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PORTUGUESE HOUSEHOLDS' STRESS TEST – DIAGNOSIS AND PROSPECTIVE ANALYSIS

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Acronyms and Abbreviations List

BdP	Bank of Portugal
EAD	Exposure at Default
EU	European Union
EC	European Commission
ECB	European Central Bank
ECHP	European Community Household Panel
EU-SILC	European Union Statistics on Income and Living Conditions
FM	Financial Margin
HFCS	Household Finance and Consumption Survey
ICOR	Survey on Income and Living Conditions
ILFPP	Survey of Financial Literacy of Portuguese Population
INE	Statistics Portugal
ISFF	Survey on the Financial Situation of Households
LGD	Loss Given Default
OECD	Organization for Economic Co-operation and Development
PD	Probability of Default
pp	Percentage Point

Abstract

This research investigates the financial vulnerability of Portuguese households and the impact of macroeconomic shocks on it. The empirical analysis is mainly based on European Union Statistics on Income and Living Conditions (EU – SILC 2010) for Portugal (5,182 households). Using stress test methodologies, the financial stress of households is identified, adopting measures of different levels of vulnerability based on financial margins. Three types of scenario are constructed to assess the impact on family vulnerability of three different types of shocks: an increase in the interest rate, an increase in the unemployment rate and a decrease on income. The empirical results show that the vulnerability of households is weakly affected by rises in the interest rate. By contrast, the rise in unemployment and the decline in the level of household income have a high impact. These computed effects converge with other empirical studies recently conducted in other European countries. The comparison between the households' situation before and after the economic and financial crisis suggests a dramatic worsening of the financial vulnerability of households, particularly those in the lowest quartile of income and households composed by a single parent or couples with dependent children.

Keywords: Stress testing; vulnerability of families; *European Union Statistics on Income and Living Conditions SILC;* Portugal; Household finance.

JEL code: D10; D14; R2.

Introduction

In recent decades, household debt has increased exponentially in most developed economies. The combination of this increase with the recent crisis has drawn attention to the financial vulnerability of households and the sustainability of the financial system. The years before 2007, characterized by a reduction of credit restrictions, the creation of new financial products and easy access to banks contributed to a very significant increase in the households' indebtedness in most of the OECD countries, particularly in Portugal. Costa & Farinha (2012) show that in 2010, about 40 % of Portuguese households are indebted. According to Anioła & Gołas (2012), the results of survey data (EC Report, Fondeville et al., 2010) indicate that in 2009 the level of household debt in Portugal exceeded the total income of Portuguese households, and it stood at 116.8 %, up from 94.4% in 2005. These values were higher than those of the average of countries in the European Union (EU), which rose from 80 % in 2005 to 96.9 % in 2009.

Currently, with restrictions on access to credit, high unemployment and reduced incomes, reduced savings (in 2010 only 50 % of the Portuguese population declares being able to save (BdP, 2011c)), and the decrease in the value of assets in particular real estate, households face difficulties in meeting their debt service, and this could thus affect the stability of the financial system. According to Leigh et al. (2012) the decrease in economic activity in most developed countries is just too great to result from the reduction of real estate value, and it is not only driven by the banking crisis.

The decrease is "the combination of house price declines and prebust leverage that explains the severity of the contraction" (Leigh et al. 2012, p. 115).

At the macroeconomic level, according to Jenkins et al. (2011) a similar reduction in GDP may have considerably different implications on living standards in different countries. The impact of a decrease in income on living standards of a country which has been softened by government policies (and probably an increase in public deficit) is significantly different from the effects where the decrease in income is fully transferred to household finances. This perspective is particularly important for Portugal since according to the Memorandum of Understanding (Governo de Portugal, 2011) the Portuguese economic policy authorities are committed to reducing the public deficit through measures that directly or indirectly affect household income. Thus, the study of financial vulnerability of households in the Portuguese case gains greater relevance since the loss of income for households and firms leads to a reduced ability to comply with the debt service of the private sector and in turn possible losses in the banking system.

The European Banking Authority, in cooperation with the European Systemic Risk Board, conducted a stress test in various EU financial institutions, with the aim of testing resilience against adverse shocks. The assumptions aimed to assess the capital adequacy of banks considering a capital ratio of Core Tier 1 of 5%. The adverse scenario associated with the stress test was set by the European Central Bank (ECB) for the period 2011 and 2012 (BdP, 2011a). In Portugal, this test was conducted by the Bank of Portugal (BdP) and was applied to the four largest bank groups, which

represented about two thirds of the total assets of the Portuguese financial system in 2010 (BdP, 2011b). The test took December 2010 as a reference date and assumed various scenarios for 2011 and 2012. The adverse scenarios included, among others, an increase in short-term rates (Euribor 3 months) and an increase in unemployment (BdP, 2011a). The test results carried out in 2010 showed that the banks had reached the suitable level of capital.

Campbell (2006), states that one of the challenges of studying the Household Finance is that the behavior of households is difficult to measure accurately. The results suggest that many families are reasonable investor but a minority, poorer and less educated, still make serious mistakes, such as not participating in risky assets markets, the low diversification of portfolios and the non-mortgage refinancing.

A recent review of household finance literature also stresses these issues (Guiso & Sodini, forthcoming).

The purpose of this research is to study the financial vulnerability of Portuguese families and how it is affected by adverse macroeconomic shocks, adapting some prospective assumptions (interest rate, unemployment and income) of the stress tests carried out in banks. The methodologies used were developed in the empirical literature on household debt and built on the definition of a financial margin of the households. Basically the financial margin is computed by subtracting from the household disposable income some spending assumed to be a minimum (for example, to meet the basic needs of the household members). Because different margins are defined, different levels of vulnerability are measured. Throughout this study, a

vulnerable household is defined as a household with a negative financial margin. The construction of two different types of scenarios is based on adverse shocks. With the prospective analysis, the research aims to test the resilience of households to changes in crucial variables for the level of financial stress, quantifying the increase in the share of vulnerable households. The study is carried out at an aggregate level (total households) and by types of families depending on their composition and level of income. Although the negative effects on the ability of the households to meet debt service also impact on the banking system, this indirect impact is beyond the scope of the current dissertation.

The empirical section of this research is mainly based on the *European Union Statistics on Income and Living Conditions (EU - SILC)* for Portugal, using 2010 data, the last available micro data for EU-SILC (INE, 2012c). The data used can reflect the effects of two years of crisis, which is taken to start in late 2007. The studies conducted before the current financial crisis (Johansson & Persson (2006), Vatne (2006), Gomez-Salvador et al. (2011), Farinha (2003), Farinha (2004), Farinha & Noorali (2004), Farinha (2007)) do not yet consider this dramatic decrease in household income and the potential losses for banks and consequent consequences in the stability of the financial system.

This research adds value in different aspects: (i) it adapts to Portugal methodologies already applied in other EU countries as for example Albacete & Fessler (2010), who conducted a stress test to assess the financial vulnerability of Austrian households; (ii) it analyses a period after crisis; (iii) it can be compared with other studies also based on EU-SILC; (iv) the results could contribute to a better understanding of the current

and future losses in the domestic banking sector as well as provide clues on how to avoid them; and (v) the methodologies applied here help to overcome the time gap between collection and diffusion of information collected by large household surveys. For example, the EU-SILC 2010 microdata are only available 2 years after being collected (Table A I in Appendix). For Banks the recent rapid progression of private debt (households and firms) is hard to capture in detail in a timely manner (BdP, 2012).

This dissertation is organized into three sections. Section 1 will present a brief literature review on household financial stress. Section 2 characterizes the database used, presents the methodology and lastly the results for household vulnerability and the impact of adverse shocks are presented and discussed. Section 3 lists the main conclusions of the study and suggests future research avenues.

1 Stress tests and Household indebtedness – A brief literature review

Testing household financial stress - i.e. the application of macroeconomic shocks on household financial margins and identifying household financial vulnerability - is a relevant research topic in a context of economic and financial crisis. Currently there are changes in the behavior of the households, who have found themselves compelled to change to ensure their financial survival. Some empirical studies have been carried out on the ability of households to pay their financial obligations after the occurrence of macroeconomic adverse shocks (household test of stress) and on the impact that any defaults arising from those shocks may have on the banking system. These studies have been developed for Portugal and for other countries. In the presentation that

follows a distinction is made between studies undertaken before and after the current crisis began, in the end of 2007.

1.1 *Household Financial Vulnerability and Impact on the Banking System - studies before the crisis*

1.1.1 The Portuguese Case

Farinha (2007) uses the *Heritage Survey of Families and Debt /Inquérito ao Património e Endividamento das Famílias* (IPEF) for 2006/2007 and applies a regression to identify the effects on household debt of some socio-economic factors (e.g. income, age, education level, employment status). She found that debt is particularly sensitive to household income and the age of the household representative, and the states of greater vulnerability appear in families with lower income levels or whose representative is young. The situation is partially mitigated by the existence of collateral, since in most housing loans in Portugal the house is given as warranty to banks, so, housing loans generally are considered low risk, assuming that housing prices are not overvalued. Additionally, Farinha (2007) argues that banks have limited the effect of rising interest rates on families through debt restructuring, i.e. increasing the maturity of the loan. The results based on IPEF show that the total debt of vulnerable families (low income and young) or which may become vulnerable (unemployed) represents a relatively low weight in total debt to banks. However some data and assumptions in Farinha (2007) have become outdated. For example, the value of real estate is currently under evaluated (INE, 2012b): in June 2012 bank evaluation

of the average value per square meter of housing for the country stood at 1,039 euros, which represents a negative growth of 7.9% compared to June 2011.

1.1.2. Other studies

Johansson & Persson (2006) studied the effects that increasing interest rates and an increase in the unemployment rate may have on the ability of Swedish families to meet debt and the subsequent potential losses in the banking sector. They use micro data taken from *Statistics Sweden for Swedish Household* 2004 and they calculate the household financial margin as a measure of household vulnerability. The financial margin is defined as the amount of income remaining after payment of debt service and the acquisition of essential goods (i.e. household disposable income net of debt service minus essential expenses, such as food, clothing, electricity, etc.). The authors assume that households with negative financial margins will go into default and therefore they have a probability of default equal to 1. On the basis of this assumption, they calculate the possible bank losses by deducting the household's debt from its wealth. They conclude that households are much more sensitive to interest rate changes than to changes in unemployment. At the time of their analysis (2004), the crisis had not yet begun and, as such, it was unlikely that the result of the household debt would cause significant banking losses. This view is no longer valid today.

Vatne (2006) uses micro data for Norway for the period 1987 to 2004 to calculate the financial margin, which is defined as the household net assets after payment of debts and essential living costs. He concludes that the percentage of total debt held by

Norwegian households with negative margin decreased from the late 1980s until 2004, which, *ceteris paribus*, gave rise to a reduction in the credit risk associated with bank loans.

Gomez-Salvador et al. (2011) use micro data from the EU-SILC for the year 2007 in order to generate information for the Eurozone on household debt. They conclude that the probability of having a housing loan increases with the degree of income and, as a function of age, it does not have a linear behavior: it first increases and then decreases in the older age groups. They also conclude that the lower the level of income, the greater the vulnerability of the household debt service. In addition, the authors point out the particular nature of the current financial crisis, which has reduced the options that families have to mitigate interest rate shocks due to falling house prices and increases in uncertainty about income.

Fuenzalida & Ruiz-Tagle (2009), using a survey for the Chilean population in 2004, concluded that financial stability can be affected by the behavior of households towards adverse macroeconomic conditions, with the financial vulnerability of households dependent on the level of debt and income. When applying a shock on the unemployment rate, they conclude that financial stability is not significantly affected.

Herrala & Kauko (2007) using data from Statistics Finland regarding 2004 conclude that the debt of vulnerable households is insensitive to shocks in the unemployment rate, in the interest rate and in housing prices. The shock of the interest rate has a more significant impact than the others shocks, although moderate, mainly because most of households credits have variable interest rates.

1.2 *Household Debt and Impact on the Banking System – after the crisis*

Unlike the financial stress tests for banks that are being applied for several years, stress test to households and the associated methodologies are being conducted recently and are fomented by the growing interest in identifying the effects of the crisis on the financial situation of individuals (households and companies), banking system and the mutual negative interactions that may occur. These studies have been conducted in several countries, for example in Austria (Albacete & Fessler, 2010), Croatia (Sugawara & Zalduendo, 2011), Finland (Petr Jakubik, 2011), Italy (Magri & Pico, 2011), or groups of countries such as EU countries (Anioła & Gołas, 2012; Fondeville et al., 2010), Asian countries (Tiongson et al., 2010). This paper applies for the first time these tests to Portugal.

The adopted methodologies to evaluate the financial stress are varied. For example application of risk indicators (Dinh et al., 2012) or determination of simple measures of vulnerability based on net interest income of households (Albacete & Fessler, 2010). The latter methodology will be adopted in this dissertation because the achieved results are comparable with the previous empirical literature, plus it allows a first approach to an issue study for the first time for the Portuguese case.

Regarding databases adopted for stress testing households, questionnaires from Eurostat (Magri & Pico, 2011), from central banks of different countries (Faruqui et al., 2012; Holló & Papp, 2007), for specific research projects (Anderloni et al., 2012) and others are used. In the present investigation the essential information used is the EU-SILC because it allows the study to be compared with previous results or replicated in

countries where it has not been used and still enables an analysis to the same individuals / households over time because EU-SILC is an annual panel survey.

1.2.1 The Portuguese Case

Eurostat surveyed families about the propensity to over-indebtedness through a special *ad hoc* module (EU-SILC 2008 Module on Over-Indebtedness and Financial Exclusion) included in EU-SILC 2008, which contains specific questions about amount of debt and credit debt. The focus of the analysis is "on households whose aggregate debts amount to over 100% of monthly disposable income" (Fondeville et al. 2010, p.27); however, the information collected by the *ad-hoc* module is mainly about the status of the households two years prior to the date of the survey (2008), so it does not fully reflect the effects of the crisis. The information collected precludes the possibility of distinguishing between situations of long-term debt and temporary borrowing, or if families increase credit demand to avoid a decrease in the expenditures. According to this study, housing loans represent a large share of total household debt in all EU countries, and Portugal is one of the countries where this phenomenon is increasing. While EU housing loans represent 67.9% of the household disposable income in 2009 (52.6% in 2005), these values for Portugal were 93.0% in 2009 (75% in 2005). According to Fondeville et al. (2010, p.21) "it is evident that there is no simple relationship between the growth of household credit in relation to income and the relative number of households experiencing financial difficulties". This result is not surprising given that some years ago access to credit access was easier and credit was used to maintain or increase consumption when the income fluctuated. A key

question is therefore to investigate whether household income is increasing in proportion to the debt service and, if not, what is the extension of this gap.

Furthermore, according to Fondeville et al. (2010) the proportion of Portuguese households showing delays in payments decreased between 2007 and 2008, from 6.6% to 5.0%. However, the proportion of Portuguese households who reported "difficulty in making ends meet" rose from 37.2% in 2007 to 45.3% in 2008. Therefore, the increased difficulty in meeting the commitments of the households was not accompanied by an increase in the percentage of households of families with late payments.

Using data for the period between January and May 2010, from the *Central de Créditos* [*Central Credit Register*], which is managed by Bank of Portugal (Portuguese Central Bank) and compiles information provided by all credit institutions operating in Portugal, Farinha & Lacerda (2010) estimate the impact of several factors on *credit delinquency*. The concept of credit delinquency adopted by the authors is defined as when the borrower has credit delay in a specific segment (housing loans, car loans, credit cards, other consumer loans and other credit) for at least three consecutive months.

Farinha & Lacerda (2010) show that defaults on housing loans differ significantly from those observed in other segments of credit; default rates associated with housing loans (which in Portugal account for about 75% of household credit) tend to be significantly lower than in any other household credit segment. Furthermore, the results obtained indicate that borrowers of housing loans are less likely to go into

default in all other segments. This result can be interpreted as a sign that the housing credit is authorized to households that have a lower risk of default because they tend to have higher levels of income and assets.

1.2.2 Other studies

Albacete & Fessler (2010) using several micro data, including the EU - SILC 2008, apply a stress test to Austrian households and assess the risk of financial instability resulting from the household indebtedness. They define a financial margin for households with debt and then, introducing different economic shocks (e.g. changes in interest rates), study their impact on financial margins. The financial margin is defined as household disposable income minus basic consumption and debt service. They conclude that Austrian households who hold the largest share of household debt have higher levels of education, income and wealth. The economic shock that has the greatest impact is the increase in interest rate. The computed potential bank losses resulting from adverse shocks applied to households do not reveal to threaten stability of the Austrian financial sector.

2 Empirical Analysis

2.1 Data bases and Methodology

2.1.1 European Union Statistics on Income and Living Conditions (EU-SILC) EU - SILC

The micro data base used in the empirical work is the European Union Statistics on Income and Living Conditions (EU-SILC) for Portugal and for the year 2010 (7 th wave)

the latest data available of SILC (INE, 2012c). In the methodological document (INE, 2009) about SILC and on the Eurostat website (Eurostat, 2012) there is a detailed explanation of the survey methodology and content. Although the EU-SILC, successor to the European Community Household Panel (ECHP), "is not a pure household finance survey, it contains relevant information for the analysis of household indebtedness" (Gomez-Salvador et al., 2011, p. 12) and the study of financial vulnerability of households. The differences and similarities between the two surveys (SILC vs. ECHP) are discussed in Eurostat (2005).

The EU-SILC – in Portuguese *Inquérito às Condições de Vida e Rendimento (ICOR)* – started in 2004, and it provides standardized information for the countries of the EU, is collected in an annual basis based on a sample of about 5,000 households. Table AI in Appendix summarizes some of the existing information about household financial situation in Portugal and EU and provide some examples of empirical literature which uses those surveys results. The Tables AII and AIII in the Appendix select the questions and list the main information topics in EU-SILC 2010 that are relevant to the present research. For example the minimum income needed as it is perceived by respondents (Question A39, Table A III in Appendix).

2.1.2 Other Sources of Information

This section presents briefly some results relevant to the analysis and obtained from other databases than the EU-SILC. The *Inquérito à Situação Financeira das Famílias (ISFF)* conducted in 2010 is part of the European Household Finance and Consumption Survey (HFCS). In Portugal the ISFF is conducted jointly by BdP and INE, and it aims to

obtain a detailed characterization of the financial situation of the households in a comparable manner across the Euro zone countries. It is expected that HFCS data will be published in 2013 (Table A I in Appendix).

BdP & INE (2012) indicates that 75% of individuals who worked in the three years preceding the survey report that they did not felt a deterioration of working conditions during the three years preceding the survey and 15% lost their jobs. 10 % of families stated that their expenses in the 12 months before to the survey were higher than their income in the same period, and to manage this most households use their savings. Regarding the reason for the realization of savings, more than half of the total household states that is for funding unexpected events. BdP & INE (2012) also show that approximately 40% of households are indebted, and 25% constituted mortgages on their primary residence.

The Inquérito à Literacia Financeira da População Portuguesa (ILFPP) [Survey of Financial Literacy Portuguese Population (ILFPP)], is published by the Bank of Portugal and is within the scope of supervision role of central bank. The financial crisis has reinforced the importance of financial literacy as a way to promote the stability of the financial system (BdP, 2011c). In 2010, 48% of ILFPP's respondents do not save and of these 88% is because the income does not allow it. Those who save, 44% do it irregulary, using for example, the Holiday Pay or the Christmas Pay. When asked about the reason for saving 58% of respondents declared that it is to cover unforeseen costs and only 6% mentioned the intention to use the savings in future retirement. Most of the the respondents with loans (about 22% of total) say they have never made payments in advance and the main reason mentioned is lack of money available.

2.1.3 Sample (Portugal, 2010)

The sample EU-SILC 2010 in Portugal includes 5,182 households and 11,380 individuals. According to the original variables approximately 28% of households report no capacity to handle unexpected expenses, of which 55% are composed of one adult with one or more children dependents, and about 80% say they feel it difficult to make customary charges and ends meet (see Tables A IV, A V, AVI, A VIIa and A VIIb in Appendix). Surprisingly, the percentage of families who claims to have delayed payment of rent or monthly mortgage loan is low (7%). However, the answer to this question (Tables A VIIa and A VIIb in Appendix) have a very high percentage of missings approximately 53% , suggesting an underestimation of the cases of delayed payments. Additionally, almost all households (98%) that have delays in the payment of rent or monthly mortgage loan also feel it difficult to make ends meet.

2.1.4 Methodology – Stress Tests

There is a large gap between the date of collection of data from households and the date of release of the information, so there is a delay in diagnosis of the vulnerability of families when large household surveys are used. This dissertation contributes to overcome that gap.

The total household debt as a percentage of the disposable income is accurate measure for market risk monitoring (Vatne, 2006). A high proportion of debt in relation to disposable income can lead to a reduction of expenditure by households, a decline in demand for goods and services, and a consequent reduced ability for firms

to pay debt service and finally losses in banks, direct consequence of the adverse financial situation of households and firms (Albacete & Fessler, 2010).

The process of computing the number of vulnerable households before and after the testing of stress and the existence of potential bank losses is developed following four phases. These phases are summarized in Figure 1. The software used was SPSS 14.0 (Norusis, 2002) and STATA 9 (Hamilton, 2004).

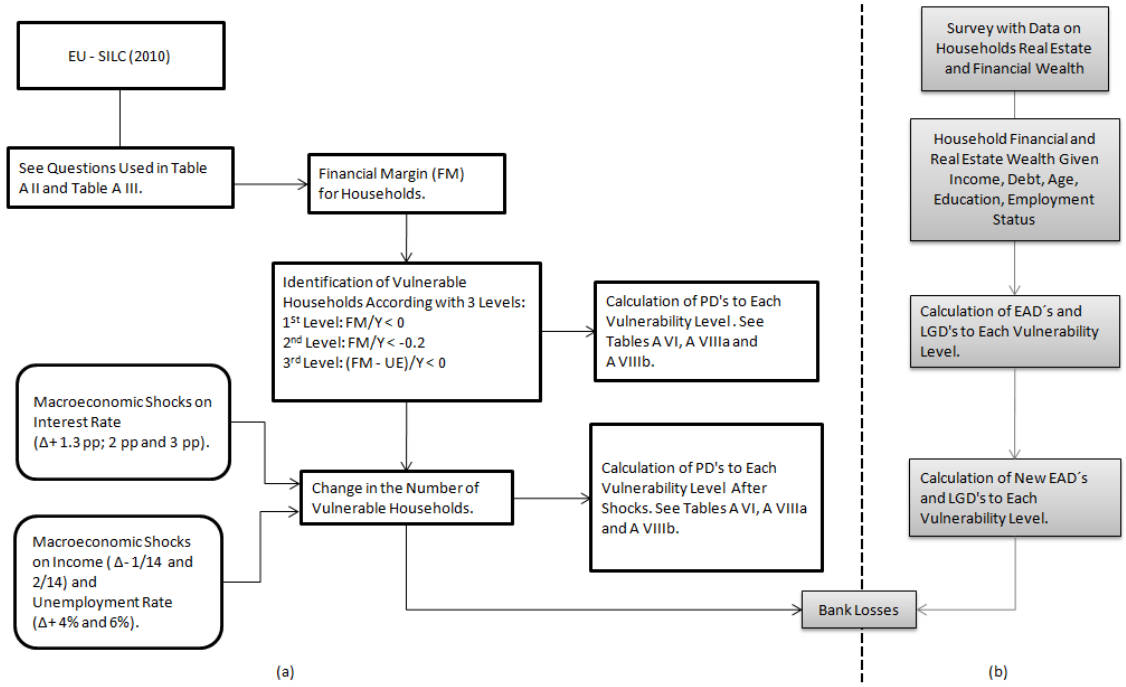

FIGURE 1 – Summary of the Analysis.

Source: Table adapted by the author based on Albacete & Fessler (2010, p. 76), Chart 2.

(a) Analysis made in the present paper based on available information from EU-SILC 2010 database.

(b) Suggestion of analysis for the calculation of bank losses based in additional data.

Legend: Y= Disposable Income; UE = Unexpected Expenses (400€); PD= Probability of Default; EAD= Exposure at Default; LGD= Loss Given Default.

Figures 1 and the description of the four phases include the calculation of the parameters Exposure at Default (EAD) and Loss Given Default (LDG). However those measures are not calculated in this study due to lacking data. The calculation of both indicators (EAD and LGD) requires a detailed knowledge of total household debt, as well as its wealth (real assets, savings, etc.). As far as the author knows, this

information is not available in micro data, existing only in tabulated format (e.g. Farinha & Lacerda, 2010).

In general, applying the stress test to households involves a sequence of procedures: calculating baseline figures; identifying vulnerable households; subjecting households to shocks, e.g. unemployment shock or interest rate shock (Tiongson et al., 2010).

The present research will be developed in three phases.

Phase 1- Vulnerability Measures

For the identification of vulnerable households financial margins are computed. Being at financial risk means a negative margin. The empirical literature has multiple examples of financial margins evaluation. Financial margin represents the proportion of the income of each family that becomes available after completion of debt service and payment of current expenses (Johansson & Persson, 2006), so the financial margin is "a measure of how well the household is able to make ends meet "(Albacete & Fessler, 2010, p 78). It is through the financial margin that the resilience of families will be monitored when adverse macroeconomic shocks happen. For example, comparing the vulnerability measures before and after an income decrease or an increase in interest rate or unemployment rate.

One way of computing the margin for each household is:

(1a) $FM_j = Y_j - (BC_j + DS_j)$. $(j = 1, \ldots, n)$

Where, Y_j is the monthly household disposable income (Tables A VI, A VIIIa and A VIIIb in Appendix); BC_j is the basic consumption of household j (self perception) and DS_j the

debt service. The sum of these two expenditures is obtained directly from the EU-SILC 2010 (question A39, variable HS130, Tables A II, A III, A VIIIa and A VIIIb in Appendix).

The amount used for the calculation of net interest income on basic consumption and debt service is given by the answer to the question " Tell about what is the minimum monthly income needed to make usual ends meet" (Albacete and Fessler, 2010), variable HS130. Gomez-Salvador et al. (2011, p. 32) states that the "total cost housing" "*includes mortgage interest payments, structural insurance, mandatory services and charges, regular maintenance and repairs, taxes and the cost of utilities, current monthly cost*" .

Using the same database other financial margin can be computed. This dissertation suggests a new margin calculated as:

(1b) $FMU_j = Y_j - (BC_j + DS_j) - Unexpect_j.$ (j= 1, …, n)

Where, the variables have the same meaning that (1a) and $Unexpect_j$ is unexpected expenses. The value of unexpected expenses in the present research is fixed in 400 Euros (question A37, EU SILC 2010, Tables A II and A III in Appendix).

A different group of measures is based on relative values, for example the share of margin on disposable income. Figures 2 to 5 show graphically these indicators distributed by deciles (deciles were calculated based on the variable household income per adult equivalent) for the total family (Figures 2 and 3) and only to households holding loans (Figures 4 and 5). The households in the bottom decile have negative margin (disposable income less basic expenditures) which is more than twice the

disposable income. The households in the upper decile have on average a positive margin representing approximately 30% of the disposable income (Figure 2).

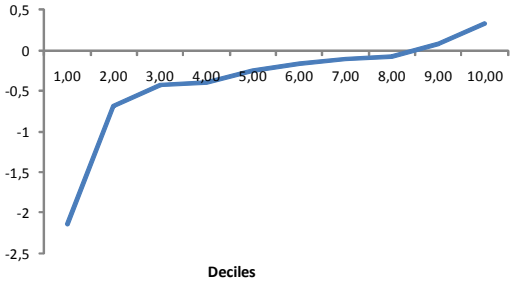

FIGURE 2– Mean of Percentual Margin by Deciles for All Households (N= 5,040).*

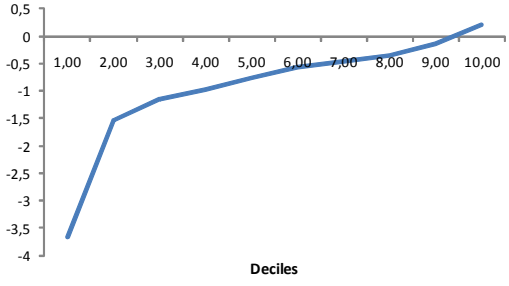

FIGURE 3– Mean of Percentual Margin After Unexpected Expenses by Deciles for All Households (N= 5,040).*

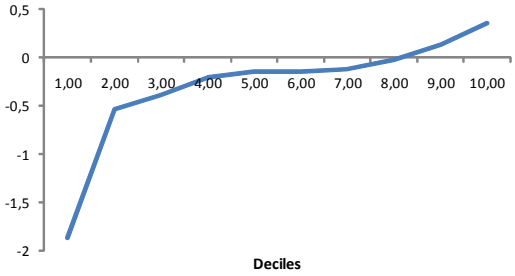

FIGURE 4– Mean of Percentual Margin by Deciles only for Households with Mortgage Loans (N= 1,126).*

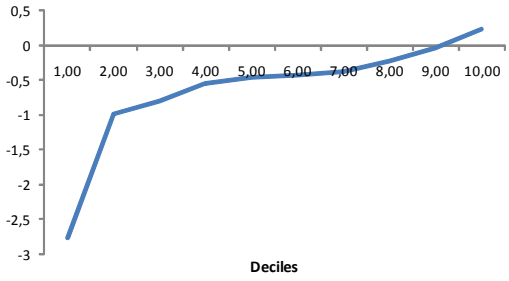

FIGURE 5– Mean of Percentual Margin After Unexpected Expenses by Deciles only for Households with Mortgage Loans (N= 1,126).*

Source: Figures constructed by the author based on microdata from the EU-SILC 2010 database.

(*) Deciles based on Income per Adult Equivalent from EU-SILC. Percentual Margem computed as: (Disposable Income - Minimum Income to meet expenses and charges) / Disposable Income. Percentual Margem After Unexpected Expenses computed as: (Disposable Income - Minimum Income to meet expenses and charges - 400€) / Disposable Income.

When the unexpected expenditures are deducted, only the households belonging to the top decile hold , on average, positive margin (Figure 3).For families with housing loans, it appears that in the bottom deciles the share of negative margin in disposable income is slightly lower than for the total households (with and without housing loans) (Figure 4). The results obtained through the EU-SILC 2010 (Figures 4 and 5) suggest that families with housing loans earn more on average. Results shown by Farinha & Lacerda (2010) using a different database (Central Credit Register, managed by Bank Portugal) converge with this.

Phase 2- Vulnerable Households Identification – Probability of Default

Using the previous vulnerability measures is possible to classify households according to vulnerability levels.

For the qualitative analysis of the situation of families two dummy variables were created associated with positive and negative margins. It is assumed that the probability of default of the household j (PD_j) is equal to 1 if its financial margin is negative and equal to 0 otherwise:

$$(2) \qquad PD_j = \begin{cases} 1 \text{ if } FM_j < 0 \\ 0 \text{ otherwise.} \end{cases} \qquad (j= 1, \ldots, n)$$

$$(3) \qquad EAD= ((\sum_j PD_j D_j) / \sum_j D_j) \times 100. \qquad (j= 1, \ldots, n)$$

Where, D_j is household debt.

$$(4) \qquad LGD= ((\sum_j PD_j N_j) / \sum_j D_j) \times 100. \qquad (j= 1, \ldots, n)$$

Where, N_j is the debt deducted from the aggregate household wealth.

A method of calculating the variables FM, PD, EAD and LGD was proposed by Albacete & Fessler (2010) and Johansson & Persson (2006). Due to lack of information available the last two variables described (EAD and LGD) are not calculated. In fact, "*The EU-SILC Does Not Provide direct estimate of the overall debt service, but only of interest payments on mortgage debt (excluding capital payments).*" (Gomez-Salvador et al., 2011, p. 19).

Based on the margins (in value and as percentage) three vulnerability levels were identified according to the following criteria (see also Table A VIIIa in Appendix):

- *Vulnerability Level 1*: It builds on the assumption of vulnerability in a broader sense. It means Disposable Income deducted of the Basic Needs Expenditures (self-perceived). Albacete & Fessler (2010) and Johansson & Persson (2006) compute this indicator;

- *Vulnerability Level 2*: It is assumed that a family is vulnerable only when the negative margin as a percentage of disposable income reaches a value of -20%;

- *Vulnerability Level 3*: Part of the first but additionally includes unexpected expenses in the amount of 400 Euros, that is, according to this criterion a family is considered vulnerable if the financial margin computed previously (vulnerability 1) less 400 Euros is negative.

Although the percentage of households with negative margins, i.e. the proportion of families at risk, is a good proxy measure of household resilience against different shocks, this is not sufficient for calculation of possible bank losses. So, the knowledge about vulnerability of households improves when the proportion of assets and liabilities held by these vulnerable families are taking into account (Albacete & Fessler, 2010 and Johansson & Persson, 2006).

Brief diagnosis of the vulnerability of Portuguese households:

The descriptive statistics calculated are shown in Table A VIIIb in Appendix. According to the calculations made 42.3% of households had a positive financial margin, this

value decrease to 20.4% when the financial margin with unexpected expenses is applied. It should be noted that these values are different from those calculated by INE to identify families with *severe material deprivation* that are 10.4%.

The degree of vulnerability by level and income quartile is presented in Table A IX in Appendix where is shown that vulnerability, as expected, is more intense in low income levels. Throughout this analysis the 1st quartile represents the households with lower incomes and the 4th quartile represents the households with higher incomes. These results are consistent with those calculated in accordance with the original variables contained in the EU-SILC 2010, where about 49% of households in the 1st quartile income report no capacity to withstand unexpected expenses and 95% of families belonging to the same quartile of income claim to have difficulty making ends meet and customary charges (Table A IV in Appendix). The percentage of households with negative margin is in line with the other levels of vulnerability here computed: 57.7%, 44.4% and 79.6%, respectively (Table A IX in Appendix).

Considering the composition of the household, the households who are most vulnerable, according to the three levels mentioned are families consisting of 'an adult with one or more dependent children', 76%, 64% and 92% have a negative financial margin; this group is followed by families composed of individuals living alone, 70%, 55% and 93% hold a negative financial margin (Table A X in Appendix).

The identified vulnerability based on the three measures reaches higher levels than the vulnerability arising from direct questions included in the questionnaire (e.g. severe material deprivation). There is also a strong association between measures of

vulnerability calculated in this research and the poverty indicator directly obtained by questionnaire, according to which 21.3% of the households are below the poverty line.

Phase 3- Test 'Stress' and changing the number of vulnerable households

The application of 'Stress Test' contributes to the identification of the families that, before and/or after adverse shocks (e.g. decrease in income, increased in interest rate and increase in unemployment rate) have vulnerable status.

2.2 Stress Test Scenarios: Results and Discussion

2.2.1 Scenario of Increase in Interest Rate

Three scenarios are considered for interest rate: variation of 1.3 percentage points (pp), 2 pp and 3 pp. These variations follows the assumptions for test of stress of Portuguese banks (with time horizon of two years, 2011-2012; 3-month Euribor, end of period values) that passage the base value of 1.5% to 2.8%, i.e. 1.3% increase (BoP, 2011a). In this study, the base rate is unknown for what was decided to use the three values previously mentioned. The impact of a rise in interest rate is dependent on the type of interest (e.g. flexible or fix) associated with each loan. Following (Vatne, 2006) it is assumed that all contracts are renegotiated at the new rate and the new rate is applied immediately to all loans. Additionally, it is assumed that loans are repaid in accordance with the original plan without increasing maturity of the contract as suggested by Albacete & Fessler (2010) and it is considered that all the mortgage loans existing in 2012 also existed in 2010.

The application of interest rate shock only focused on households with mortgages loan, this subset of households is about 22% of all families (5,182 households were surveyed of which 1,126 have housing credit). The results before and after the application of the three scenarios for interest rates increase, according to the three levels of vulnerability are detailed by quartiles in Table A XI and by household composition in Table A XII, in Appendix. In general the impacts are zero or very small. For the 1st and 3rd level of vulnerability, the households with 'two adults with three or more dependent children' are the most vulnerable after a shock of 1.3 pp or 3pp interest rate. Like Johansson & Persson (2006, p. 36) our results show that a *sharper rise in interest rates does not greatly affect the proportion of households below the margin*".

2.2.2 Scenario of Decrease in Income and Increased in Unemployment Rate

Two scenarios are considered for disposable income change: a decrease by 1/14 (7%) and a decrease by 2/14 (14%). The increase in the unemployment rate adapt and update the scenario used in the test of stress applied to Portuguese banks in 2010 (adverse scenario anticipated for 2012 was 12.9%). The two adverse scenarios integrate an unemployment rate of 15% (the unemployment rate in the second quarter of the current year equals 15% according the Labour Force Survey (INE, 2012a)) and a more pessimistic scenario with an employment rate of 17%.

Table I shows the strong impact of income decrease in particular in the bottom income level. Moreover, when the income decreases by 14% there are groups of income

where a large majority (or even the all group) of the households in that group became vulnerable.

TABLE I

EFFECTS OF INCOME DECREASE

Disposable Income decrease (in pp)	1st Level of Vulnerability % of Vulnerable Households	3rd Level of Vulnerability % of Vulnerable Households
	Before -> After	Before -> After
7%		
Total	57.7% -> 62.9%	79.6%->83.2%
1st Income Quartile	82.9%->86.1%	99.5%->99.8%
2nd Income Quartile	65.2%->72.0%	94.2%->96.3%
3rd Income Quartile	50.7%->56.9%	79.1%->84.2%
4th Income Quartile	31.6%->36.1%	44.9%->51.1%
14%		
Total	57.7% -> 67.8%	79.6%->86.1%
1st Income Quartile	82.9%->90.8%	99.5%->100%
2nd Income Quartile	65.2%->77.3	94.2%->98.2%
3rd Income Quartile	50.7%->62.7%	79.1%->88%.1
4th Income Quartile	31.6%->40.2%	44.9%->57.4

Source: Table constructed by the author based on microdata from the EU-SILC 2010 database.
Note: Number of observations=3,602.

TABLE II

EFFECTS OF UNEMPLOYMENT RATE INCREASE

Unemployment Rate	1st Level of Vulnerability % of Vulnerable Households	3rd Level of Vulnerability % of Vulnerable Households
	Before -> After	Before -> After
10.8%-> **15%**	55.3%->56.8%	75.6%->76.6%
10.8%-> **17%**	55.3%->57.5%	75.6%->77.2%

Source: Table constructed by the author based on microdata from the EU-SILC 2010 database.
Note: Number of observations=3,602.

The application of the shock of unemployment only focused on families with active individuals, and uses the EU_SILC question about work intensity in the household. There were four answer options with two limit options: the household members worked 12 months during the year precedent to the survey, or, during that period they did not work at all. Figure 6 shows the results for the vulnerability level 1 and 3 , for each level of work intensity in the household, and illustrates the positive impact employment has on lower levels of vulnerability. The impact of 15% and 17% in the unemployment rate level, assuming 2010 as base year with approximately 11% of unemployment rate (the annual average of the unemployment rate in 2010 was 10,8% according to INE, 2011b) was computed by the following way (results are shown in Table II): it was assumed that the changes of the unemployed in all the active population (e.g. a change from 11% in 2010 to 15%) have a correspondent change in the percentage of unemployed households in the total of households (in 2010 was 19.9%), and the increase of unemployment only affect the households with intensity of work of zero or one. So, the increase in the households with all members unemployed is equal to the decrease in the number of households where all members are employed. Consequently, the structure of the households regarding work intensity changed and the vulnerability measures (level 1 and level 3) were recalculated based on a new weighted mean. The impact exists but is relatively low in percentual points: between1 and 3 pp. However, it represents, in absolute values, a large number of Portuguese households.

FIGURE 6 – Work Intensity of the Household and Vulnerability (level 1 and level 3), percentage in each household work intensity group.

TABLE III

SUMMARY OF EFFECTS OF THE THREE SHOCKS

Interest Rate Increases [a] (in percentage point)			Unemployment Rate Increases [b] (in %)			Income Decrease [b] (in %)		
	1st Level of Vulnerability	3rd Level of Vulnerability		1st Level of Vulnerability	3rd Level of Vulnerability		1st Level of Vulnerability	3rd Level of Vulnerability
	% of Vulnerable Households	% of Vulnerable Households		% of Vulnerable Households	% of Vulnerable Households		% of Vulnerable Households	% of Vulnerable Households
	Before -> After	Before -> After		Before -> After	Before -> After		Before -> After	Before -> After
1.3 pp	54.71% -> 54.80%	73.45% -> 73.45%	10.8%-> **15%**	55.3%->56.8%	75.6%->76.6%	7%	57.7% -> 62.9%	79.6%->83.2%
2 pp	54.71% -> 54.88%	73.45% -> 73.62%	10.8%-> **17%**	55.3%->57.5%	75.6%->77.2%	14%	57.7% -> 67.8%	79.6%->86.1%
3 pp	54.71% -> 54.97%	73.45% -> 73.62%						

Source: Table constructed by the author based on microdata from the EU-SILC 2010 database.

(a) The interest rate shock was only applied to households with mortgage loan (N=1,126). See Tables A XI and A XII for households vulnerability by disposable income quartiles and household composition.

(b) N= 3,602.

Summing up, the impacts of an income decrease have a large impact on household vulnerability and the effect of interest rate increase is very small and directly only in small share of total population. An increase in unemployment rate affects household vulnerability but in a lower scale compared with income decrease (Table III). Johansson & Persson (2006), conclude that not even a marked rise in interest rates affect

significantly the proportion of households below the margin. In the same way, Sugawara & Zalduendo (2011), testing a devaluation in currency exchange rate (in combination with interest rate and unemployment shocks) conclude that the additional households facing financial distress are few. Both findings converge with these empirical results. Table III summarizes the effects of each shock.

To compute the potential bank losses as a result of adverse shocks applied in the previous sections a 4th and final step would be necessary. It should include the computation of EAD's and LGD's given by the expressions (3) and (4). The Notice (*Aviso*) of Bank of Portugal No 5/2007 (BdP, 2007) defines the method of calculating LGD associated with risk exposures (for institutions not allowed to use their own estimates of LGD), PD and EAD. It also defines the need for periodic tests of stress in banking system. These formulas for EAD, LGD and PD, cannot be replicated in the present research, even in a simplified format. The main data to carry out that exercise are not available.

3 Conclusions and Future Research

The current financial crisis has highlighted the importance of the research in Household Finance and in particular the behaviour of families in managing their financial resources and debts. Much of the literature on household debt focuses exclusively on the impact on the banking system. This research focuses on the financial vulnerability of households from the perspective of diagnosis and prospective analysis, which could be a first step in the research of the impact of families' financial status on banks. While stress tests have been conducted for banks, they have also become more common for families over recent years. This dissertation adapts methodologies applied to other economies' performances, and, to the author's knowledge, carries out the first stress test on Portuguese households, using the latest available micro data obtained by Portuguese household surveys, the SILC 2010 (INE, 2012c).

In the first part of the empirical analysis, the financial situation of Portuguese Households is diagnosed. Then macroeconomic shocks - a decrease in income, unemployment and interest rate increases - are applied and their impact on household financial vulnerability is analyzed. This study introduces some differences compared to previous tests on the stress and financial vulnerability of households. It introduces different levels of vulnerability and explores new variables (for example, it examines the quantitative impact of an unexpected expense on the financial margin). This work is innovative in that it combines quantitative data with qualitative data. Furthermore it is comparable with previous studies using similar methodologies and can be replicated for all countries in the EU27, since SILC is a Eurostat survey.

The analysis of the financial situation of households shows that those holding credit have on average higher incomes, and situations of greater vulnerability appear in families with lower income levels. These results converge with those of the previous literature. The results from the prospective analysis also converge with most of the empirical literature on other countries, in particular after current crisis. A rise in the unemployment rate has a more negative impact on the vulnerabilities of households than a rise in interest rates. After a rise in interest rate by 3pp, the financial margin in relation to disposable income (the difference between income and basic household expenditures) increases from -29.55% to -29.84%, and the margin for unexpected expenses over 400 Euros increases from -64.11% to -64.52%. A decrease of 14% in income results in an increase in the number of families with a negative margin from 57.7% to 67.8% (1st vulnerability level) and from 79.6% to 86.1% (3rd vulnerability level), and a rise in unemployment from 10.8% to 17% leads to an increase in percentage of vulnerable households from 55.3% to 57.5% (1st vulnerability level) and from 75.6% to 77.2% (3rd vulnerability level). The impact on the level of vulnerability differs according to family composition and the income quartile to which it belongs. Families belonging to the bottom income quartile are the most vulnerable regardless of the extent of vulnerability measure used. Single parents and families composed of couples with dependent children are the most vulnerable types of households.

The methodology used in this study makes it possible to bridge the gap that currently exists between the collection of data from households and the dissemination of information about the indebtedness of the households, while enabling the

identification of the types of families that are most vulnerable, an aspect not covered in the financial and banking statistics.

One limitation of this study is that the analysis of the vulnerability of families and their financial margins are considered on the basis of information on income only, and it ignores wealth. However, in the current crisis this is essential. Nonetheless, because data on accumulated wealth for each family are ignored, the results about vulnerability could be overestimated.

A main avenue for future research would be to apply the methodology suggested in section 2.2.2 4th phase: identification of transmission channels between the financial vulnerability of households and the banking system, and quantification of the potential impact of macroeconomic shocks. This would make it possible to obtain an estimate of potential bank losses, and thus assess the sustainability of the financial system as a whole. Other relevant points for continuation of this research could involve: the application of an exogenous shock to the level of depreciation of real assets, i.e. devaluation of the value of the property under mortgage; and definition of a new measure of vulnerability achieved by restructuring the debt held by families, such as an increased period of funding.

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Appendix

Tables Index

TABLE A I

SUMMARY OF SOME EXISTENT INFORMATION ABOUT HOUSEHOLDS INDEBTEDNESS [*]

Source	Entity that Collects and Process Data	Availability of Microdata (Last Information Available)	Period of Information (Frequency)	Literature
European Union Statistics on Income and Living Conditions (EU-SILC)	Eurostat	Yes (2010)	2004 – 2011 [**] (Annual)	(a)
European Community Household Panel (ECHP)	Eurostat	Yes (2001)	1994 – 2001 (Annual)	(b)
Household Finance and Consumption Survey (HFCS)	European Central Bank; National Central Banks	Forthcoming 2013/2014 ?	Late 2010/ Early 2011	-
European Social Survey (ESS)	EC's Framework programme	Yes (2012)	2002-2004-2006-2008-2010 Biannual	-
Central Credit Register	Bank of Portugal	No	Monthly	(c)
Household Wealth and Indebtedness Survey (IPEF)	Statistics Portugal (INE); Bank of Portugal	Yes (2006)	1994; 2000; 2006/2007 (Quinquennial)	(d)
Inquérito à Situação Financeira das Familias (ISFF)	Statistics Portugal (INE); Bank of Portugal	No (2010)	-	(e)
Household Budget Survey. Inquérito aos Orçamentos Familiares (IDEF)	Statistics Portugal (INE)	Yes (2006)	1980/81 1989/90 1994/1995 2000 2005/2006 (Quinquennial)	-

Source: Table constructed by the author based on: European Central Bank (2012), Eurostat (2012), INE (2006), INE (2011), INE (2012c) and HFCN (2009).

(*) This table is not exhaustive. It does not include, for example, information produced by the statistical authorities of each country.

(**) The 2008 survey includes a special ad hoc module on Over-Indebtedness.

(a) Aniola & Golás (2012); Fondeville et al (2010); Albacete & Fessler (2010). Period of analysis: 2008, and Gomez-Salvador et al (2011). Period of analysis: 2007.

(b) Georgarakos et al (2009). Period of analysis: 1994-2001.

(c) Farinha & Lacerda (2010). Period of analysis: January to May 2010.

(d) Farinha (2003); Farinha (2004). Period of analysis: 1994-2000, Farinha & Noorali (2004). Period of analysis: 2000, Cardoso et al (2008). Period of analysis: 2006, and Farinha (2007). Period of analysis: Last quarter 2006 and first quarter 2007

(e) BdP & INE (2012). Period of analysis: 2010.

TABLE A II

SUMMARY OF THE INFORMATION USED FROM EU-SILC 2010

Issue		Areas and Questions	Reference Period
Household	Housing Costs	Interest (*question A22*) and Monthly Installments of Housing Loan (*questions A20 and A23*)	Last Installment Paid
		Rent (*question A27*)	Last Rent Paid
		Burden of Housing Costs (*question A31*)	Time of Interview
	Economic Situation	Financial Capability (*question A33*)	Time of Interview
		Indebtedness due to Consumer Credit and Credit Card (*question A34*) and Arrears in Payments (*question A36*)	Time of Interview (A34); Past 12 Months (A36)
		Unexpected Expense (*question A37*)	Time of Interview
		Degree of Difficulty in Supporting All Expenses (*question A38*)	Time of Interview
	Basic Consumption	Minimum Monthly Income Needed to Make Ends Meet (*question A39*)	Time of Interview
	Interest on Mortgages	Interest (*question A64*) and Annual Installments of Housing Loans (*question A65*)	Calendar Year Preceding the Interview (2009)
Individual *	Biographical Information	Gender (*question I2*)	-
		Age (*question I3*)	Date of Birth
	Socio-professional Information	Employment Status (*question I12*)	Time of Interview
		Category that Describes Employment Status (*question I40*)	Time of Interview
	Education	Education, Highest Level of Education Completed (*question I29*)	Time of Interview
	Income	Net Monthly Income from Work for Third Parties (*question I62*)	Calendar Year Preceding the Interview (2009)

Source: Table adapted by the author based on INE (2009, p.18 and 19) and INE (2012c).

(*) Individual microdata were not explored in the present research.

TABLE A III

TRANSCRIPTION OF QUESTIONS FROM EU-SILC 2010*

# [a]	Variable EU-SILC [a]	Portuguese Version [a]	English Version [b]
A22	HY100N	Qual o valor mensal pago de juros (de crédito à habitação)?	Do you know the amount of interest you paid on your mortgage in the last 12 months? If yes specify that amount. [c]
	HS011	Nos últimos 12 meses (anteriores à entrevista) o agregado atrasou algum dos seguintes pagamentos regulares, por dificuldades económicas: A36-1: Rendas ou prestações de crédito à habitação relativas à residência principal.	In the last 12 months, did it happen that the household was unable to pay rent or to make a mortgage repayment for the main dwelling on time, due to financial difficulties?
A36	HS021	A36-2: Despesas correntes (água, electricidade, gás e condomínio) relativas à residência principal.	In the last 12 months, did it happen that the household was unable to pay utility bills (heating, electricity, gas, refuse collection) for the main dwelling on time, due to financial difficulties?
	HS031	A36-3: Despesas não relacionadas com a residência principal - empréstimos para compra de bens ou serviços (por exemplo, para automóvel, férias, mobiliário, computador, roupa), utilização de cartão de crédito, leasings, ….	In the last 12 months, did it happen that the household was unable to pay hire purchase installments or other loan payments (besides mortgage repayments) on time, due to financial difficulties?
A37	HS060	Se surgisse uma despesa inesperada de cerca de 400 Euros, conseguiria o agregado pagá-la de imediato sem recorrer a empréstimo?	Can your household afford an unexpected expense of 1145 Euros without borrowing?
A38	HS120	Tendo em conta o rendimento total do agregado, como é que o agregado consegue gerir todas as despesas habituais? 1. Com grande dificuldade 2.Com dificuldade 3. Com alguma dificuldade 4. Com alguma facilidade 5. Com facilidade 6. Com grande facilidade 9. NS/NR	A household may have different sources of income and more than one household member may contribute to it. Concerning your household total monthly or weekly income, with which degree of ease or difficulty is the household able to make ends meet? 1. With great difficulty 2. With difficulty 3. With some difficulty 4. Fairly easily 5. Easily 6. Very easily
A39	HS130	Pense em todas as despesas com as quais o agregado tem de lidar habitualmente. Indique aproximadamente, qual o rendimento mínimo mensal necessário para fazer face às despesas habituais?	In your opinion what is the very lowest net monthly income your household would need to make ends meet?

Source: Table constructed by the author based on INE (2012c) and Eurostat (2010).

(*) Most of the questions among the different countries are coincidente, however a detailed analysis of portuguese, UK and irish questionnaires reveals differences in some questions content. This fact creates problems of comparability. The above questions in portuguese and english versions are comparable. The European Union Quality Reports are produced annually by Eurostat based on the quality reports provided by countries. The quality report for 2010 questionnaire is not available.

(a) Questions taken from EU- SILC Questionnaire for Portugal 2010.

(b) Questions taken from EU- SILC Questionnaire for Ireland 2010.

(c) Note: Division by 12 is necessary in order to obtain equivalent measures.

TABLE A IV

SAMPLE CHARACTERISTICS BY HOUSEHOLD DISPOSABLE INCOME QUARTILES AND DEBT RELEVANT INDICATORS

Income Quartiles	N[a]	Delay in Payment of Rent or Monthly Mortgage Loan	Delay in Payment of Loans or the Provision of Goods or Services Purchased (excluding housing)	Capacity to Handle Unexpected Expenses	Delay in Current Expenditure on Housing	Ability to Make Ends Meet and Customary Charges	Severe Material Deprivation
Total	5,182	7%	7%	28%	4%	80%	10%
1st Income Quartile	1,295	14%	12%	49%	8%	95%	23%
2nd Income Quartile	1,296	8%	10%	35%	5%	90%	12%
3rd Income Quartile	1,296	6%	6%	22%	3%	81%	6%
4th Income Quartile	1,295	2%	2%	8%	1%	52%	1%

Source: Table constructed by the author based on microdata from the EU-SILC 2010 database.See also Tables AVIIa e AVIIb.
(a) N: Number of observations.

TABLE A V

SAMPLE CHARACTERISTICS BY HOUSEHOLD COMPOSITION AND DEBT RELEVANT INDICATORS

Household Type	N[a]	Delay in Payment of Rent or Monthly Mortgage Loan	Delay in Payment of Loans or the Provision of Goods or Services Purchased (excluding housing)	Capacity to Handle Unexpected Expenses	Delay in Current Expenditure on Housing	Ability to Make Ends Meet and Customary Charges	Severe Material Deprivation
Total	5,182	7%	7%	28%	4%	80%	10%
One adult	1,070	3%	5%	40%	3%	81%	18%
Two adults without dependent children both <65 years	649	5%	5%	25%	4%	74%	6%
Two adults without dependent children at least one adult aged 65 years or more	1,053	2%	4%	23%	2%	77%	9%
Other households without dependent children	699	8%	6%	21%	3%	80%	8%
One adult with one or more dependent children	160	13%	14%	55%	16%	91%	18%
Two adults with one dependent child	557	8%	7%	26%	6%	80%	8%
Two adults with two dependent	454	7%	7%	21%	4%	80%	4%
Two adults with three or more dependent children	102	18%	17%	42%	16%	82%	23%
Other households with one or more dependent children	438	10%	9%	28%	7%	84%	11%

Source: Table constructed by the author based on microdata from the EU-SILC 2010 database.See also Tables AVIIa e AVIIb.
(a) N: Number of observations.

TABLE A VI

VARIABLES DESCRIPTION FROM EU-SILC 2010 DATA

EU-SILC Original Variable	Variable Code
Household disposable income (annual)	hy020
Late payment of rent or monthly housing loan	HS011
Delay in current expenditure on housing	HS021
Delay in payment of loans or in provision of goods or services purchased (excluding housing)	HS031
Capacity to handle unexpected expenses	HS060
Ability to make ends meet and usual charges	HS120
Monthly minimum income to meet expenses and charges	HS130
Interest paid on housing loans with mortgage	HY100N
Household Composition	hx060
Poverty Indicator	hx080
Income per Adult Equivalent (in €)	hx090
Severe material deprivation	hx110

Source: Table constructed by the author based on INE (2012c).

TABLE A VIIa

ORIGINAL VARIABLES DESCRIPTION

	Variable Description *	Variable Composition
[1]	Household disposable income (annual)	-
[2]	Delay in Payment of Rent or Monthly Mortgage Loan (dummy)	=1 if delay, 0 otherwise
[3]	Delay in Current Expenditure on Housing (dummy)	=1 if delay, 0 otherwise
[4]	Delay in Payment of Loans or the Provision of Goods or Services Purchased (excluding housing) (dummy)	=1 if delay, 0 otherwise
[5]	Capacity to Handle Unexpected Expenses (dummy)	=1 if haven't capacity to handle unexpected debt, 0 otherwise
[6]	Ability to Make Ends Meet and Customary Charges (dummy)	=1 if haven't capacity to suport usual debt, 0 otherwise
[7]	Monthly minimum income to meet expenses and charges	-
[8]	Interest paid on housing loans with mortgage	-
[9]	Poverty Indicator (dummy)	= 1 if Equivalent disposable income equal or above poverty line, 0 otherwise
[10]	Income per Adult Equivalent (in €)	-
[11]	Severe Material Deprivation (dummy)	= 1 if With Severe Material Deprivation, 0 otherwise

Source: Table constructed by the author based on microdata from the EU-SILC 2010 database.

(*) See description of the original variables from EU-SILC 2010 in Table A VI.

TABLE A VIIb

DESCRIPTIVE STATISTICS OF ORIGINAL VARIABLES

	Variable *	N [a]	Valid N	Missings	Mean	Median	Std Deviation	Minimum	Maximum
[1]	Household disposable income (annual)	5,182	5,182	0	17,451	13,601	14,514	440	177,576
[2]	Delay in Payment of Rent or Monthly Mortgage Loan [b]	5,182	2,428	2,754	0.07	0	0.25	0	1.00
[3]	Delay in Current Expenditure on Housing [b]	5,182	5,161	21	0.04	0	0.21	0	1.00
[4]	Delay in Payment of Loans or the Provision of Goods or Services Purchased (excluding housing) [b]	5,182	1,461	3,721	0.07	0	0.25	0	1.00
[5]	Capacity to Handle Unexpected Expenses [b]	5,182	5,165	17	0.28	0	0.45	0	1.00
[6]	Ability to Make Ends Meet and Customary Charges [b]	5,182	5,177	5	0.80	1.00	0.40	0	1.00
[7]	Monthly minimum income to meet expenses and charges	5,182	5,040	142	1,282	1,000	1,068	50	50,000
[8]	Interest paid on housing loans with mortgage	5,182	5,182	0	457	0	1,175	0	28,047
[9]	Poverty Indicator [b]	5,182	5,182	0	0.21	0	0.41	0	1.00
[10]	Income per Adult Equivalent (in €)	5,182	5,182	0	10,111	7,934	7,821	207	88,237
[11]	Severe Material Deprivation [b]	5,182	5,182	0	0.10	0	0.31	0	1.00

Source: Table constructed by the author based on microdata from the EU-SILC 2010 database.

(*) See description of the original variables from EU-SILC 2010 in Table A VI.

(a) N: Number of observations.

(b) Dummy variable.

TABLE A VIIIa

VARIABLES DESCRIPTION

		Variable Description	Variable Composition *
[1]	Calculation of Initial Margins	Monthly Disposable Income (€ per household)	hy020/14
[2]		Monthly Margin (€ per household)	Mdinc-HS130
[3]		Percentual Margin	mgdibiM/Mdinc
[4]		Monthly Margin After Unexpected Expenses of 400 Euros (€ per household)	mgdibiM-400
[5]		Percentual Margin After Unexpected Expenses of 400 Euros	mgl400M/Mdinc
[6]		Percentual Margin (dummy)	=1 if mgperM<0, 0 otherwise
[7]		Percentual Margin After Unexpected Expenses of 400 Euros (dummy)	=1 if mgl400Mper<0, 0 otherwise
[8]	Calculation of the Three Levels of Vulnerability	1st Vulnerability Level	=mg_YNR
[9]		2nd Vulnerability Level	=1 if mgperM< -0.2, 0 otherwise
[10]		3rd Vulnerability Level	=mgl400_YNR
[11]	Calculation of Margins After Increases on Interest Rates	Monthly Interest of Mortgage Loan (€ per household)	HY100N/12
[12]		Households with Mortgage Loan	=1 if intM>0, 0 otherwise
[13]		Increase on Monthly Interest Rate Paid by 1.3 p.p. (€ per household)	=0.013*intM
[14]		Increase on Monthly Interest Rate Paid by 2 p.p. (€ per household)	=0.02*intM
[15]		Increase on Monthly Interest Rate Paid by 3 p.p. (€ per household)	=0.03*intM
[16]		Impact of the Rise in Monthly Interest Rate by 1.3 p.p. on Monthly Minimum Income to Meet Expenses and Charges (€ per household)	=HS130+ir1
[17]		Impact of the Rise in Monthly Interest Rate by 2 p.p. on Monthly Minimum Income to Meet Expenses and Charges (€ per household)	=HS130+ir2
[18]		Impact of the Rise in Monthly Interest Rate by 3 p.p. on Monthly Minimum Income to Meet Expenses and Charges (€ per household)	=HS130+ir3
[19]		Monthly Margin After Rise Interest Rate 1.3 p.p. (€ per household)	Mdinc-Chir1
[20]		Monthly Margin After Rise Interest Rate 2 p.p. (€ per household)	Mdinc-Chir2
[21]		Monthly Margin After Rise Interest Rate 3 p.p. (€ per household)	Mdinc-Chir3
[22]		Percentual Margin After Rise Interest Rate 1.3 p.p.	mgMAir1/Mdinc
[23]		Percentual Margin After Rise Interest Rate 2 p.p.	mgMAir2/Mdinc
[24]		Percentual Margin After Rise Interest Rate 3 p.p.	mgMAir3/Mdinc
[25]		Monthly Margin After Un. Exp. and After Rise Interest Rate 1.3 p.p. (€ per household)	Mdinc-Chir1-400
[26]		Monthly Margin After Un. Exp. and After Rise Interest Rate 2 p.p. (€ per household)	Mdinc-Chir2-400
[27]		Monthly Margin After Un. Exp. and After Rise Interest Rate 3 p.p. (€ per household)	Mdinc-Chir3-400
[28]		Percent. Margin After Un. Exp. and After Rise Interest Rate 1.3 p.p.	mgMl400Air1/Mdinc
[29]		Percent. Margin After Un. Exp. and After Rise Interest Rate 2 p.p.	mgMl400Air2/Mdinc
[30]		Percent. Margin After Un. Exp. and After Rise Interest Rate 3 p.p.	mgMl400Air3/Mdinc
[31]	Calculation of the Three Levels of Vulnerability After Increases on Interest Rates	1st Vulnerability Level After Rise Interest Rate 1.3 p.p.	=1 if mgperMAir1<0, 0 otherwise
[32]		1st Vulnerability Level After Rise Interest Rate 2 p.p.	=1 if mgperMAir2<0, 0 otherwise
[33]		1st Vulnerability Level After Rise Interest Rate 3 p.p.	=1 if mgperMAir3<0, 0 otherwise
[34]		2nd Vulnerability Level After Rise Interest Rate 1.3 p.p.	=1 if mgperMAir1<-0.2, 0 otherwise
[35]		2nd Vulnerability Level After Rise Interest Rate 2 p.p.	=1 if mgperMAir2<-0.2, 0 otherwise
[36]		2nd Vulnerability Level After Rise Interest Rate 3 p.p.	=1 if mgperMAir3<-0.2, 0 otherwise
[37]		3rd Vulnerability Level After Rise Interest Rate 1.3 p.p.	=1 if mgperMl400Air1<0, 0 otherwise
[38]		3rd Vulnerability Level After Rise Interest Rate 2 p.p.	=1 if mgperMl400Air2<0, 0 otherwise
[39]		3rd Vulnerability Level After Rise Interest Rate 3 p.p.	=1 if mgperMl400Air3<0, 0 otherwise
[40]	Original Variable Vs Margin	Severe Material Deprivation Vs Margin	hx110_YNR - mg_YNR

Source: Table constructed by the author based on microdata from the EU-SILC 2010 database.

(*) See description of the original variables from EU-SILC 2010 in Table A VI.

TABLE A VIIIb

DESCRIPTIVE STATISTICS OF VARIABLES *

	Variable	N [a]	Valid N	Missings	Mean	Median	Std Deviation	Minimum	Maximum
[1]	Monthly Disposable Income (€ per household)	5,182	5,182	0	1,246.50	971.50	1,036.75	31.43	12,684.00
[2]	Monthly Margin (€ per household)	5,182	5,040	142	(40.39)	(89.69)	1,135.58	(48,672.81)	10,684.00
[3]	Percentual Margin	5,182	5,040	142	(0.38)	(0.11)	1.55	(48.54)	0.98
[4]	Monthly Margin After Unexpected Expenses of 400 Euros (€ per household)	5,182	5,040	142	(440.39)	(489.69)	1,135.58	(49,072.81)	10,284.00
[5]	Percentual Margin After Unexpected Expenses of 400 Euros	5,182	5,040	142	(0.94)	(0.60)	1.98	(58.45)	0.85
[6]	Percentual Margin (dummy)	5,182	5,040	142	0.58	1.00	0.49	0	1.00
[7]	Percentual Margin After Unexpected Expenses of 400 Euros (dummy)	5,182	5,040	142	0.80	1.00	0.40	0	1.00
[8]	1st Vulnerability Level	5,182	5,040	142	0.58	1.00	0.49	0	1.00
[9]	2nd Vulnerability Level	5,182	5,040	142	0.44	0	0.50	0	1.00
[10]	3rd Vulnerability Level	5,182	5,040	142	0.80	1.00	0.40	0	1.00
[11]	Monthly Interest of Mortgage Loan (€ per household)	5,182	1,149	4,033	171.84	150.00	142.27	1.00	2,337.23
[12]	Households with Mortgage Loan	5,182	5,182	0	0.22	0	0.42	0	1.00
[13]	Increase on Monthly Interest Rate Paid by 1.3 p.p. (€ per household)	5,182	1,149	4,033	2.23	1.95	1.85	0.01	30.38
[14]	Increase on Monthly Interest Rate Paid by 2 p.p. (€ per household)	5,182	1,149	4,033	3.44	3.00	2.85	0.02	46.74
[15]	Increase on Monthly Interest Rate Paid by 3 p.p. (€ per household)	5,182	1,149	4,033	5.16	4.50	4.27	0.03	70.12
[16]	Impact of the Rise in Monthly Interest Rate by 1.3 p.p. on Monthly Minimum Income to Meet Expenses and Charges (€ per household)	5,182	1,126	4,056	1,708.53	1,502.38	877.60	300.14	7,008.27
[17]	Impact of the Rise in Monthly Interest Rate by 2 p.p. on Monthly Minimum Income to Meet Expenses and Charges (€ per household)	5,182	1,126	4,056	1,709.73	1,503.66	877.78	300.21	7,012.73
[18]	Impact of the Rise in Monthly Interest Rate by 3 p.p. on Monthly Minimum Income to Meet Expenses and Charges (€ per household)	5,182	1,126	4,056	1,711.45	1,505.49	878.03	300.32	7,019.09
[19]	Monthly Margin After Rise Interest Rate 1.3 p.p. (€ per household)	5,182	1,126	4,056	(31.77)	(100.83)	1,039.12	(3,795.86)	7,438.29
[20]	Monthly Margin After Rise Interest Rate 2 p.p. (€ per household)	5,182	1,126	4,056	(32.97)	(101.81)	1,039.08	(3,798.96)	7,436.89
[21]	Monthly Margin After Rise Interest Rate 3 p.p. (€ per household)	5,182	1,126	4,056	(34.68)	(103.21)	1,039.03	(3,803.38)	7,434.90
[22]	Percentual Margin After Rise Interest Rate 1.3 p.p.	5,182	1,126	4,056	(0.30)	(0.07)	1.67	(48.58)	0.89
[23]	Percentual Margin After Rise Interest Rate 2 p.p.	5,182	1,126	4,056	(0.30)	(0.07)	1.67	(48.61)	0.89
[24]	Percentual Margin After Rise Interest Rate 3 p.p.	5,182	1,126	4,056	(0.30)	(0.07)	1.68	(48.64)	2.00
[25]	Monthly Margin After Un. Exp. and After Rise Interest Rate 1.3 p.p. (€ per household)	5,182	1,126	4,056	(431.77)	(500.83)	1,039.12	(4,195.86)	7,038.29
[26]	Monthly Margin After Un. Exp. and After Rise Interest Rate 2 p.p. (€ per household)	5,182	1,126	4,056	(432.97)	(501.81)	1,039.08	(4,198.96)	7,036.89
[27]	Monthly Margin After Un. Exp. and After Rise Interest Rate 3 p.p. (€ per household)	5,182	1,126	4,056	(434.68)	(503.21)	1,039.03	(4,203.38)	7,034.90
[28]	Percent. Margin After Un. Exp. and After Rise Interest Rate 1.3 p.p.	5,182	1,126	4,056	(0.64)	(0.36)	2.01	(58.49)	0.84
[29]	Percent. Margin After Un. Exp. and After Rise Interest Rate 2 p.p.	5,182	1,126	4,056	(0.64)	(0.37)	2.01	(58.52)	0.84
[30]	Percent. Margin After Un. Exp. and After Rise Interest Rate 3 p.p.	5,182	1,126	4,056	(0.65)	(0.37)	2.01	(58.55)	0.84
[31]	1st Vulnerability Level After Rise Interest Rate 1.3 p.p.	5,182	1,126	4,056	0.55	1.00	0.50	0	1.00
[32]	1st Vulnerability Level After Rise Interest Rate 2 p.p.	5,182	1,126	4,056	0.55	1.00	0.50	0	1.00
[33]	1st Vulnerability Level After Rise Interest Rate 3 p.p.	5,182	1,126	4,056	0.55	1.00	0.50	0	1.00
[34]	2nd Vulnerability Level After Rise Interest Rate 1.3 p.p.	5,182	1,126	4,056	0.41	0	0.49	0	1.00
[35]	2nd Vulnerability Level After Rise Interest Rate 2 p.p.	5,182	1,126	4,056	0.41	0	0.49	0	1.00
[36]	2nd Vulnerability Level After Rise Interest Rate 3 p.p.	5,182	1,126	4,056	0.41	0	0.49	0	1.00
[37]	3rd Vulnerability Level After Rise Interest Rate 1.3 p.p.	5,182	1,126	4,056	0.73	1.00	0.44	0	1.00
[38]	3rd Vulnerability Level After Rise Interest Rate 2 p.p.	5,182	1,126	4,056	0.74	1.00	0.44	0	1.00
[39]	3rd Vulnerability Level After Rise Interest Rate 3 p.p.	5,182	1,126	4,056	0.74	1.00	0.44	0	1.00
[40]	Severe Material Deprivation Vs Margin	5,182	5,040	142	(0.47)	0	0.54	(1.00)	1.00

Source: Table constructed by the author based on microdata from the EU-SILC 2010 database.

(*) See Table A VIIIa for variable description. Parenthesis "( )" denote negative numbers.

(a) N: Number of observations.

TABLE A IX

HOUSEHOLDS BY VULNERABILITY LEVELS AND DISPOSABLE INCOME QUARTILES

Income Quartiles	N	Vulnerability Level [a] 1st Level % of Vulnerable Households	2nd Level % of Vulnerable Households	3rd Level % of Vulnerable Households
Total	5,040	57.7%	44.4%	79.6%
1st Income Quartile	1,260	82.9%	71.0%	99.5%
2nd Income Quartile	1,266	65.2%	52.1%	94.2%
3rd Income Quartile	1,269	50.7%	35.8%	79.1%
4th Income Quartile	1,245	31.6%	18.4%	44.9%

Source: Table constructed by the author based on microdata from the EU-SILC 2010 database.

(a) See section 2.1.4 'Methodology' for vulnerability criteria and Table A VIIIa for vulnerability measures.

TABLE A X

HOUSEHOLDS BY VULNERABILITY LEVELS AND HOUSEHOLD COMPOSITION [a]

Household Composition [b]	N	Vulnerability Level [a] 1st Level % of Vulnerable Households	2nd Level % of Vulnerable Households	3rd Level % of Vulnerable Households
One adult	1,046	69.50%	55.45%	92.83%
Two adults without dependent children both <65 years	628	60.99%	47.93%	79.46%
Two adults without dependent children at least one adult aged 65 years or more	1,015	55.86%	42.46%	83.74%
One adult with one or more dependent children	160	76.25%	64.37%	91.87%
Two adults with one dependent child	543	59.67%	46.96%	80.29%
Two adults with two dependent children	449	54.12%	39.42%	74.16%
Two adults with three or more dependent children	100	58.00%	46.00%	79.00%

Source: Table constructed by the author based on microdata from the EU-SILC 2010 database.

(a) See section 2.1.4 'Methodology' for vulnerability criteria and Table A VIIIa for vulnerability measures.

(b) Two categories of Households were excluded from the analyse: 'other households without dependent children' (N= 673) and 'other households with one or more dependent children' (N= 426).

TABLE A XI

EFFECTS OF INTEREST RATE INCREASES ON HOUSEHOLDS VULNERABILITY BY DISPOSABLE INCOME QUARTILES

Interest Rate Increases (in percentage point) by Income Quartiles		Vulnerability Level [a]		
		1st Level	2nd Level	3rd Level
		% of Vulnerable Households [b]	% of Vulnerable Households [b]	% of Vulnerable Households [b]
		Before -> After	Before -> After	Before -> After
	1.3 pp			
	Total	54.71% -> 54.80%	40.94% -> 40.94%	73.45% -> 73.45%
1st Income Quartile		79.08% -> 79.08%	70.92% -> 70.92%	96.81% -> 96.81%
2nd Income Quartile		58.87% -> 58.87%	42.55% -> 42.55%	82.27% -> 82.27%
3rd Income Quartile		52.46% -> 52.82%	35.21% -> 35.21%	74.30% -> 74.30%
4th Income Quartile		28.06% -> 28.06%	14.75% -> 14.75%	39.93% -> 39.93%
	2 pp			
	Total	54.71% -> 54.88%	40.94% -> 41.03%	73.45% -> 73.62%
1st Income Quartile		79.08% -> 79.08%	70.92% -> 71.28%	96.81% -> 96.81%
2nd Income Quartile		58.87% -> 58.87%	42.55% -> 42.55%	82.27% -> 82.27%
3rd Income Quartile		52.46% -> 52.82%	35.21% -> 35.21%	74.30% -> 74.65%
4th Income Quartile		28.06% -> 28.42%	14.75% -> 14.75%	39.93% -> 40.29%
	3 pp			
	Total	54.71% -> 54.97%	40.94% -> 41.03%	73.45% -> 73.62%
1st Income Quartile		79.08% -> 79.43%	70.92% -> 71.28%	96.81% -> 96.81%
2nd Income Quartile		58.87% -> 58.87%	42.55% -> 42.55%	82.27% -> 82.27%
3rd Income Quartile		52.46% -> 52.82%	35.21% -> 35.21%	74.30% -> 74.65%
4th Income Quartile		28.06% -> 28.42%	14.75% -> 14.75%	39.93% -> 40.29%

Source: Table constructed by the author based on microdata from the EU-SILC 2010 database.

(a) See section 2.1.4 'Methodology' for vulnerability criteria and Table A VIIIa for vulnerability measures.

(b) The interest rate shock was only applied to households with mortgage loan (N=1,126).

TABLE A XII

EFFECTS OF INTEREST RATE INCREASES ON HOUSEHOLDS VULNERABILITY BY HOUSEHOLD COMPOSITION [a]

Interest Rate Increases (in percentage point) by Household Composition [b]	Vulnerability Level [a]		
	1st Level	2nd Level	3rd Level
	% of Vulnerable Households [c]	% of Vulnerable Households [c]	% of Vulnerable Households [c]
	Before -> After	Before -> After	Before -> After
1.3 pp			
One adult	62.22% -> 62.22%	50.00% -> 50.00%	84.44% -> 84.44%
Two adults without dependent children both <65 years	57.59% -> 57.59%	43.67% -> 43.67%	74.05% -> 74.05%
Two adults without dependent children at least one adult aged 65 years or more	56.10% -> 56.10%	46.34% -> 46.34%	75.61% -> 75.61%
One adult with one or more dependent children	67.92% -> 67.92%	54.72% -> 54.72%	84.91% -> 84.91%
Two adults with one dependent child	55.65% -> 55.65%	43.15% -> 43.15%	77.02% -> 77.02%
Two adults with two dependent children	53.91% -> 54.30%	38.28% -> 38.28%	72.27% -> 72.27%
Two adults with three or more dependent children	70.00% -> 70.00%	45.00% -> 45.00%	85.00% -> 85.00%
2 pp			
One adult	62.22% -> 62.22%	50.00% -> 50.00%	84.44% -> 84.44%
Two adults without dependent children both <65 years	57.59% -> 57.59%	43.67% -> 43.67%	74.05% -> 74.68%
Two adults without dependent children at least one adult aged 65 years or more	56.10% -> 56.10%	46.34% -> 46.34%	75.61% -> 75.61%
One adult with one or more dependent children	67.92% -> 67.92%	54.72% -> 54.72%	84.91% -> 86.79%
Two adults with one dependent child	55.65% -> 55.65%	43.15% -> 43.15%	77.02% -> 77.02%
Two adults with two dependent children	53.91% -> 54.30%	38.28% -> 38.67%	72.27% -> 72.27%
Two adults with three or more dependent children	70.00% -> 70.00%	45.00% -> 45.00%	85.00% -> 85.00%
3 pp			
One adult	62.22% -> 62.22%	50.00% -> 50.00%	84.44% -> 84.44%
Two adults without dependent children both <65 years	57.59% -> 57.59%	43.67% -> 43.67%	74.05% -> 74.68%
Two adults without dependent children at least one adult aged 65 years or more	56.10% -> 56.10%	46.34% -> 46.34%	75.61% -> 75.61%
One adult with one or more dependent children	67.92% -> 67.92%	54.72% -> 54.72%	84.91% -> 86.79%
Two adults with one dependent child	55.65% -> 55.65%	43.15% -> 43.15%	77.02% -> 77.02%
Two adults with two dependent children	53.91% -> 54.30%	38.28% -> 38.67%	72.27% -> 72.27%
Two adults with three or more dependent children	70.00% -> 70.00%	45.00% -> 45.00%	85.00% -> 85.00%

Source: Table constructed by the author based on microdata from the EU-SILC 2010 database.

(a) See section 2.1.4 'Methodology' for vulnerability criteria and Table A VIIIa for vulnerability measures.

(b) Two categories of Households were excluded from the analyse ('other households without dependent children' and 'other households with one or more dependent children'.

(c) The interest rate shock was only applied to households with mortgage loan (N=1,126).