.

Table 3 - Banking sector (average 2000-2010) and macroeconomics characteristics (2010)
(*percentages)*

	Bank concentration	Bank deposits to GDP	Growth rate of loans	Inflation	GDP growth	Unemployment rate
Austria	42.3	154.8	5.9	1.7	1.8	4.4
Belgium	80.8	237.3	3.3	2.3	2.3	8.2
Cyprus	61.6	385.6	13.5	2.6	1.3	6.3
France	48.7	140.3	8.1	1.7	1.7	9.7
Germany	22.8	152.8	1.0	1.2	4.0	7.1
Greece	67.3	132.8	22.0	4.7	-4.9	12.5
Italy	29.5	89.6	9.4	1.6	1.7	8.4
Luxembourg	31.0	1761.8	6.7	2.8	3.1	5.8
Malta	75.8	486.5	10.2	2.0	4.2	6.9
Netherlands	84.2	193.9	6.2	0.9	1.5	4.5
Portugal	65.8	184.0	9.0	1.4	1.9	10.8
Slovakia	68.0	111.7	21.4	0.7	4.4	14.5
Spain	42.8	164.0	13.2	2.0	-0.2	20.1

Table 4 - DSR ≥40 per cent and income below the median (all indebted households) (*Logit estimations – Odds ratio*)

	Model 1		Model 2		Model 3		Model 4	
	Odds ratio	Std. Err.	Odds ratio	Std. Err.	Odds ratio	Std. Err.	Odds ratio	Std. Err.
Sex: female	1.15	*0.17*	1.15	*0.17*	1.14	*0.17*	1.16	*0.18*
Tenure of house: non owner	0.88	*0.19*	0.82	*0.17*	0.80	*0.16*	0.84	*0.18*
Age <35	1.34	*0.26*	1.35	*0.26*	1.33	*0.25*	1.32	*0.26*
Age 45-54	1.06	*0.19*	1.07	*0.19*	1.03	*0.18*	1.07	*0.19*
Age 55-64	1.04	*0.25*	1.04	*0.25*	1.02	*0.24*	1.04	*0.25*
Age ≥65	0.72	*0.26*	0.76	*0.27*	0.81	*0.29*	0.75	*0.27*
Education: Low (0-2 ISCED)	1.41 **	*0.22*	1.48 ***	*0.22*	1.61 ***	*0.23*	1.45 **	*0.22*
Education: High (5-6 ISCED)	0.75	*0.17*	0.78	*0.18*	0.80	*0.18*	0.76	*0.17*
N° of children: 1	1.27	*0.22*	1.29	*0.23*	1.34	*0.24*	1.28	*0.23*
N° of children: 2	1.62 **	*0.31*	1.63 **	*0.32*	1.65 ***	*0.32*	1.63 **	*0.32*
N° of children: 3+	2.11 ***	*0.49*	2.12 ***	*0.50*	2.02 ***	*0.48*	2.05 ***	*0.48*
N° of income earners: 0	3.95 ***	*1.12*	3.85 ***	*1.09*	3.80 ***	*1.08*	3.71 ***	*1.04*
N° of income earners: 1	1.93 ***	*0.33*	1.92 ***	*0.33*	1.92 ***	*0.32*	1.92 ***	*0.33*
N° of income earners: 3+	1.05	*0.43*	1.07	*0.43*	1.08	*0.45*	1.07	*0.43*
Working status: Self-employed	2.67 ***	*0.49*	2.57 ***	*0.47*	2.53 ***	*0.47*	2.68 ***	*0.49*
Working status: Unemployed	1.18	*0.31*	1.25	*0.33*	1.36	*0.35*	1.26	*0.33*
Working status: Retired	0.75	*0.25*	0.72	*0.24*	0.67	*0.23*	0.75	*0.26*
Working status: Other	1.25	*0.33*	1.30	*0.34*	1.36	*0.35*	1.33	*0.35*
Financial asset quintile: 2°	0.72 *	*0.13*	0.69 **	*0.12*	0.72 *	*0.12*	0.70 **	*0.12*
Financial asset quintile: 3°	0.47 ***	*0.09*	0.46 ***	*0.09*	0.48 ***	*0.09*	0.46 ***	*0.09*
Financial asset quintile: 4°	0.43 ***	*0.10*	0.42 ***	*0.09*	0.43 ***	*0.09*	0.43 ***	*0.09*
Financial asset quintile: 5°	0.36 ***	*0.09*	0.37 ***	*0.08*	0.37 ***	*0.09*	0.36 ***	*0.09*
Only mortgage debt	0.73 *	*0.12*	0.74 *	*0.12*	0.73 *	*0.12*	0.74 *	*0.12*
Only non-mortgage debt	0.23 ***	*0.05*	0.23 ***	*0.05*	0.22 ***	*0.05*	0.24 ***	*0.05*
Inflation			0.55 ***	*0.11*			0.65 **	*0.12*
GDP growth rate			0.76 ***	*0.07*			0.87 *	*0.07*
Unemployment rate			1.02	*0.01*			1.04 **	*0.02*
Bank concentration					1.01 **	*0.00*	1.01 **	*0.00*
Bank deposits/GDP					1.00 ***	*0.00*	1.00 ***	*0.00*
Growth rate of bank loans					1.03 **	*0.02*	1.00	*0.02*
Country fixed effects	yes		no		no		no	
Constant	0.03 ***	*0.01*	0.19 ***	*0.12*	0.03 ***	*0.01*	0.05 ***	*0.04*
No. of observations	20,603		20,603		20,603		20,603	

Note: In model 1 we control for the country dummies, in model 2 for the macro variables, in model 3 for the banking variables, in model 4 for both the macro and the banking variables. (legend: * p<.1; ** p<.05; *** p<.01)

Table 5 - DSR ≥40 per cent and income below the median (households with mortgage) (*Logit estimations – Odds ratio*)

	Model 1		Model 2		Model 3		Model 4	
	Odds ratio	Std. Err.	Odds ratio	Std. Err.	Odds ratio	Std. Err.	Odds ratio	Std. Err.
Sex: female	1.27	*0.24*	1.28	*0.24*	1.31	*0.24*	1.31	*0.24*
Age <35	1.61	*0.40*	1.67 **	*0.40*	1.65 **	*0.39*	1.60 *	*0.39*
Age 45-54	1.22	*0.26*	1.22	*0.25*	1.18	*0.24*	1.25	*0.26*
Age 55-64	1.46	*0.50*	1.49	*0.49*	1.43	*0.47*	1.51	*0.51*
Age ≥65	0.54	*0.31*	0.61	*0.33*	0.59	*0.32*	0.60	*0.33*
Education: Low (0-2 ISCED)	1.60 **	*0.33*	1.63 **	*0.31*	1.73 ***	*0.32*	1.56 **	*0.31*
Education: High (5-6 ISCED)	0.74	*0.17*	0.76	*0.17*	0.78	*0.17*	0.73	*0.17*
N° of children: 1	1.41	*0.33*	1.39	*0.32*	1.43	*0.33*	1.39	*0.32*
N° of children: 2	1.68 **	*0.41*	1.67 **	*0.41*	1.66 **	*0.40*	1.65 **	*0.40*
N° of children: 3+	2.34 **	*0.78*	2.42 ***	*0.80*	2.26 **	*0.75*	2.28 **	*0.76*
N° of income earners: 0	5.25 ***	*2.05*	5.35 ***	*2.05*	4.99 ***	*1.88*	5.03 ***	*1.92*
N° of income earners: 1	2.21 ***	*0.48*	2.21 ***	*0.48*	2.15 ***	*0.46*	2.19 ***	*0.48*
N° of income earners: 3+	0.65	*0.37*	0.68	*0.38*	0.66	*0.37*	0.68	*0.38*
Working status: Self-employed	2.32 ***	*0.61*	2.20 ***	*0.58*	2.23 ***	*0.59*	2.29 ***	*0.61*
Working status: Unemployed	1.07	*0.40*	1.15	*0.42*	1.31	*0.46*	1.14	*0.41*
Working status: Retired	0.74	*0.37*	0.69	*0.34*	0.68	*0.33*	0.74	*0.36*
Working status: Other	0.82	*0.29*	0.84	*0.28*	0.88	*0.29*	0.87	*0.29*
Financial asset quintile: 2°	0.79	*0.20*	0.76	*0.18*	0.78	*0.19*	0.77	*0.19*
Financial asset quintile: 3°	0.50 **	*0.14*	0.49 ***	*0.13*	0.50 **	*0.14*	0.50 **	*0.14*
Financial asset quintile: 4°	0.52 **	*0.15*	0.52 **	*0.15*	0.51 **	*0.15*	0.53 **	*0.16*
Financial asset quintile: 5°	0.33 ***	*0.10*	0.36 ***	*0.10*	0.34 ***	*0.10*	0.35 ***	*0.10*
10% ≥ LTV <30%	1.83 ***	*0.43*	1.81 **	*0.43*	1.82 **	*0.43*	1.86 ***	*0.44*
30% ≥ LTV <50%	1.76 **	*0.47*	1.69 **	*0.43*	1.69 **	*0.43*	1.80 **	*0.46*
50% ≥ LTV <80%	2.43 ***	*0.71*	2.28 ***	*0.66*	2.29 ***	*0.65*	2.51 ***	*0.74*
LTV ≥80%	2.92 ***	*1.08*	2.84 ***	*0.94*	2.77 ***	*0.92*	3.12 ***	*1.08*
N° of mortgage loans	0.98	*0.15*	0.99	*0.16*	0.96	*0.15*	0.99	*0.15*
Refinancing	1.16	*0.30*	1.24	*0.30*	1.28	*0.31*	1.21	*0.30*
Rate on HMR mortgage: fixed	1.07	*0.20*	0.87	*0.14*	0.80	*0.13*	0.94	*0.16*
HMR mortgage lenght	0.99	*0.01*	0.99	*0.01*	0.99	*0.01*	0.99	*0.01*
Only mortgage debt	0.74 *	*0.13*	0.76	*0.13*	0.74 *	*0.13*	0.75	*0.13*
Inflation			0.75	0.24			0.85	*0.23*
GDP growth rate			0.87	0.13			1.00	*0.12*
Unemployment rate			1.04 **	0.02			1.08 ***	*0.03*
Bank concentration					1.01	*0.00*	1.02 ***	*0.01*
Bank deposits/GDP					1.00 ***	*0.00*	1.00 ***	*0.00*
Growth rate of bank loans					1.04 *	*0.02*	1.00	*0.03*
Country fixed effects	yes		no		no		no	
Constant	0.02 ***	*0.01*	0.03 ***	0.04	0.014 ***	*0.01*	0.01 ***	*0.01*
No. of observations	8,583		8,583		8,583		8,583	

Table 6 - Vulnerability indicators (*percentages of vulnerable households among indebted households*)

	memo: hh with any debt	DSR>=40% & income<median	Debt/income >=3	Net wealth<0	Income-debt payments<food expenses	Liquid asset< 2 months of income	N° indicators >Euro area mean
Austria	*35.6*	2.8	9.2	14.8	2.9	36.8	1
Belgium	*44.8*	6.0	15.0	6.0	8.0	44.3	2
Cyprus	*65.4*	13.6	31.5	4.4	13.6	56.8	4
France	*46.9*	3.3	12.4	8.3	1.2	47.5	0
Germany	*47.4*	2.2	11.3	15.7	2.3	49.0	1
Greece	*36.6*	6.7	12.2	6.9	5.5	72.4	3
Italy	*25.2*	4.9	11.0	5.7	5.1	50.5	2
Luxembourg	*58.3*	5.1	20.6	6.5	3.2	44.1	2
Malta	*34.1*	1.2	10.5	2.4	3.2	20.8	0
Netherland	*65.7*	7.8	35.2	17.7	8.7	42.9	4
Portugal	*37.7*	10.2	28.3	6.8	9.1	53.8	4
Slovakia	*26.8*	6.7	11.4	4.4	6.0	70.7	3
Spain	*50.0*	10.9	24.2	6.9	6.6	57.0	4
EURO AREA	***43.4***	**5.0**	**16.0**	**10.9**	**4.1**	**49.9**	

Table 7 - Debt/income ≥3 (all indebted households) (*Logit estimation – Odds ratio)*

	Model 1		Model 2		Model 3		Model 4	
	Odds ratio	Std. Err.	Odds ratio	Std. Err.	Odds ratio	Std. Err.	Odds ratio	Std. Err.
Sex: female	1.07	*0.10*	1.08	*0.10*	1.04	*0.09*	1.08	*0.10*
Tenure of house: non owner	0.55 **	*0.14*	0.56 **	*0.14*	0.55 **	*0.13*	0.55 **	*0.14*
Age <35	2.00 ***	*0.25*	2.01 ***	*0.25*	1.94 ***	*0.24*	1.97 ***	*0.25*
Age 45-54	0.70 ***	*0.09*	0.71 ***	*0.09*	0.70 ***	*0.09*	0.71 ***	*0.09*
Age 55-64	0.51 ***	*0.09*	0.52 ***	*0.09*	0.53 ***	*0.09*	0.52 ***	*0.09*
Age ≥65	0.45 ***	*0.12*	0.50 ***	*0.13*	0.56 **	*0.14*	0.48 ***	*0.13*
Education: Low (0-2 ISCED)	1.06	*0.12*	1.09	*0.11*	1.17	*0.12*	1.07	*0.11*
Education: High (5-6 ISCED)	1.10	*0.13*	1.15	*0.14*	1.14	*0.13*	1.11	*0.13*
N° of children: 1	1.00	*0.12*	0.98	*0.11*	0.99	*0.12*	0.99	*0.12*
N° of children: 2	0.97	*0.12*	0.93	*0.11*	0.94	*0.11*	0.95	*0.11*
N° of children: 3+	0.98	*0.15*	0.15	*-0.39*	0.90	*0.14*	0.93	*0.15*
N° of income earners: 0	2.82 ***	*0.64*	2.83 ***	*0.62*	2.94 ***	*0.65*	2.69 ***	*0.60*
N° of income earners: 1	1.70 ***	*0.18*	1.70 ***	*0.18*	1.74 ***	*0.18*	1.68 ***	*0.18*
N° of income earners: 3+	0.75	*0.17*	0.17	*-1.27*	0.76	*0.17*	0.76	*0.17*
Working status: Self-employed	2.02 ***	*0.29*	1.90 ***	*0.27*	1.87 ***	*0.26*	2.00 ***	*0.28*
Working status: Unemployed	0.78	*0.16*	0.82	*0.16*	0.81	*0.16*	0.82	*0.16*
Working status: Retired	0.55 **	*0.13*	0.52 ***	*0.12*	0.47 ***	*0.11*	0.55 **	*0.13*
Working status: Other	0.81	*0.17*	0.88	*0.18*	0.89	*0.18*	0.88	*0.18*
Financial asset quintile: 2°	0.93	*0.13*	0.90	*0.12*	0.93	*0.13*	0.89	*0.12*
Financial asset quintile: 3°	0.72 **	*0.10*	0.71 **	*0.10*	0.73 **	*0.10*	0.69 ***	*0.10*
Financial asset quintile: 4°	0.51 ***	*0.08*	0.51 ***	*0.08*	0.52 ***	*0.08*	0.49 ***	*0.08*
Financial asset quintile: 5°	0.46 ***	*0.09*	0.50 ***	*0.10*	0.50 ***	*0.10*	0.46 ***	*0.09*
Only mortgage debt	0.75 ***	*0.07*	0.75 ***	*0.07*	0.75 ***	*0.07*	0.75 ***	*0.07*
Only non-mortgage debt	0.09 ***	*0.02*	0.09 ***	*0.02*	0.09 ***	*0.02*	0.09 ***	*0.02*
Inflation			0.40 ***	*0.04*			0.41 ***	*0.04*
GDP growth rate			0.74 ***	*0.04*			0.70 ***	*0.04*
Unemployment rate			0.98 *	*0.01*			1.01	*0.01*
Bank concentration					1.01 ***	*0.00*	1.01 **	*0.00*
Bank deposits/GDP					1.00 ***	*0.00*	1.00 ***	*0.00*
Growth rate of bank loans					0.98 **	*0.01*	0.95 ***	*0.01*
Country fixed effects	yes		no		no		no	
Constant	0.47 ***	*0.09*	4.48 ***	*1.72*	0.30 ***	*0.06*	3.43 ***	*1.37*
No. of observations	20,597		20,597		20,597		20,597	

Table 8 - Debt/income ≥3 (Only households with mortgage) (*Logit estimation – Odds ratio)*

	Model 1		Model 2		Model 3		Model 4	
	Odds ratio	Std. Err.	Odds ratio	Std. Err.	Odds ratio	Std. Err.	Odds ratio	Std. Err.
Sex: female	0.97	*0.12*	0.95	*0.12*	0.95	*0.12*	0.97	*0.12*
Age <35	1.30	*0.22*	1.35 *	*0.22*	1.31 *	*0.21*	1.29	*0.21*
Age 45-54	0.95	*0.17*	0.93	*0.17*	0.93	*0.17*	0.95	*0.17*
Age 55-64	1.00	*0.23*	0.98	*0.22*	0.98	*0.22*	1.00	*0.23*
Age ≥65	0.70	*0.28*	0.70	*0.28*	0.72	*0.29*	0.70	*0.28*
Education: Low (0-2 ISCED)	1.04	*0.17*	1.10	*0.17*	1.13	*0.18*	1.05	*0.17*
Education: High (5-6 ISCED)	0.91	*0.14*	0.93	*0.14*	0.95	*0.14*	0.91	*0.14*
N° of children: 1	1.02	*0.18*	1.02	*0.17*	1.03	*0.18*	1.02	*0.18*
N° of children: 2	1.18	*0.21*	1.18	*0.21*	1.16	*0.21*	1.18	*0.21*
N° of children: 3+	0.95	*0.22*	1.00	*0.23*	0.95	*0.22*	0.95	*0.22*
N° of income earners: 0	4.53 ***	*1.43*	4.81 ***	*1.50*	4.64 ***	*1.45*	4.52 ***	*1.41*
N° of income earners: 1	1.99 ***	*0.34*	2.03 ***	*0.34*	2.00 ***	*0.34*	2.00 ***	*0.34*
N° of income earners: 3+	0.65	*0.20*	0.66	*0.20*	0.65	*0.20*	0.65	*0.20*
Working status: Self-employed	2.02 ***	*0.46*	1.95 ***	*0.44*	1.96 ***	*0.44*	2.01 ***	*0.46*
Working status: Unemployed	0.70	*0.21*	0.71	*0.21*	0.76	*0.22*	0.71	*0.21*
Working status: Retired	0.63	*0.22*	0.60	*0.21*	0.59	*0.20*	0.63	*0.22*
Working status: Other	0.82	*0.24*	0.79	*0.23*	0.82	*0.24*	0.82	*0.24*
Financial asset quintile: 2°	1.08	*0.21*	1.07	*0.21*	1.10	*0.21*	1.08	*0.21*
Financial asset quintile: 3°	0.90	*0.18*	0.90	*0.18*	0.91	*0.19*	0.91	*0.19*
Financial asset quintile: 4°	0.61 **	*0.14*	0.61 **	*0.14*	0.61 **	*0.14*	0.61 **	*0.14*
Financial asset quintile: 5°	0.53 ***	*0.13*	0.54 ***	*0.13*	0.53 ***	*0.12*	0.53 ***	*0.13*
10% ≥ LTV <30%	4.05 ***	*1.15*	4.01 ***	*1.14*	4.03 ***	*1.15*	4.05 ***	*1.15*
30% ≥ LTV <50%	10.56 ***	*3.14*	10.19 ***	*3.02*	10.28 ***	*3.02*	10.52 ***	*3.13*
50% ≥ LTV <80%	35.01 ***	*10.89*	32.76 ***	*10.12*	32.84 ***	*10.01*	34.64 ***	*10.73*
LTV ≥80%	88.80 ***	*28.40*	81.99 ***	*25.81*	83.23 ***	*25.88*	87.65 ***	*27.75*
N° of mortgage loans	1.21	*0.14*	1.20	*0.13*	1.21 *	*0.14*	1.20	*0.14*
Refinancing	1.31	*0.25*	1.34	*0.24*	1.40 *	*0.26*	1.32	*0.25*
Rate on HMR mortgage: fixed	0.92	*0.12*	0.83	*0.10*	0.77 **	*0.09*	0.89	*0.11*
HMR mortgage lenght	1.02 ***	*0.01*	1.03 ***	*0.01*	1.03 ***	*0.01*	1.03 ***	*0.01*
Only mortgage debt	0.89	*0.11*	0.89	*0.11*	0.88	*0.11*	0.89	*0.11*
Inflation			0.68 ***	*0.09*			0.71 **	*0.10*
GDP growth rate			0.82 ***	*0.06*			0.91	*0.06*
Unemployment rate			1.03 **	*0.01*			1.05 ***	*0.02*
Bank concentration					1.01	*0.00*	1.01 **	*0.00*
Bank deposits/GDP					1.00 ***	*0.00*	1.00 ***	*0.00*
Growth rate of bank loans					1.04 ***	*0.02*	1.01	*0.02*
Country fixed effects	yes		no		no		no	
Constant	0.01 ***	*0.00*	0.02 ***	*0.01*	0.01 ***	*0.00*	0.01 ***	*0.00*
No. of observations	8,582		8,582		8,582		8,582	

Table 9 - Net wealth<0 (all indebted households) (*Logit estimation – Odds ratio*)

	Model 1		Model 2		Model 3		Model 4	
	Odds ratio	Std. Err.	Odds ratio	Std. Err.	Odds ratio	Std. Err.	Odds ratio	Std. Err.
Sex: female	1.15	*0.16*	1.23	*0.16*	1.20	*0.16*	1.19	*0.16*
Tenure of house: non owner	19.57 ***	*4.83*	19.20 ***	*4.33*	17.19 ***	*3.85*	18.63 ***	*4.45*
Age <35	1.22	*0.21*	1.25	*0.21*	1.21	*0.20*	1.23	*0.21*
Age 45-54	1.05	*0.21*	1.06	*0.21*	1.03	*0.20*	1.06	*0.21*
Age 55-64	0.79	*0.21*	0.83	*0.21*	0.81	*0.21*	0.80	*0.21*
Age ≥65	0.48 *	*0.21*	0.56	*0.23*	0.56	*0.23*	0.51	*0.21*
Education: Low (0-2 ISCED)	1.20	*0.19*	1.03	*0.16*	1.11	*0.16*	1.10	*0.17*
Education: High (5-6 ISCED)	1.24	*0.23*	1.27	*0.24*	1.24	*0.23*	1.23	*0.23*
N° of children: 1	0.72 *	*0.13*	0.68 **	*0.12*	0.68 **	*0.12*	0.70 **	*0.12*
N° of children: 2	0.90	*0.18*	0.82	*0.16*	0.83	*0.16*	0.87	*0.17*
N° of children: 3+	0.80	*0.19*	0.69	*0.16*	0.68	*0.16*	0.73	*0.17*
N° of income earners: 0	0.95	*0.30*	1.03	*0.32*	1.00	*0.31*	0.94	*0.29*
N° of income earners: 1	0.96	*0.16*	0.99	*0.16*	1.00	*0.16*	0.96	*0.16*
N° of income earners: 3+	0.72	*0.30*	0.77	*0.31*	0.84	*0.34*	0.75	*0.30*
Working status: Self-employed	0.68	*0.22*	0.61	*0.19*	0.68	*0.21*	0.67	*0.21*
Working status: Unemployed	1.39	*0.37*	1.41	*0.37*	1.35	*0.35*	1.41	*0.37*
Working status: Retired	1.11	*0.40*	0.92	*0.32*	0.94	*0.34*	1.06	*0.37*
Working status: Other	1.19	*0.34*	1.30	*0.36*	1.31	*0.37*	1.26	*0.35*
Financial asset quintile: 2°	0.23 ***	*0.04*	0.24 ***	*0.04*	0.24 ***	*0.04*	0.23 ***	*0.04*
Financial asset quintile: 3°	0.08 ***	*0.02*	0.09 ***	*0.02*	0.09 ***	*0.02*	0.08 ***	*0.02*
Financial asset quintile: 4°	0.05 ***	*0.02*	0.06 ***	*0.02*	0.06 ***	*0.02*	0.05 ***	*0.02*
Financial asset quintile: 5°	0.01 ***	*0.01*	0.02 ***	*0.01*	0.02 ***	*0.01*	0.01 ***	*0.01*
Only mortgage debt	0.30 ***	*0.09*	0.29 ***	*0.09*	0.30 ***	*0.09*	0.30 ***	*0.09*
Only non-mortgage debt	0.24 ***	*0.06*	0.22 ***	*0.05*	0.25 ***	*0.06*	0.24 ***	*0.06*
Inflation			0.32 ***	*0.06*			0.29 ***	*0.05*
GDP growth rate			0.75 ***	*0.06*			0.45 ***	*0.07*
Unemployment rate			0.93 ***	*0.02*			0.97	*0.02*
Bank concentration					1.02 ***	*0.00*	1.00	*0.00*
Bank deposits/GDP					1.00	*0.00*	1.00 ***	*0.00*
Growth rate of bank loans					0.90 ***	*0.01*	0.81 ***	*0.04*
Country fixed effects	yes		no		no		no	
Constant	0.34 ***	*0.10*	5.52 ***	*3.37*	0.23 ***	*0.07*	38.03 ***	*37.31*
No. of observations	20,603		20,603		20,603		20,603	

Table 10 - Income - debt payments ≥ food expenses (all indebted households) (*Logit estimation – Odds ratio*)

	Model 1		Model 2		Model 3		Model 4	
	Odds ratio	Std. Err.	Odds ratio	Std. Err.	Odds ratio	Std. Err.	Odds ratio	Std. Err.
Sex: female	1.28	*0.19*	1.29 *	*0.19*	1.28 *	*0.19*	1.30 *	*0.20*
Tenure of house: non owner	0.93	*0.20*	0.80	*0.16*	0.82	*0.16*	0.83	*0.17*
Age <35	1.17	*0.26*	1.15	*0.25*	1.12	*0.25*	1.12	*0.25*
Age 45-54	1.20	*0.24*	1.20	*0.23*	1.19	*0.23*	1.21	*0.24*
Age 55-64	0.82	*0.19*	0.79	*0.19*	0.79	*0.19*	0.79	*0.19*
Age ≥65	0.78	*0.23*	0.83	*0.25*	0.88	*0.27*	0.83	*0.26*
Education: Low (0-2 ISCED)	1.25	*0.22*	1.38 *	*0.23*	1.43 **	*0.23*	1.35 *	*0.23*
Education: High (5-6 ISCED)	0.75	*0.17*	0.79	*0.18*	0.78	*0.17*	0.76	*0.17*
N° of children: 1	1.00	*0.20*	1.03	*0.20*	1.04	*0.20*	1.02	*0.20*
N° of children: 2	1.23	*0.23*	1.25	*0.24*	1.26	*0.24*	1.25	*0.24*
N° of children: 3+	0.42	*0.43*	1.43	*0.39*	1.37	*0.37*	1.37	*0.37*
N° of income earners: 0	6.65 ***	*1.97*	5.71 ***	*1.65*	5.60 ***	*1.65*	5.43 ***	*1.58*
N° of income earners: 1	2.39 ***	*0.46*	2.33 ***	*0.44*	2.34 ***	*0.44*	2.31 ***	*0.44*
N° of income earners: 3+	0.23	*0.23*	0.56	*0.24*	0.57	*0.24*	0.56	*0.24*
Working status: Self-employed	2.61 ***	*0.61*	2.54 ***	*0.59*	2.60 ***	*0.61*	2.70 ***	*0.63*
Working status: Unemployed	1.13	*0.31*	1.32	*0.36*	1.36	*0.37*	1.34	*0.37*
Working status: Retired	0.52 **	*0.17*	0.52 **	*0.17*	0.50 **	*0.17*	0.54 *	*0.18*
Working status: Other	0.86	*0.25*	1.02	*0.30*	1.06	*0.30*	1.05	*0.30*
Financial asset quintile: 2°	0.63 *	*0.16*	0.59 **	*0.14*	0.61 **	*0.14*	0.60 **	*0.14*
Financial asset quintile: 3°	0.45 ***	*0.09*	0.43 ***	*0.08*	0.44 ***	*0.09*	0.43 ***	*0.09*
Financial asset quintile: 4°	0.59 *	*0.16*	0.56 **	*0.15*	0.56 **	*0.15*	0.56 **	*0.15*
Financial asset quintile: 5°	0.64 *	*0.17*	0.64 *	*0.17*	0.63 *	*0.17*	0.61 *	*0.17*
Only mortgage debt	0.78	*0.15*	0.80	*0.15*	0.80	*0.15*	0.81	*0.15*
Only non-mortgage debt	0.50 ***	*0.10*	0.49 ***	*0.10*	0.50 ***	*0.10*	0.52 ***	*0.10*
Inflation			0.57 ***	*0.11*			0.72 *	*0.13*
GDP growth rate			0.76 ***	*0.07*			0.91	*0.07*
Unemployment rate			0.99	*0.02*			1.02	*0.02*
Bank concentration					1.01 ***	*0.00*	1.01 ***	*0.00*
Bank deposits/GDP					1.00 ***	*0.00*	1.00 ***	*0.00*
Growth rate of bank loans					1.01	*0.02*	1.01	*0.02*
Country fixed effects	yes		no		no		no	
Constant	0.02 ***	*0.01*	0.14 ***	*0.09*	0.01 ***	*0.01*	0.02 ***	*0.02*
No. of observations	20,603		20,603		20,603		20,603	

Table 11 - Income - debt payments ≥ food expenses (Only households with mortgage) (*Logit estimation – Odds ratio*)

	Model 1		Model 2		Model 3		Model 4	
	Odds ratio	Std. Err.	Odds ratio	Std. Err.	Odds ratio	Std. Err.	Odds ratio	Std. Err.
Sex: female	1.64 **	*0.38*	1.65 **	*0.37*	1.67 **	*0.37*	1.69 **	*0.38*
Age <35	1.37	*0.51*	1.38	*0.49*	1.32	*0.47*	1.31	*0.48*
Age 45-54	1.31	*0.38*	1.33	*0.38*	1.33	*0.38*	1.34	*0.38*
Age 55-64	0.93	*0.35*	0.97	*0.36*	0.98	*0.36*	0.98	*0.37*
Age ≥65	0.68	*0.34*	0.78	*0.37*	0.79	*0.37*	0.77	*0.37*
Education: Low (0-2 ISCED)	1.53	*0.41*	1.65 **	*0.40*	1.60 **	*0.38*	1.57 *	*0.39*
Education: High (5-6 ISCED)	0.64	*0.18*	0.67	*0.18*	0.64 *	*0.17*	0.64 *	*0.17*
N° of children: 1	1.02	*0.32*	1.05	*0.32*	1.04	*0.32*	1.04	*0.32*
N° of children: 2	1.27	*0.35*	1.29	*0.35*	1.27	*0.34*	1.27	*0.34*
N° of children: 3+	1.75	*0.68*	1.78	*0.69*	1.66	*0.64*	1.65	*0.64*
N° of income earners: 0	7.30 ***	*3.53*	7.02 ***	*3.30*	6.57 ***	*3.11*	6.50 ***	*3.06*
N° of income earners: 1	2.43 ***	*0.70*	2.41 ***	*0.68*	2.38 ***	*0.67*	2.37 ***	*0.67*
N° of income earners: 3+	0.32 *	*0.22*	0.35	*0.23*	0.35	*0.24*	0.35	*0.24*
Working status: Self-employed	2.33 ***	*0.67*	2.17 ***	*0.61*	2.22 ***	*0.62*	2.27 ***	*0.64*
Working status: Unemployed	1.14	*0.48*	1.32	*0.53*	1.30	*0.53*	1.28	*0.52*
Working status: Retired	0.29 ***	*0.14*	0.28 ***	*0.13*	0.29 ***	*0.14*	0.31 **	*0.14*
Working status: Other	0.57	*0.26*	0.62	*0.26*	0.63	*0.27*	0.65	*0.28*
Financial asset quintile: 2°	0.64	*0.23*	0.60	*0.20*	0.63	*0.22*	0.62	*0.22*
Financial asset quintile: 3°	0.54 *	*0.18*	0.51 **	*0.17*	0.52 **	*0.17*	0.51 **	*0.17*
Financial asset quintile: 4°	0.69	*0.26*	0.66	*0.23*	0.65	*0.24*	0.65	*0.25*
Financial asset quintile: 5°	0.49 **	*0.16*	0.51 **	*0.16*	0.51 **	*0.16*	0.51 **	*0.16*
10% ≥ LTV <30%	1.52	*0.39*	1.56 *	*0.41*	1.60 *	*0.42*	1.60 *	*0.42*
30% ≥ LTV <50%	1.13	*0.36*	1.14	*0.35*	1.20	*0.38*	1.20	*0.38*
50% ≥ LTV <80%	1.56	*0.55*	1.58	*0.56*	1.72	*0.61*	1.72	*0.61*
LTV ≥80%	1.25	*0.52*	1.33	*0.49*	1.44	*0.54*	1.46	*0.57*
N° of mortgage loans	1.16	*0.24*	1.15	*0.21*	1.14	*0.21*	1.14	*0.22*
Refinancing	1.48	*0.41*	1.57 *	*0.41*	1.57 *	*0.42*	1.54	*0.41*
Rate on HMR mortgage: fixed	0.78	*0.16*	0.55 ***	*0.11*	0.55 ***	*0.11*	0.59 ***	*0.11*
HMR mortgage lenght	0.97 **	*0.01*	0.98	*0.01*	0.98 **	*0.01*	0.97 **	*0.01*
Only mortgage debt	0.71 *	*0.15*	0.75	*0.15*	0.75	*0.15*	0.75	*0.15*
Inflation			0.71	*0.20*			0.84	*0.21*
GDP growth rate			0.84	*0.11*			1.02	*0.11*
Unemployment rate			0.98	*0.02*			1.02	*0.03*
Bank concentration					1.02 ***	*0.01*	1.02 **	*0.01*
Bank deposits/GDP					1.00 *	*0.00*	1.00 *	*0.00*
Growth rate of bank loans					1.00	*0.03*	1.02	*0.03*
Country fixed effects	yes		no		no		no	
Constant	0.02 ***	*0.02*	0.09 **	*0.09*	0.01 ***	*0.01*	0.01 ***	*0.01*
No. of observations	8,583		8,583		8,583		8,583	

Table 12 - Liquid assets < 2 months of income (all indebted households) (*Logit estimation – Odds ratio*)

	Model 1		Model 2		Model 3		Model 4	
	Odds ratio	Std. Err.	Odds ratio	Std. Err.	Odds ratio	Std. Err.	Odds ratio	Std. Err.
Sex: female	1.08	*0.10*	1.11	*0.10*	1.10	*0.10*	1.10	*0.10*
Tenure of house: non owner	1.56 ***	*0.19*	1.64 ***	*0.19*	1.55 ***	*0.18*	1.54 ***	*0.18*
Age <35	0.66 ***	*0.09*	0.70 ***	*0.09*	0.68 ***	*0.09*	0.68 ***	*0.09*
Age 45-54	1.38 ***	*0.15*	1.40 ***	*0.15*	1.39 ***	*0.15*	1.40 ***	*0.15*
Age 55-64	1.25	*0.20*	1.29	*0.21*	1.28	*0.21*	1.28	*0.21*
Age ≥65	1.01	*0.23*	1.15	*0.26*	1.13	*0.26*	1.10	*0.25*
Education: Low (0-2 ISCED)	1.08	*0.13*	1.04	*0.12*	1.05	*0.12*	1.02	*0.12*
Education: High (5-6 ISCED)	1.02	*0.11*	1.08	*0.12*	1.05	*0.11*	1.03	*0.11*
N° of children: 1	0.98	*0.12*	0.93	*0.11*	0.95	*0.12*	0.95	*0.12*
N° of children: 2	1.13	*0.15*	1.05	*0.13*	1.10	*0.14*	1.11	*0.14*
N° of children: 3+	1.29	*0.27*	1.25	*0.26*	1.24	*0.26*	1.26	*0.26*
N° of income earners: 0	0.23 ***	*0.05*	0.26 ***	*0.05*	0.24 ***	*0.05*	0.23 ***	*0.05*
N° of income earners: 1	0.53 ***	*0.06*	0.55 ***	*0.06*	0.54 ***	*0.06*	0.54 ***	*0.06*
N° of income earners: 3+	1.38 *	*0.24*	1.36 *	*0.23*	1.37 *	*0.24*	1.37 *	*0.24*
Working status: Self-employed	1.20	*0.15*	1.09	*0.13*	1.16	*0.15*	1.17	*0.15*
Working status: Unemployed	1.24	*0.32*	1.27	*0.31*	1.28	*0.31*	1.25	*0.31*
Working status: Retired	1.36	*0.28*	1.17	*0.23*	1.24	*0.25*	1.27	*0.25*
Working status: Other	0.95	*0.19*	1.01	*0.19*	1.04	*0.20*	1.01	*0.19*
Financial asset quintile: 2°	0.05 ***	*0.01*	0.05 ***	*0.01*	0.05 ***	*0.01*	0.05 ***	*0.01*
Financial asset quintile: 3°	0.01 ***	*0.00*	0.01 ***	*0.00*	0.01 ***	*0.00*	0.01 ***	*0.00*
Financial asset quintile: 4°	0.00 ***	*0.00*	0.00 ***	*0.00*	0.00 ***	*0.00*	0.00 ***	*0.00*
Financial asset quintile: 5°	0.00 ***	*0.00*	0.00 ***	*0.00*	0.00 ***	*0.00*	0.00 ***	*0.00*
Only mortgage debt	0.60 ***	*0.06*	0.58 ***	*0.06*	0.58 ***	*0.06*	0.59 ***	*0.06*
Only non-mortgage debt	0.61 ***	*0.08*	0.57 ***	*0.07*	0.60 ***	*0.08*	0.62 ***	*0.08*
Inflation			0.94	*0.10*			0.88 ***	*0.09*
GDP growth rate			1.03	*0.05*			0.86 ***	*0.04*
Unemployment rate			0.98 **	*0.01*			1.01 ***	*0.01*
Bank concentration					1.01 ***	*0.00*	1.01	*0.00*
Bank deposits/GDP					1.00 ***	*0.00*	1.00 ***	*0.00*
Growth rate of bank loans					0.94 ***	*0.01*	0.90	*0.01*
Country fixed effects	yes		no		no		no	
Constant	236.34 ***	*81.91*	196.16 ***	*94.28*	162.85 ***	*57.17*	340.95 ***	*172.14*
No. of observations	20,603		20,603		20,603		20,603	

Table 13 - Liquid assets < 2 months of income (Only households with mortgage) (*Logit estimation – Odds ratio*)

	Model 1		Model 2		Model 3		Model 4	
	Odds ratio	Std. Err.	Odds ratio	Std. Err.	Odds ratio	Std. Err.	Odds ratio	Std. Err.
Sex: female	1.05	*0.14*	1.08	*0.14*	1.09	*0.14*	1.08	*0.14*
Age <35	0.67 *	*0.15*	0.70 *	*0.15*	0.70 *	*0.15*	0.69 *	*0.15*
Age 45-54	1.28	*0.20*	1.31 *	*0.21*	1.30	*0.20*	1.31 *	*0.21*
Age 55-64	1.22	*0.30*	1.27	*0.31*	1.24	*0.30*	1.27	*0.31*
Age ≥65	0.53 *	*0.20*	0.64	*0.24*	0.57	*0.22*	0.59	*0.22*
Education: Low (0-2 ISCED)	0.83	*0.17*	0.80	*0.16*	0.79	*0.16*	0.76	*0.15*
Education: High (5-6 ISCED)	1.02	*0.16*	1.09	*0.17*	1.09	*0.16*	1.04	*0.16*
N° of children: 1	0.91	*0.17*	0.87	*0.16*	0.90	*0.17*	0.89	*0.17*
N° of children: 2	1.19	*0.25*	1.11	*0.23*	1.15	*0.23*	1.16	*0.24*
N° of children: 3+	1.17	*0.34*	1.19	*0.33*	1.16	*0.33*	1.17	*0.33*
N° of income earners: 0	0.26 ***	*0.09*	0.31 ***	*0.11*	0.28 ***	*0.10*	0.29 ***	*0.10*
N° of income earners: 1	0.52 ***	*0.10*	0.55 ***	*0.11*	0.53 ***	*0.10*	0.54 ***	*0.10*
N° of income earners: 3+	1.94 **	*0.51*	1.84 **	*0.47*	1.85 **	*0.47*	1.86 **	*0.47*
Working status: Self-employed	1.58 **	*0.29*	1.41 *	*0.25*	1.48 **	*0.27*	1.49 **	*0.27*
Working status: Unemployed	1.72 *	*0.54*	1.65	*0.52*	1.73 *	*0.53*	1.65	*0.51*
Working status: Retired	1.81	*0.67*	1.52	*0.55*	1.65	*0.60*	1.66	*0.60*
Working status: Other	0.93	*0.29*	0.97	*0.29*	1.01	*0.30*	0.97	*0.29*
Financial asset quintile: 2°	0.02 ***	*0.01*	0.02 ***	*0.01*	0.02 ***	*0.01*	0.02 ***	*0.01*
Financial asset quintile: 3°	0.00 ***	*0.00*	0.00 ***	*0.00*	0.00 ***	*0.00*	0.00 ***	*0.00*
Financial asset quintile: 4°	0.00 ***	*0.00*	0.00 ***	*0.00*	0.00 ***	*0.00*	0.00 ***	*0.00*
Financial asset quintile: 5°	0.00 ***	*0.00*	0.00 ***	*0.00*	0.00 ***	*0.00*	0.00 ***	*0.00*
10% ≥ LTV <30%	0.95	*0.18*	1.02	*0.19*	1.00	*0.19*	1.00	*0.19*
30% ≥ LTV <50%	1.10	*0.23*	1.20	*0.25*	1.17	*0.24*	1.20	*0.25*
50% ≥ LTV <80%	1.10	*0.24*	1.24	*0.26*	1.19	*0.25*	1.22	*0.26*
LTV ≥80%	1.50	*0.41*	1.76 **	*0.46*	1.63 *	*0.43*	1.67 *	*0.45*
N° of mortgage loans	1.06	*0.11*	1.09	*0.11*	1.05	*0.11*	1.07	*0.11*
Refinancing	0.90	*0.15*	1.02	*0.16*	0.96	*0.15*	0.96	*0.16*
Rate on HMR mortgage: fixed	0.86	*0.15*	0.84	*0.12*	0.87	*0.12*	0.88	*0.14*
HMR mortgage lenght	1.01	*0.01*	1.01	*0.01*	1.01	*0.01*	1.01	*0.01*
Only mortgage debt	0.66 ***	*0.09*	0.63 ***	*0.08*	0.63 ***	*0.08*	0.63 ***	*0.08*
Inflation			1.27 *	*0.17*			1.09	*0.16*
GDP growth rate			1.21 ***	*0.08*			0.96	*0.07*
Unemployment rate			1.00	*0.01*			1.04 **	*0.02*
Bank concentration					1.00	*0.00*	1.00	*0.00*
Bank deposits/GDP					1.00 ***	*0.00*	1.00 ***	*0.00*
Growth rate of bank loans					0.94 ***	*0.01*	0.90 ***	*0.02*
Country fixed effects	yes		no		no		no	
Constant	500.25 ***	*349.63*	105.55 ***	82.07	345.45 ***	*244.99*	287.40 ***	*234.71*
No. of observations	8,583		8,583		8,583		8,583	

Table 14 - Principal component analysis

	Scoring factors	Mean	Std.Dev.
DSR≥40% & income<median(income)	0.632	0.050	0.217
Debt/income≥3	0.488	0.157	0.363
Net wealth<0	0.077	0.108	0.310
Income-debt payments<food expenses	0.597	0.039	0.195
Liquid<2months income	0.006	0.499	0.500

Table 15 - PCA combined indicator (all indebted households) (*OLS regressions*)

	Model 1		Model 2		Model 3		Model 4	
	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
Sex: female	0.07 *	*0.03*	0.08 **	*0.03*	0.07 **	*0.03*	0.08 **	*0.03*
Tenure of house: non owner	-0.08 *	*0.04*	-0.08 **	*0.04*	-0.09 **	*0.04*	-0.09 **	*0.04*
Age <35	0.19 ***	*0.06*	0.19 ***	*0.06*	0.18 ***	*0.06*	0.18 ***	*0.06*
Age 45-54	-0.01	*0.05*	-0.02	*0.05*	-0.02	*0.05*	-0.01	*0.05*
Age 55-64	-0.11 *	*0.06*	-0.11 *	*0.06*	-0.10 *	*0.06*	-0.11 *	*0.06*
Age ≥65	-0.19 **	*0.08*	-0.16 *	*0.08*	-0.13	*0.08*	-0.16 *	*0.08*
Education: Low (0-2 ISCED)	0.10 **	*0.05*	0.12 ***	*0.05*	0.15 ***	*0.05*	0.11 **	*0.05*
Education: High (5-6 ISCED)	-0.05	*0.05*	-0.03	*0.05*	-0.03	*0.05*	-0.04	*0.05*
N° of children: 1	0.03	*0.04*	0.03	*0.04*	0.04	*0.04*	0.03	*0.04*
N° of children: 2	0.11 **	*0.05*	0.09 *	*0.05*	0.10 *	*0.05*	0.10 *	*0.05*
N° of children: 3+	0.18 **	*0.09*	0.16 *	*0.09*	0.14	*0.09*	0.15 *	*0.09*
N° of income earners: 0	0.55 ***	*0.08*	0.53 ***	*0.08*	0.52 ***	*0.08*	0.51 ***	*0.08*
N° of income earners: 1	0.25 ***	*0.04*	0.25 ***	*0.04*	0.25 ***	*0.04*	0.25 ***	*0.04*
N° of income earners: 3+	-0.08	*0.06*	-0.06	*0.06*	-0.06	*0.06*	-0.07	*0.06*
Working status: Self-employed	0.37 ***	*0.07*	0.35 ***	*0.07*	0.35 ***	*0.07*	0.37 ***	*0.07*
Working status: Unemployed	0.09	*0.10*	0.13	*0.10*	0.15	*0.10*	0.13	*0.10*
Working status: Retired	-0.19 **	*0.08*	-0.21 ***	*0.08*	-0.23 ***	*0.08*	-0.19 **	*0.08*
Working status: Other	0.00	*0.08*	0.06	*0.08*	0.08	*0.08*	0.06	*0.08*
Financial asset quintile: 2°	-0.18 ***	*0.06*	-0.20 ***	*0.06*	-0.19 ***	*0.06*	-0.20 ***	*0.06*
Financial asset quintile: 3°	-0.32 ***	*0.06*	-0.33 ***	*0.06*	-0.32 ***	*0.06*	-0.34 ***	*0.06*
Financial asset quintile: 4°	-0.35 ***	*0.06*	-0.35 ***	*0.06*	-0.35 ***	*0.06*	-0.36 ***	*0.06*
Financial asset quintile: 5°	-0.40 ***	*0.07*	-0.37 ***	*0.07*	-0.39 ***	*0.07*	-0.41 ***	*0.07*
Only mortgage debt	-0.18 ***	*0.06*	-0.17 ***	*0.06*	-0.17 ***	*0.06*	-0.17 ***	*0.06*
Only non-mortgage debt	-0.60 ***	*0.05*	-0.62 ***	*0.05*	-0.62 ***	*0.05*	-0.60 ***	*0.05*
Inflation			-0.32 ***	*0.06*			-0.30 ***	*0.06*
GDP growth rate			-0.12 ***	*0.02*			-0.12 ***	*0.03*
Unemployment rate			0.00	*0.01*			0.01 **	*0.01*
Bank concentration					0.005 ***	*0.001*	0.004 ***	*0.001*
Bank deposits/GDP					0.000 ***	*0.000*	0.001 ***	*0.000*
Growth rate of bank loans					0.003	*0.004*	-0.013 **	*0.006*
Country fixed effects	yes		no		no		no	
Constant	0.23 ***	*0.08*	1.06 ***	*0.18*	0.06	*0.09*	0.76 ***	*0.19*
No. of observations	20,597		20,597		20,597		20,597	

Table 16 - PCA combined indicator (only households with mortgage) (*OLS regressions*)

	Model 1		Model 2		Model 3		Model 4	
	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
Sex: female	0.09	*0.07*	0.09	*0.06*	0.10	*0.06*	0.11	*0.07*
Age <35	0.24 **	*0.11*	0.25 **	*0.11*	0.24 **	*0.11*	0.23 **	*0.11*
Age 45-54	0.07	*0.07*	0.08	*0.07*	0.07	*0.07*	0.08	*0.07*
Age 55-64	0.06	*0.10*	0.07	*0.10*	0.07	*0.10*	0.08	*0.10*
Age ≥65	-0.28 *	*0.17*	-0.24	*0.16*	-0.24	*0.17*	-0.24	*0.17*
Education: Low (0-2 ISCED)	0.19 **	*0.10*	0.21 **	*0.09*	0.23 **	*0.09*	0.19 **	*0.09*
Education: High (5-6 ISCED)	-0.11 *	*0.06*	-0.09	*0.06*	-0.08	*0.06*	-0.11 *	*0.06*
N° of children: 1	0.08	*0.08*	0.08	*0.08*	0.08	*0.08*	0.08	*0.08*
N° of children: 2	0.18 **	*0.08*	0.17 **	*0.08*	0.16 **	*0.08*	0.17 **	*0.08*
N° of children: 3+	0.25 *	*0.14*	0.27 *	*0.14*	0.23 *	*0.14*	0.24 *	*0.14*
N° of income earners: 0	0.99 ***	*0.19*	1.00 ***	*0.19*	0.97 ***	*0.19*	0.96 ***	*0.19*
N° of income earners: 1	0.38 ***	*0.09*	0.39 ***	*0.09*	0.38 ***	*0.09*	0.38 ***	*0.09*
N° of income earners: 3+	-0.11	*0.09*	-0.09	*0.08*	-0.10	*0.09*	-0.09	*0.09*
Working status: Self-employed	0.39 ***	*0.10*	0.36 ***	*0.10*	0.37 ***	*0.10*	0.38 ***	*0.10*
Working status: Unemployed	0.17	*0.21*	0.20	*0.21*	0.24	*0.21*	0.20	*0.21*
Working status: Retired	-0.38 **	*0.15*	-0.40 ***	*0.15*	-0.40 ***	*0.15*	-0.37 **	*0.15*
Working status: Other	-0.13	*0.15*	-0.12	*0.15*	-0.10	*0.15*	-0.10	*0.15*
Financial asset quintile: 2°	-0.19	*0.13*	-0.22 *	*0.13*	-0.21	*0.13*	-0.22	*0.13*
Financial asset quintile: 3°	-0.36 ***	*0.13*	-0.37 ***	*0.13*	-0.37 ***	*0.13*	-0.37 ***	*0.13*
Financial asset quintile: 4°	-0.38 ***	*0.13*	-0.39 ***	*0.12*	-0.39 ***	*0.13*	-0.38 ***	*0.13*
Financial asset quintile: 5°	-0.47 ***	*0.13*	-0.45 ***	*0.12*	-0.47 ***	*0.13*	-0.47 ***	*0.13*
10% ≥ LTV <30%	0.18 ***	*0.06*	0.18 ***	*0.06*	0.19 ***	*0.06*	0.19 ***	*0.06*
30% ≥ LTV <50%	0.28 ***	*0.07*	0.28 ***	*0.07*	0.29 ***	*0.07*	0.29 ***	*0.07*
50% ≥ LTV <80%	0.70 ***	*0.10*	0.69 ***	*0.10*	0.71 ***	*0.10*	0.72 ***	*0.10*
LTV ≥80%	1.00 ***	*0.12*	1.01 ***	*0.11*	1.02 ***	*0.12*	1.03 ***	*0.12*
N° of mortgage loans	0.05	*0.05*	0.05	*0.05*	0.05	*0.05*	0.05	*0.05*
Refinancing	0.15	*0.09*	0.17 *	*0.09*	0.18 **	*0.09*	0.16 *	*0.09*
Rate on HMR mortgage: fixed	-0.04	*0.06*	-0.15 ***	*0.05*	-0.17 ***	*0.05*	-0.12 **	*0.05*
HMR mortgage lenght	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*
Only mortgage debt	-0.13 **	*0.06*	-0.12 *	*0.06*	-0.13 **	*0.06*	-0.12 **	*0.06*
Inflation			-0.14	*0.09*			-0.13	*0.10*
GDP growth rate			-0.07	*0.04*			-0.01	*0.04*
Unemployment rate			0.01 *	*0.01*			0.03 ***	*0.01*
Bank concentration					0.00 **	*0.00*	0.01 ***	*0.00*
Bank deposits/GDP					0.00 ***	*0.00*	0.00 ***	*0.00*
Growth rate of bank loans					0.02 *	*0.01*	0.00	*0.01*
Country fixed effects	yes		no		no		no	
Constant	-0.47 **	0.20	-0.10	*0.33*	-0.60 ***	*0.20*	-0.67 *	*0.38*
No. of observations	8,582		8,582		8,582		8,582	

References

Bartiloro, L., and Rampazzi, C. (2013), "Il risparmio e la ricchezza delle famiglie italiane durante la crisi", Banca d'Italia Occasional Papers, n. 148.

Boot, A.W.A., and Thakor, A. (2000), "Can relationship lending survive competition?", Journal of Finance, 55 (2000), pp. 679–713.

Bover, O., Casado, J. M., Costa, S., Du Caju, P., McCarthy, Y., Sierminska, E., Tzamourani, P., Villanueva, E., and Zavadil, T. (2014). "The distribution of debt across euro area countries: the role of individual characteristics, institutions and credit conditions," ECB Working Paper Series 1639.

Brandolini, A., Carta, F., and D'Amuri, F. (2014), "A feasible unemployment-based shock absorber for the Euro Area" Banca d'Italia Occasional paper, n,254.

Brunetti, M., Giarda, E., and Torricelli, C. (2012), "Is financial fragility a matter of illiquidity? An appraisal for Italian households", CEFIN Working Paper.

Cahill, M.B., and Sánchez, N. (2001), "Using principal components to produce an economic and social development index: An application to Latin America and the U.S.", *Atlantic Economic Journal*, 29(3), pp. 311-329.

Campbell, J.Y., and Cocco, J.F. (2011), "A model of mortgage default", NBER Working paper n. 17516.

Campbell, T. S., and Dietrich, J. K. (1983), "The determinants of default on insured conventional residential mortgage loans", *The Journal of Finance*, 38(5), pp. 1569-1581.

D'Alessio, G., and Iezzi, S. (2013), "Household over-indebtedness: definition and measurement with Italian data", Banca d'Italia Occasional paper, n. 149.

Dell'Ariccia, G., Igan, D., and Laeven, L. U. (2012), "Credit booms and lending standards: Evidence from the subprime mortgage market", *Journal of Money, Credit and Banking*, 44, pp. 367-384.

Diaz-Serrano, L. (2004), "Income volatility and residential mortgage delinquency: evidence from 12 EU countries", IZA Discussion papers series, n. 1396.

Duygan-Bump, B., and Grant, C. (2009), "Household debt repayment behaviour: what role do institutions play?", *Economic Policy*, 24(57), pp. 108-140.

ECB (2013a), "The Eurosystem Household Finance and Consumption Survey - Methodological report for the first wave", ECB Statistics Paper n.1, April 2013.

ECB (2013b), "The Eurosystem Household Finance and Consumption Survey – Results from the first wave", ECB Statistics Paper n.2, April 2013.

Ehrmann, M., and Ziegelmeyer, M. (2014), "Household risk management and actual mortgage choice in the euro area", ECB Working Paper n.1631.

Elul, R., Souleles, N. S., Chomsisengphet, S., Glennon, D., & Hunt, R. M. (2010), "What 'Triggers' Mortgage Default?", *American Economic Review* Vol. 100, No. 2, pp. 490–494.

Gambacorta, R., Ilardi, G., Locatelli, A., Pico, R., and Rampazzi, C. (2013), "Main Results of the Eurosystem's Household Finance and Consumption Survey: Italy in the International Context", Banca d'Italia Occasional Papers, n. 161.

Holmstrom, B., and Tirole, J. (1997), "Financial intermediation, loanable funds, and the real sector", *the Quarterly Journal of economics*, vol. 112, n. 3, pp. 663-691.

IMF (2011), *United Kingdom—Vulnerabilities of Household and Corporate Balance Sheets and Risks for the Financial Sector Technical Note*, July 2011.

IMF (2012), "Spain—Vulnerabilities of Private Sector Balance Sheets and Risks to the Financial Sector", *Technical Note for the Financial Sector Assessment Program Update*, May 2012.

IMF (2013), "Italy— The financial situation of Italian households and non-financial corporations and risks to the banking system", *Technical Note for the Financial Sector Assessment Program Update*, August 2013.

Jordà, Ò., Schularick, M., and Taylor, A. M. (2011), "Financial crises, credit booms, and external imbalances: 140 years of lessons", IMF Economic Review, 59(2), pp. 340-378.

Lusardi A., Schneider, D., and Tufano, P. (2011), "Financially fragile households: Evidence and implications", *Brookings Papers on Economic Activity*, Spring, 83-134.

Magri, S., and Pico, R. (2012), "L'Indebitamento delle famiglie italiane dopo la crisi del 2008", Banca d'Italia Occasional Paper n.134.

Michelangeli, V., and Pietrunti, M. (2014), "A microsimulation model to evaluate Italian households' financial vulnerability", *International Journal of Microsimulation*, 7(3), pp. 53-79.

Mishkin, F.S. (1999), "Financial consolidation: Dangers and opportunities", Journal of Banking and Finance, 23, pp. 675–691.

Ram, R. (1982), "Composite Indices of Physical Quality of Life, Basic Needs Fulfilment, and Income: A 'Principal Component' Representation", Journal of Development Economics, 11, pp. 227-47.

Shapiro, A. F. (2014), "Self-employment and business cycle persistence: Does the composition of employment matter for economic recoveries?", *Journal of Economic Dynamics and Control*, 46, 200-218.

Schularick, M., and Taylor, A. M. (2009), "Credit booms gone bust: Monetary policy, leverage cycles and financial crises, 1870-2008", NBER Working paper n. 15512.

Srinivasan, T.N. (1994), "Human Development: A New Paradigm or Reinvention of the Wheel?," *American Economic Review*, 84, 2, pp. 238-43.

Svaleryd, H. (2015), "Self-employment and the local business cycle", *Small Business Economics*, 44(1), pp. 55-70.

Thakor, A. V. (2014), "Bank capital and financial stability: an economic tradeoff or a Faustian bargain?", *Annual Review of Financial Economics*, forthcoming.

Wong, J., Fung, L., and Sze, A., (2004), "Residential mortgage default risk and the loan-to-value ratio", Hong Kong Monetary Authority Quarterly Bulletin.

Zeldes, S. (1989), "Consumption and Liquidity Constraints: an Empirical Investigation", *Journal of Political Economy*, 97, 2, pp. 305-46.

Methodological notes

SOURCES

Macro data

Real GDP and GDP growth rate, Eurostat; bank concentration, bank deposit-to-GDP, growth rate of bank loans, ECB; inflation (average consumer prices) and unemployment rate, IMF.

Micro data

The analysis is based on the first wave of the Household Finance and Consumption Survey (HFCS). ECB (2013a) provides a detailed overview of the main methodological features of the survey. Estonia and Ireland will collect data only from the second edition onwards; most of the national surveys were conducted in 2010.

Finland is excluded in all this paper because of the lack of some data very important for the analysis: a) only household main residence mortgage payments are available (payments for other property mortgages and for non-collateralised debt are not collected); b) food consumption expenditure items are not collected. Slovenia is excluded because the sample is too small.

DEFINITIONS

The household reference person in this paper is identified as the financially knowledgeable person.

Net wealth is defined as the difference between total assets and total liabilities. Total assets consist of real assets and financial assets.

Real assets include:
- household main residence (for owners);
- other real estate property;
- vehicles (cars and other vehicles, such as boats, planes or motorbikes);
- valuables;
- value of self-employment businesses of household members.

Financial assets consist of:
- deposits (sight accounts, saving accounts);
- mutual funds' shares;
- bonds;
- investments held in non-self-employment private businesses;
- publicly traded shares;
- managed investment accounts;
- money owed to households as private loans;
- other financial assets: options, futures, index certificates, precious metals, oil and gas leases, future proceeds from a lawsuit or estate that is being settled, royalties or any other private pension plans and whole life insurance policies.
- Current value of public and occupational pension plans is not included.

Total liabilities (debt) consist of:

household main residence mortgages and other real estate property mortgages;
debt on credit cards and credit lines/bank overdrafts;
other, non-collateralized, loans (including loans from commercial providers and private loans).

Debt includes that held for business purposes, either guaranteed by a mortgage or non collateralized.

Household income is measured as gross income and is defined as the sum of labour and non-labour income for all household members. In case the original surveys collect net income, gross values are estimated: this is done for all records for Greece and Italy, while for Belgium and Slovenia it is done only if respondents were not able to provide gross amounts.

Equivalent income is calculated using the modified OECD scale of equivalence, which assigns a coefficient of 1 to the head of household, 0.5 to each member aged 14 or over and 0.3 to each member under 14 years of age. The number of "equivalent adults" is calculated for each household by summing the coefficients for each member. The household's income is then divided by this coefficient.

INDICATORS

They are calculated for the total sample and refer to household's gross income:

i) debt service to income >= 40%

Debt service-income ratio: ratio of total monthly debt payments to household gross monthly income. Payments for household's total debt are the monthly payments (or the monthly equivalent of other time frequency payments) of the household to the lender to repay the loan. They include interest and repayment but exclude any required payments for taxes, insurance and other fees. The household's total payments include the payments for mortgages and the payments for other loans, such as car loans, consumer and installment loans and loans from relatives, friends, employers, etc.

ii) debt to income >=3

Debt-income ratio: ratio of total liabilities and total gross household income.

iii) income – debt payments < food expenses

This variable aims at capturing household gross income available for consumption. That "residual" income results from the difference between gross monthly income and total monthly debt payments. We compare each household's "residual" income with its stated share of food expenditure in household income multiplied it by its income (for France many missing values for the share of food expenditure are recorded).

iv) liquid assets < 2 months of income

Liquid assets are calculated as the sum of value of deposits, mutual funds, bonds, non-self-employment business wealth, (publicly traded) shares and managed accounts.

v) net wealth < 0

PRINCIPAL COMPONENT ANALYSIS

We construct a vulnerability index that accounts for the different kinds of financial fragility (Section 4).

In the construction of a vulnerability index, two main concerns need to be addressed. First, all the indicators included in the index should be of a compatible scale. Second, a weight should be assigned to each indicator to capture its role in explaining household vulnerability.

To address the first concern, we adopt the following approach. Let x_k with $k=1, \dots N$ be an indicator that enters in the vulnerability index. For each household i belonging to country j we take its value of the indicator x_k, defined as x_{ijk}. We then subtract the mean of the euro area x_{Ek} from each household indicator x_{ijk} and we divide that result by the standard deviation of the euro area s_{Ek}. This approach guarantees the scale compatibility of the indicators and could be particularly useful when non-dummy indicators are included in the index.

Second, each of the indicators x_k included in the vulnerability index should be assigned a weight f_k. Let the formula for the vulnerability index for each household i belonging to country $j=1,\dots 13$, I_{ij}, be given by:

$$I_{ij} = f_1(x_{ij1} - x_{E1})/s_{E1} + \dots + f_N(x_{ijN} - x_{EN})/s_{EN}$$

One approach could be to assign an equal weight $f_k=1$ to each indicator. However, aside from being discretionary, that approach may be inadequate if the indicators considered are correlated, as it is in our sample. Therefore, we implement a different approach, namely we use the Principal Component Analysis (PCA) for the choice of the weights in the vulnerability index. That statistical procedure uses the correlation between the observed indicators to determine the weights and, subsequently, determines the role of each indicator in the index. We aim at constructing a vulnerability index that weights each indicator to capture the overall country degree of household vulnerability, without imposing ex-ante a prominence of one indicator over another. Principal components are uncorrelated and orthogonal. The first principal component is the linear combination of weighted observed indicators with the largest amount of information shared by all indicators. Therefore, given that the first component accounts for the largest fraction of the common information and given the need for a parsimonious representation of multiple facets of household vulnerability, following Srinivasan (1994), Cahill and Sanchez (2001) and Ram (1982), we choose the factors associated to the first component for the selection of the weights (Table A12). Specifically, to construct a PCA-based vulnerability index, we set the weights f_k equal to the "scoring factors" for the first component obtained using the PCA.