EUROPEAN CENTRAL BANK

EUROSYSTEM

WORKING PAPER SERIES

NO 1737 / OCTOBER 2014

FINANCIAL FRAGILITY OF EURO AREA HOUSEHOLDS

Miguel Ampudia, Has van Vlokhoven and Dawid Żochowski

In 2014 all ECB publications feature a motif taken from the €20 banknote.

HOUSEHOLD FINANCE AND CONSUMPTION NETWORK

Household Finance and Consumption Network

This paper contains research conducted within the Household Finance and Consumption Network (HFCN). The HFCN consists of survey specialists, statisticians and economists from the ECB, the national central banks of the Eurosystem and a number of national statistical institutes.

The HFCN is chaired by Gabriel Fagan (ECB) and Carlos Sánchez Muñoz (ECB). Michael Haliassos (Goethe University Frankfurt), Tullio Jappelli (University of Naples Federico II), Arthur Kennickell (Federal Reserve Board) and Peter Tufano (University of Oxford) act as external consultants, and Sébastien Pérez Duarte (ECB) and Jiri Slacalek (ECB) as Secretaries.

The HFCN collects household-level data on households' finances and consumption in the euro area through a harmonised survey. The HFCN aims at studying in depth the micro-level structural information on euro area households' assets and liabilities. The objectives of the network are:

1) understanding economic behaviour of individual households, developments in aggregate variables and the interactions between the two;

2) evaluating the impact of shocks, policies and institutional changes on household portfolios and other variables;

3) understanding the implications of heterogeneity for aggregate variables;

4) estimating choices of different households and their reaction to economic shocks;

5) building and calibrating realistic economic models incorporating heterogeneous agents;

6) gaining insights into issues such as monetary policy transmission and financial stability.

The refereeing process of this paper has been co-ordinated by a team composed of Gabriel Fagan (ECB), Pirmin Fessler (Oesterreichische Nationalbank), Michalis Haliassos (Goethe University Frankfurt), Tullio Jappelli (University of Naples Federico II), Sébastien PérezDuarte (ECB), Jiri Slacalek (ECB), Federica Teppa (De Nederlandsche Bank), Peter Tufano (Oxford University) and Philip Vermeulen (ECB).

The paper is released in order to make the results of HFCN research generally available, in preliminary form, to encourage comments and suggestions prior to final publication. The views expressed in the paper are the author's own and do not necessarily reflect those of the ESCB.

Acknowledgements

This paper uses data from the Eurosystem Household Finance and Consumption Survey. It presents the authors' personal opinions and does not necessarily reflect the views of the European Central Bank or the Eurosystem Household Finance and Consumption Network. We are grateful to participants at seminars at the ECB, the Household Finance and Consumption Network, Loughborough University and Eurofound for useful comments

Miguel Ampudia
European Central Bank; e-mail: Miguel.Ampudia@ecb.europa.eu

Has van Vlokhoven
European Central Bank; e-mail: hasvanvlokhoven@live.nl

Dawid Żochowski
European Central Bank; e-mail: Dawid.Zochowski@ecb.europa.eu

Address	Kaiserstrasse 29, 60311 Frankfurt am Main, Germany
Postal address	Postfach 16 03 19, 60066 Frankfurt am Main, Germany
Telephone	+49 69 1344 0
Internet	http://www.ecb.europa.eu

ISSN	1725-2806 (online)
ISBN	978-92-899-1145-0
EU Catalogue No	QB-AR-14-111-EN-N (online)

Abstract

We propose a novel framework to identify distressed households by taking account of both the solvency and the liquidity situation of an individual household. Using the data from the Household Finance and Consumption Survey and the country-level data on non-performing loans we calibrate our metric of distress and estimate stress-test elasticities in response to an interest rate shock, an income shock and a house price shock. We find that, albeit euro-area households are relatively resilient as a whole, there are large discrepancies in the impact of macroeconomic shocks across countries. Furthermore, while losses given default as calculated using our framework are low, they are sensitive to house prices changes. Hence, any factors hindering the seizure of the collateral or lowering its value, such as inefficient legal systems, moratoria on foreclosures or bottlenecks in judicial procedures may significantly increase losses facing banks. Finally, we demonstrate that our framework could be used for macroprudential purposes, in particular for the calibration of country level loan-to-value ratio caps.

JEL-codes: D10, D14, G21

Keywords: household indebtedness, stress testing, household finance, financial stability.

Non-technical summary

The recent financial crisis has underscored the importance and need for in-depth surveillance and analysis of risks faced by financial institutions in a consistent and uniformed manner. For that purpose, three rounds of macro stress tests were conducted in Europe and their results were published by the European Banking Authority (EBA), and by its predecessor, the Committee of European Banking Supervisors (CEBS), between 2009 and 2011. In addition, the European Central Bank (ECB) is conducting a comprehensive assessment prior to assuming full responsibility for supervision under the Single Supervisory Mechanism (SSM) in November 2014.

While credit risk is the most important factor determining banks' solvency, macro-stress tests, because of their nature, do not look into the build-up of vulnerabilities and imbalances in the household or corporate sector, but rather link macro-variables to aggregate probabilities of defaults. However, stress testing corporate or household balance sheets directly could provide useful insight into risks arising from the real sector for the banking sector. In this way, they may further enhance the accuracy of the macro stress-tests, for instance, by providing micro-based foundations for the elasticity of the real sector to macro-shocks, also taking account of the distributional aspects of the ability-to-pay of households.

In this paper we attempt to fill that gap by proposing a framework for stress-testing individual household balance sheets. Exploiting the data from the Household Finance and Consumption Survey (HFCS) collected between 2008 and 2011, we put forward a metric of household distress, which is constructed by combining the data on income, expenditure, assets, debt and collateral from the aforementioned survey. Thus, this metric takes into consideration the situation of the household in terms of both liquidity and solvency. It is a micro-level yardstick of default and can be aggregated, for instance, at a country level to calculate credit risk indicators such as Probability of Default (PD), Exposure at Default (EAD) or Loss Given Default (LGD) and their distributions. We demonstrate how these indicators could be calibrated using macro-data and used for stress-testing, for which a scenario can consist of an employment shock, an interest rate shock, a house price shock or any combination of them.

Using this metric, we then calculate country-by-country the elasticities of PDs, EADs and LGDs to hypothetical adverse macroeconomic scenarios comprising the interest rate, employment and house price shocks. We find that, the risks posed by the household sector to the stability of the financial system in the euro area are generally contained. Under the worst case scenario of a combined interest rate, employment and house price shock, the potential losses for the banking system are not higher than 5% of total household debt in any euro area country. However, there is substantial heterogeneity across countries, and the relative impact of the shocks on bank losses is significant in many countries. Overall, the effects of the shocks depend on both the households' initial distribution of assets, liabilities and income and the institutional factors prevailing in each country. For example, in countries where fixed-rate mortgages dominate, the impact on banks' losses of an interest rate shock is negligible. In the case of the house price shock, countries with high loan-to-value (LTV) ratios are affected the most. Nevertheless, one caveat requires due consideration: low LGDs as calculated using our metric heavily depend on the value of the collateral. Hence, any factors hindering the seizure of the collateral or lowering its value, such as an inefficient legal system,

moratoria on foreclosures, deadlocks in the courts, may significantly increase losses to the banking sector.

Overall, the effects of the shocks depend on both the households' initial distribution of assets, liabilities and income and the institutional factors prevailing in each country. For example, in countries where fixed-rate mortgages dominate, the impact on banks' losses of an interest rate shock is negligible. In the case of the house price shock, countries with high loan-to-value (LTV) ratios are affected the most.

We also demonstrate how the framework could potentially be used for macroprudential purposes, in particular the calibration of optimal LTV ratio caps. We show that the reduction of losses for the banking sector from the imposition of LTV ratio caps can be substantial and exhibits a non-linear pattern. For instance, setting LTV ratio caps at a too-low level may fully outweigh the benefits of higher cushion against possible defaults by reducing banking sector revenues, due to trimming good credit, by more than the amount of losses that the banks could suffer without the restriction on the LTV ratio cap.

1. Introduction

The recent financial crisis has underscored the importance and need for in-depth surveillance and analysis of risks faced by financial institutions in a consistent and uniformed manner. For that purpose, three rounds of macro stress tests were conducted in Europe and their results were published by the European Banking Authority (EBA), and by its predecessor, the Committee of European Banking Supervisors (CEBS), between 2009 and 2011. Those tests looked at how the capital ratios of the banks would be affected in case of an adverse macroeconomic scenario and a sovereign risk shock. Also, in the run-up to the assumption of the new supervisory and macro-prudential powers by the ECB, a top-down macro stress testing framework was developed in order to conduct regular forward-looking bank solvency assessments (Henry and Kok, 2013).

While credit risk is the most important factor determining banks' solvency, macro-stress tests, because of their nature, do not look into the build-up of vulnerabilities and imbalances in the household or corporate sector, but rather link macro-variables to aggregate probabilities of defaults. Yet, stress testing corporate's or household's balance sheets directly could provide useful insight into risks arising from the real sector for the banking sector. In this way, they may further enhance the accuracy of the macro stress-tests, for instance, by providing micro-based foundations for the elasticity of the real sector to macro-shocks, also taking account of the distributional aspects of the ability-to-pay of households.

In particular, studying the vulnerabilities of the household sector is important for at least two reasons. First, while the entire wealth in an economy is held by households, non-profit organizations, foreigners or the state, households hold most of it. Since wealth is one of the important factors determining households' consumption through its lifecycle, household's consumption decisions are influenced by its solvency position, thereby impacting the economic activity. Second, vulnerable households pose a threat to the financial stability due to their tight linkages to financial institutions.

Until recently, the lack of appropriate harmonised and good quality data has been the major obstacle in conducting the vulnerability exercise of the household sector in the euro area. This data problem has been partially circumvented by the dissemination of the Household Finance and Consumption Survey (HFCS), a novel dataset which collects information on socio-demographic variables, assets, liabilities, income and consumption for a sample of households that is representative both at the national and the euro area level.

In particular, these micro data give an opportunity to conduct stress tests on households, by quantifying the impact of various adverse shocks on the households' balance sheets and their ability to continue servicing their debt. Moreover, thanks to micro information on the distribution of wealth and income, the data are useful in detecting groups of households or countries that are particularly vulnerable to shocks. Therefore, it gives the policy makers a tool to adequately impose macro-prudential policy measures. In particular, from a central bank perspective, the impact of monetary policy decisions on credit risk stemming from the household sector across euro area countries could be assessed and quantified. This, in turn, could inform the macro-prudential policy makers' decisions on optimal preventive measures and their application across countries in order to mitigate the risks to the extent possible.

The aim of this paper is to analyse the financial vulnerability of households in the euro area to different macro shocks using micro data on households' balance sheet structure. As such, this paper contributes to enhancing the framework for the assessment of risks facing euro area banks and, more broadly, financial stability. We propose a new measure of households' financial vulnerability, which takes into account both households' liquidity and solvency, and we demonstrate how this yardstick can be used to estimate potential losses of the banking sector in the event of an adverse shock scenario, which can be composed of any combination of interest rate, house prices and income shocks.

There are several studies which look at household financial vulnerabilities, originating mostly from national central banks' research agenda in their interest to better assess the risks to financial stability. Still, a common problem faced by the work in this area has been that of the availability of an appropriate dataset.

The structure of most of these studies is common. The first step is to choose a measure in order to classify a household as vulnerable. Most studies use the so-called financial margin or the debt-service-to-income ratio, which are indicators of the households' monthly cash-flow position. Then the shocks are defined, both their typology and quantification. The third step is to show the impact of these shocks on the households' vulnerability measures. Lastly, the impact on the banks is analysed by looking at measures such as the Exposure at Default (EAD) and the Losses Given Default (LGD). The former measure represents the debt held by vulnerable households as a percentage of total debt, while the latter represents potential losses faced by the banking sector as a percentage of total debt. We will provide exact definitions of both measures when presenting our stress testing framework.

Zajączkowski and Żochowski (2007) study the distribution and dispersion of debt burden ratios among households in Poland and point out that those in the lowest income quartile group exhibit higher debt-service-to-income ratios, although the numbers are still lower than those in other European countries. For their study, they use data from the Polish Households Budget Survey, which mainly focuses on income and expenditure and suffers from a high non-response rate. Sugawara and Zaluendo (2011) perform a stress testing exercise on Croatian households where they look at the impact of four types of shocks on the debt-service-to-income ratio and the financial margin. When facing their most adverse scenario (combined shock on interest rates, unemployment, exchange rate and house prices) the number of new vulnerable households represent only between 5.4% and 6.4% of all indebted households. They also use household budget survey data which suffers from problems of representativeness and lacks coverage of many financial assets. Herrala and Kauko (2007) using data from a survey on households' income in Finland find that following an extreme adverse scenario which combines shocks to house prices, unemployment rates and interest rates the percentage of households in distress increases from 13.9 to 20.9 percent. Beck, Kibuuka and Tiongson (2010) bring a multi-country dimension to the fore by analysing households' debt burden in some Eastern European and Central Asian countries. While the study is an important contribution, to ensure broad coverage of countries the authors needed to draw on various data sources. Hence, the results are not fully comparable across countries. The Sveriges Riksbank conducts stress testing simulation exercises using household's micro data as part of its regular assessment of the potential threats to financial stability. The logic of these exercises and some results are summarized by

Persson (2009). In 2005, 7.35% of Swedish households exhibited a negative financial margin, which resulted in an EAD of 4.98% and a LGD of 0.83%.

To the best of our knowledge, so far only two studies use the HFCS for similar purposes, namely Albacete and Lindner (2013) for Austria and IMF (2012) for Spain. For Austria, the estimates for loss given default range from 0.2% to 10% depending on the definition of vulnerability. However, the Austrian study does not conduct any stress testing. The IMF study performs some stress testing exercises and it finds that the debt at risk not covered by household assets can more than triple under a certain macroeconomic adverse scenario.

The structure of the paper is as follows. We first present an overview of the debt burden of euro area households, by analysing the impact of three negative shocks on three different measures of debt distress. Namely, we demonstrate the effect of an interest rate shock on the debt-service-to-income ratio, the effect of an asset price shock on the debt-to-asset ratio and the effect of an income shock on the debt-to-income ratio. In section 3 we define a more comprehensive measure of household's distress which takes account of both the liquidity and solvency situation of a household; the rest of the paper focuses on this measure. Section 4 presents the results of a stress testing exercise by analysing the effects of negative shocks on the households' distress measure and by quantifying potential losses of the financial industry that could materialise as a result. In section 5 we discuss other possible measures of distress and we compare them with the measure derived in section 3. Section 6 analyses the use of the loan-to-value (LTV) ratio as a policy tool by quantifying how it can impact bank losses. Section 7 concludes the paper.

2. Financial burden indicators

Before putting forward a yardstick of financial distress that takes account of notions of liquidity and solvency, in this section we provide an overview of three financial burden indicators which have been used throughout the literature as indicators of potential financial distress, namely, the debt-service-to-income ratio, the debt-to-asset ratio and the debt-to-income ratio. We will analyse the impact of three different shocks on these ratios, aiming at identifying those countries that could be particularly affected by the shocks.

In order to conduct our analysis we will use household-level data from the Household Finance and Consumption Survey (HFCS). The HFCS provides ex-ante comparable data for all euro area countries with the exception of Estonia, Ireland and Latvia[5]. It contains information regarding socio-demographic variables, assets, liabilities, income and consumption for a sample of households that is representative both at the national and the euro area level. A set of population weights is provided in order to ensure the representativeness of the sample. All our calculations use these population weights.

Since data on debt payments was not collected in Finland, we have excluded this country from the analysis. Our sample covers more than 51,000 households in 14 euro area countries, namely Austria, Belgium, Cyprus, France, Germany, Greece, Italy, Luxembourg, Malta, the Netherlands, Slovenia,

[5] For more details on the survey, see http://www.ecb.europa.eu/home/html/researcher_hfcn.en.html. The results from the first wave are described in detail in Household Finance and Consumption Network (2013a).

Slovakia, Spain and Portugal. The first wave of the HFCS was conducted around 2010, but the reference periods have not been fully harmonized. In particular, the reference period for the Spanish data is 2008/2009, for Greece and the Netherlands is 2009 and for the rest of the countries, 2010.

Another important feature of the HFCS is that missing observations (i.e. questions that were not answered by the respondent households) are imputed five times – an issue that we will take into account when assessing the statistical significance of our estimates[6]. In the remainder of this paper, the statistics are calculated using indebted households only. In interpreting the results one should bear in mind that the proportion of indebted households varies across countries, from 25.2% in Italy to 65.7% in the Netherlands (see Figure 1). This discrepancy could be explained by several factors. First, the level of financial deepening, which for instance explains a relatively low percentage of indebted households in Slovakia, an economy that is yet to advance in the use of financial services. Second, differences in institutional settings or policy measures, such as tax incentives for borrowers like in the Netherlands or poor legal enforcement and limited informal enforcement through social trusts, which independently constrain the supply of loans to households in Italy (Casolaro, Gambacorta and Guiso, 2006). Finally, various risk attitudes towards indebtedness related to cultural differences, wealth accumulation or past experiences with hyperinflation can also play a role.

Figure 1 here

2.1 Interest rate shock and the debt-service-to-income ratio

Our first measure of financial pressure, the debt-service-to-income ratio, reflects the capacity of the household to repay its debt without resorting to selling assets. Since the majority of households' assets are illiquid[7], this indicator reflects the ability of households to repay their debt on time and thus focuses on the short-term angle. The debt-service-to-income ratio is constructed as total monthly debt payments to monthly net income[8].

We are interested how this ratio would change subject to a hypothetical 300 basis points increase in the interest rate[9]. We chose the level of the shock so that it is equivalent to the reduction of interest rates carried out by the ECB between October 2008 and mid-2010[10], hence the shock reflects the transition back to the pre-crisis interest rate level. The change in the interest rate affects the ratio via two channels, first, through the increase of debt payments and, second, through the increase of financial income received from interest paying accounts.

[6] Variables necessary to construct wealth and income aggregates are multiply imputed in each country. Some countries imputed other variables, too. For more information see section 6 and subsection 9.2.7 of Household Finance and Consumption Network (2013b), which describes the most relevant methodological features of the survey, including information on sampling design and weighting.

[7] For a complete picture of the composition euro area households' balance sheet see Household Finance and Consumption Network (2013a).

[8] HFCS data are cross-sectional and therefore we have information only on the monthly debt payment and the monthly income at the time when the survey was conducted. Finland is excluded from the analysis as for the Finnish households the debt service payments are not recorded by the survey.

[9] A very similar simulation has been conducted by Ehrmann and Ziegelmayer (2013). However, they use gross income instead of net income and they do not include the positive effect of the increase in the interest rate on the income due to higher interests from deposits.

[10] The level is also in the range used in other stress testing exercises, for instance IMF(2012), Albacete and Lindner (2013) or BdE economic bulletin (2011).

Considering the first channel, the pass-through of official rates to the lending rates needs to be assessed. This, however, is a challenging task, especially in a cross-sectional dimension of countries with different financial products and different banking practices. In particular, the pass-through depends on the conditions of the debt contract, namely whether the loan is subject to an adjustable or a fixed rate. Furthermore, bank practices regarding the pass-through of interest rates on existing adjustable-rate loans also differ across countries. For indexed loans the contractual interest rate is constructed using a reference rate, typically the EURIBOR, plus a margin. For reviewable mortgages the interest rate can change at banks' discretion. Indexed adjustable-rate mortgages dominated in Europe after 2000 (Dübel and Rothemund, 2011). Furthermore, in many European countries, legislation requires lenders to pass-through decreases in interest rates onto the consumer even in the case of reviewable-mortgages (Dübel and Rothemund, 2011).

Taking all this into account, we assume a 100% pass-through of the official interest rate to the individual loan rate for adjustable-rate loans. Conversely, fixed interest rate loan contracts are not affected by the interest rate shock. Note that we only have information on the type of loan (fixed vs. adjustable-rate) for loans linked to the household's main residence and to other real estate property. Nevertheless, these two types of loans account for more than 80% of total debt for the whole sample[11]. We treat all non-collateralised loans as if they were adjustable-rate loans.

An important factor that may anchor interest rates even for adjustable-rate mortgages are caps on the maximum change in the interest rate. In most European countries such caps apply to less than 5% of outstanding adjustable-rate loans (ECB, 2009). However, in Belgium, 34%, and in France, as much as 50% of the outstanding adjustable-rate loans are subject to such caps. In France, for loans subject to the cap, the interest rates typically cannot increase by more than 2 p.p. over the initial rate (Dübel and Rothemund, 2011); while in Belgium the interest rates cannot deviate from the initial rate by more than 2 p.p. in the first three years of the contact (iff/ZEW, 2010). Given that the HFCS was mainly conducted in 2010, just after a period in which the official interest rates had declined substantially, it is unlikely that the caps would be binding under the interest rate shock scenario. Nevertheless, in cases where we apply a 500-basis-point shock (see section 4 of the paper) we consider a 3 p.p. cap as binding for France and Belgium. Hence, for these two countries where the caps are relevant, we effectively refrain from a 100% pass-through assumption.

Our classification of a loan into adjustable or fixed rate comes from the information contained in the HFCS.[12] As a robustness check we compared the shares of adjustable rate loans as declared in the HFCS with those in ECB (2009). In the latter, a loan is only classified as adjustable if the rate fixation period is one year or less (see figure 2). The percentages are consistent for most of the countries. The main exception is the Netherlands where the share of adjustable-rate loans declared in the HFCS

[11] In some cases the respondent does not know whether the household has a fixed or adjustable rate mortgage. We treat these loans as if the proportion of adjustable rate loans to total loans is the same as in the loans for which we have information about.

[12] In some countries what is considered an adjustable-rate loan in the HFCS may only be subject to adjustment on a time frequency higher than a year. This stems from the wording of the question in the HFCS regarding having an adjustable loan: "Does the loan have an adjustable interest rate; that is, does the loan agreement allow the interest rate to vary from time to time during the life of the contract?"

is 84% compared to 18% in ECB (2009).[13] Therefore, the numbers for this country should be examined with caution. Our results are probably overestimating the impact of the interest rate shock.

Figure 2 here

Regarding the second channel, we consider that the change in the interest rate partly translates into the interest rate paid on sight accounts and savings accounts following the pass-through rates reported by Kleimeier and Sander (2006). We also assume that all these accounts are interest bearing.

Figure 3 here

Figure 3 depicts the impact of the interest rate shock on the debt-service-to-income ratio for the euro area as a whole and for each individual country. The impact of the shock on the median ratio for the euro area is relatively small - the ratio increases from 18.7% to 21.2%. However, the size of the impact varies across countries substantially. In the Netherlands and Portugal the median ratio increases the most, from 18.0% to 24.5% and from 22.0% to 28.2%, respectively. For some other countries the effect is minimal. For instance, in Germany and France it increases only by 1 percentage point (from 15.0% to 16.0% and from 19.6% to 20.6%, respectively). This is an obvious consequence of the high ratio of fixed rate mortgages in these two countries. The distribution of the debt-service-to-income ratio across net wealth quintiles shows a hump shaped pattern. This can be explained by the combination of two stylized facts: first, poorer households are unlikely to hold large amounts of debt, and, second, richer households tend to have very high levels of income. The households in the middle quintile of the net wealth distribution feel the adverse implication of the interest rate increase the most, followed by those in the two upper quintiles.

From a financial stability viewpoint, it is more interesting to look at those households who face a high risk of not being able to service their debt payments. For that purpose, we look at the proportion of households with a debt-service-to-income ratio greater than 0.4. The increase in the interest rate substantially increases the number of households that need to spend more than 40% of their net income for servicing their debt, from 16.0% before the shock to 21.4% after the shock for the euro area as whole. Again, there is substantial variability in the impact across the different countries. In some countries, more than a third of the indebted households have debt-service-to-income ratios greater than 0.4 after the interest rate shock, as it is in Cyprus (40.3%) and Spain (36.0%). To the contrary, in Germany and France the numbers are contained, and stand at 13.9% and 16.6% after the shock, respectively. Across net wealth quintiles, the proportion of distressed households before the increase in the interest rate ranges from 14.4% to 17.8% (figure 3.4). The interest rate shock impacts the households in the middle quintiles the most.

[13] For Belgium, Greece and Italy it seems that the HFCS may also overestimate the share of adjustable rate mortgages, albeit to a lesser extent than for the Netherlands. However, the ECB data are quite volatile and the shares for 2005 are more in line with the HFCS.

2.2 House price shock and the debt-to-asset ratio

In this subsection we calculate the debt-to-asset ratio, constructed as total debt over total assets and analyse how it changes in view of a house price shock. This ratio acts as a yardstick for the household's solvency.

Figure 4 here

Figure 4 depicts the increase of this ratio after a 20% decline in the level of house prices[14]. The impact of the shock on the ratio is relatively contained and similar in magnitude across countries. The house price decline leads to an increase of the median debt-to-asset ratio from 0.8 to 6.5 percentage points across various countries. This reflects a varying level of the coverage of debt with real assets, which unlike the financial assets are affected by the shock. Furthermore, the ratio decreases monotonically across income quintiles, while the impact of the shock is also relatively contained and equally distributed across income quintiles - the increases vary between2.8 and 4.0 percentage points.

From a financial stability perspective it is purposeful to monitor households with a debt-to-asset ratio greater than one. Those households are "under water" since should their debt be liquidated, banks would have to face losses. This ratio is greater than one for 11.1% of indebted households in the euro area. However, cross country variation is meaningful - as much as 17.8% of Dutch and only 2.4% of Maltese indebted households are "under water". While in most jurisdictions there is no legal cap on the LTV ratio, a threshold can be put in place for capital and provisioning requirements, leading to differences in typical LTV ratios set by the bank across countries (ECB, 2009) and partially explaining the variation in debt-to-asset ratios. The initial LTV ratio in the Netherlands is the highest and exceeds 100%. Interestingly, the percentage of households under water in the aftermath of the house price shock differs substantially across countries. For example, in the case of Malta or Slovenia, the house price decline has no effect whatsoever; the ratio of households with debt-to-asset ratios greater than one remains stable at 2.4% and 5.0%, respectively. To the contrary, in the Netherlands it rises from 17.8% to 23.0% and in Portugal from 6.9% to 12.4%. Turning to the impact of the shock across income quintiles, the households from the upper quintiles of the distribution are more adversely affected than those in lower quintiles. This is a direct consequence of the lower housing wealth hold by the latter group of households compared to the former.

2.3 Labour income shock and the debt-to-income ratio

Finally, we calculate the debt-to-income ratio and assess the impact on this one of an income shock. This ratio informs about how many years a household needs to generate income in order to repay its entire debt. Although this ratio has some drawbacks as it is comprised of a stock and a flow variable, it does provide some useful insight into the financial risk a household is facing. For instance, households with high debt-to-income ratios are more sensitive to shocks, in particular an interest rate shock, and therefore more likely to default should they materialise. Households in the Netherlands, Cyprus, Portugal and Spain have the highest debt-to-income ratios in the euro area, with a median ratio of 245.0%, 180.7%, 177.8% and 145.9%, respectively (see Figure 5). Households

[14] Additionally, we also conducted the analysis under the scenario of a 20% decline in equity prices. However, the impact of this shock on the ratio was negligible. This is because the share of financial assets in households' total assets is relatively low – 17% for the euro area as a whole with no country exceeding 30%.

in those countries are also affected the most by the interest rate shock studied in section 2.1. Note also that there is significant cross country variation in the level of the ratio, for instance Slovenia, Slovakia, Austria and Germany all have a median debt-to-income ratio below 50%.

Figure 5 here

We investigate the effect of a shock to labour income on the debt-to-income ratio. We assume that the unemployment rate increases by 5 percentage points. The distribution of the shock is based on personal characteristics such as age, gender, education, marital status and the presence of dependent children in the household[15]. Their labour income is replaced by unemployment benefits[16]. The impact of this shock on the debt-to-income ratio is relatively contained with some differences across countries. In general, the countries with a high debt-to-income ratio are affected by the shock to a larger extent. In Slovakia the ratio increases by just 0.5 percentage points (from 26.0% to 26.5%), while in Cyprus it changes by 4 percentage points (from 180.7% to 184.8%). The distribution of the median ratio across net wealth quintiles is hump-shaped, and the first two quintiles are hardly affected by the decrease in income. The third quintile is affected the most.

Finally, we scrutinise heavily indebted households, namely those for which the debt-to-income ratio is greater than four. We again identify substantial cross-country variation, from 32.8% of the indebted households in the Netherlands to 9.0% in Slovakia before the labour income shock. In total 15.7% of indebted households in the euro area have a debt-to-income ratio greater than four. After the labour income shock this figure increases to 16.0%.

Furthermore, looking at the net wealth distribution, the difference between the median debt-to-income ratio and the proportion of heavily indebted households (with the debt-to-income ratio greater than four) is noteworthy. While the first two quintiles have a much smaller median ratio than the other quintiles, the distribution of the proportion of heavily indebted households is more stable across the net wealth quintiles. The shock affects households in each quintile to a similar extent.

All in all, these findings suggest that, on the euro area level, the impact of the interest rate, house price and labour income shocks on the three financial burden indicators tends to be relatively contained, although this aggregate masks substantial cross-country heterogeneity. The impact of an interest rate shock on the debt service-to-income ratio tends to be greater for countries where adjustable rate loans prevail, namely in Portugal, Cyprus, Spain and the Netherlands. It is small for those countries where fixed rate mortgages dominate, i.e. in Germany and France. In the case of a house price shock, the debt-to-asset ratio of the Dutch and the Portuguese households seems to be affected the most. Lastly, we find that the impact of the income shock on the debt-to-income ratio is relatively contained across all euro area countries.

[15] For a precise definition of how the shock is constructed see Ampudia et al (2014).

[16] The value of the unemployment benefits is calculated as a percentage of last earned income. The percentage is taken, country by country, from the OECD, taking into account the maximum allowed unemployment benefits.

3. Financially vulnerable households

The three financial burden indicators presented in the previous section are useful to form a general impression on the households under financial stress. Nevertheless, they could hide important aspects of the problem. For example, while a household with a very high debt-service-to-income ratio may face difficulties covering its debt instalment from the current income stream, if it owns liquid assets it can sell them to continue servicing the debt without ever being at risk of missing the payments. In a similar vein, a household might be "under water", but if its income is sufficient to cover monthly instalments, in the absence of any negative income shock it may never default.

3.1 Moving towards default – a measure of distress

Given the drawbacks presented by financial burden indicators, we would like to put forward a comprehensive measure of financial distress in order to proxy as best as possible the household's probability of default. To this end, we put forward a measure of distress which takes account of both liquidity and solvency conditions of a household, since only if those two conditions are met the household is forced to default.

To express this concept formally, first we define financial margin FM_i^q of household *i* in country *q* as:

$$FM_i^q = I_i^q - T_i^q - DP_i^q - BLC^q \text{ [17]}, \qquad \text{(eq. 1)}$$

where I_i^q is the *i*-th household income and T_i^q and DP_i^q are taxes and debt payments paid by household *i* in country *q*, respectively. Finally, we define basic living costs as:

$$BLC^q = \varphi^q \tilde{I}^q, \qquad \text{(eq. 2)}$$

where $\tilde{I}^q$ is the median income in country *q* and φ^q [18] is a country q specific fixed percentage.[19]

This construction of the financial margin assumes that a household uses its income to pay taxes, to repay its debt and to cover basic living costs. We consider that households which are not able to cover all their spending from income, i.e. those having a negative financial margin, are in financial distress. We do not take into account any possible changes in future income, and hence do not consider restructuring.

---

[17] In addition, for tenants the rent paid is subtracted from the financial margin. This is because for those having a mortgage the housing costs are already covered by the debt payments and hence the basic living costs exclude housing costs.

[18] φ^q is chosen in such a way that the purchasing power of the basic living costs is the same across countries. If we take Germany as the reference country this would mean the following:
The purchasing power of the amount equal to the basic living costs in Germany is equal to the purchasing power of the amount equal to the basic living costs in country q:
$\varphi^{DE}\tilde{I}^{DE}PPP^{DE} = \varphi^q\tilde{I}^qPPP^q$, where PPP^q stands for the purchasing power of 1 euro in country q. Hence:
$\varphi^q = \frac{\tilde{I}^{DE}PPP^{DE}}{\tilde{I}^qPPP^q}\varphi^{DE}$.

[19] In addition, basic living costs are adjusted by the number of members for each household in line with the OECD-modified scale, which assigns a value of 1 to the household head, of 0.5 to each additional adult and of 0.3 to each child.

We calculate the financial margin using information on income and debt payments from the HFCS. Regarding taxes, we only consider income taxes, which we estimate using information on tax brackets and tax credits from the OECD[20] and individual household income. To estimate basic living costs we follow the literature on poverty lines.[21] The European Commission uses a relative poverty line in their calculations on poverty for European countries, in which the poverty line is a fixed percentage of median income (European Commission, 2011). Following this approach, we set the basic living costs as a fixed percentage, φ^q, of median income. However, since there is no agreement on the value of the percentage to be used[22], we determine it through a calibration exercise using macro data, in order to have it best reflecting its use in this specific application.

A household having a negative financial margin can still be able to service its debt in case it has sufficient assets it can sell to cover the payments, therefore we introduce a second condition related to the ability to cover the negative financial margin from liquid assets. It states that a household is considered to be in distress if the household's negative financial margin for a determined number of months, *M*, is greater than the household's liquid assets. In other words, this condition says that a household is not in distress, even if it has a negative financial margin, in case it can cover a given number of months of the flow of negative financial margin from its liquid assets.

In order to allow for some uncertainty in our measure of default, we attach a probability of default to each distressed household based on the relationship between its financial margin and its liquid assets (conditional on being in distress). That is, not all of our households in distress will default. We will explain how this probability distribution is determined in section 3.3.

Formally, we define the measure of distress, Δ_i^q [23], of household *i* in country *q* as[24]:

[20] We explored the possibility of including real estate taxes because of its relative importance in some countries, but the fact that these taxes are often determined at the local level and on the basis of many different factors made any estimation unreliable.

[21] In this literature a household is considered as being in poverty if its income is below a set poverty line, where being in poverty can be understood as being socially excluded (Laderchi, Saith and Stewart, 2003). In other words, we set the basic living costs as the minimum amount of money needed for a household necessary to avoid social exclusion, i.e. we set the basic living costs equal to the poverty line.

[22] The percentage used by the European Commission (2011) ranges from 40% to 70%.

[23] Letter Δ stands for δυστυχία, which means distress, misfortune or adversity in Greek.

[24] Note that these two conditions for distress can be rewritten to one sufficient condition as follows. A household is in distress if the following two conditions hold:

$$\begin{cases} FM_i^q = I_i^q - T_i^q - DP_i^q - BLC^q < 0 \\ |FM_i^q| * M > LIQ_i^q \Leftrightarrow FM_i^q < -\dfrac{LIQ_i^q}{M} \end{cases}$$

Where the second equation can be rewritten since that condition is only relevant if the financial margin is negative. Combining the two gives:

$$I_i^q - T_i^q - DP_i^q - BLC^q < -\frac{LIQ_i^q}{M} \text{ or equivalently } DP_i^q > I_i^q - T_i^q - BLC^q + \frac{LIQ_i^q}{M}$$

$$\Delta_i^q = \begin{cases} 1 & \Leftrightarrow \quad FM_i^q < 0 \quad \wedge \quad \sum_{t=1}^{M} FM_{t,i}^q + LIQ_i^q < 0 \\ 0 & \Leftrightarrow \quad FM_i^q \geq 0 \quad \vee \quad \sum_{t=1}^{M} FM_{t,i}^q + LIQ_i^q \geq 0 \end{cases} \qquad \text{(eq. 3)}$$

or expressed differently:

$$\Delta_i^q = \begin{cases} 1 & \Leftrightarrow \quad FM_i^q < 0 \quad \wedge \quad |FM_i^q| * M > LIQ_i^q \\ 0 & \Leftrightarrow \quad FM_i^q \geq 0 \quad \vee \quad |FM_i^q| * M \leq LIQ_i^q \end{cases} \qquad \text{(eq. 4)}$$

Where LIQ_i^q are the *i*-th household liquid assets in country *q*. Liquid assets are defined as the sum of deposits, money invested in mutual funds, bonds, shares and managed accounts, value of non-self-employment private business and other financial assets such as derivative products. Finally, *M* stands for the number of months in which the negative margin is covered from liquid assets.

A household is considered to be in distress ($\Delta_i^q = 1$) if its financial margin is negative and the sum of the household's negative flow of financial margin for a determined number of months is greater than the household's liquid assets. If any of these conditions do not hold, the household is not in distress ($\Delta_i^q = 0$).

In addition to φ^q , we also need to determine the exact number of months to be used as threshold for comparing the flow of negative financial margins with liquid assets. These two parameters will be determined in the calibration exercise in section 3.3.

It is important to note that we only consider that households are in distress if they are unable to pay its debt, i.e. do not have enough income to cover their spending and do not have enough liquid assets, too. We do not and, given the available data, we cannot consider households that are *able* but *unwilling* to service their debt. Issues such as strategic defaults are beyond the scope of this paper.

Summarizing, we consider a household to be financially vulnerable if it has a negative financial margin and if the negative monthly cash flow for a specific time period in the future cannot be covered from liquid assets. In section 3.3 we will calibrate our metric using the observed non-performing loans ratios by country. But first, we will explain in detail the concept of non-performing loans and its treatment in the different countries.

3.2 Non-performing loans as a macro-aggregate benchmark

If our measure of vulnerability fairly reflects the households' probability of default (PoD) on their debt, it should reflect the data on defaults on the macro level. Since data on household sector PoDs are not easily available across all euro area countries, we use the ratio of non-performing loans to total loans (NPL ratio) as a proxy. In particular, we are interested in defaults on loans to households. Hence, we use the NPL ratios in this particular loan market segment. We use publicly available data from national central banks, mostly published in Financial Stability Reports of these institutions (see Figure 7). However, it is important to note that the data that we are using are not yet fully

comparable across jurisdictions.[25] In particular, the following caveats of using the data as a proxy for PoDs need to be taken into account when interpreting this calibration exercise.

First, in most jurisdictions banks classify mortgages as non-performing after a 3-month delay in payments. This lag may, to some extent, explain why a household that is considered to be vulnerable could still be classified to the "performing" basket. However, in some countries there are different classification rules. For instance, in Italy a loan can be classified as non-performing, in addition to the 3-month delay rule, if a customer is in temporary difficulties even if they are expected to be cleared up in a reasonable time (Barisitz, 2013), leading to an upward bias of the NPL ratio for Italy compared to other countries. In contrast, in Spain a majority of restructured loans are not classified as non-performing, leading to a downward bias of the NPL ratio. Second, the NPL ratio is a stock variable. It is an outcome of past interactions between the cash flows resulting from defaults, recoveries and write-offs, which all three are flow variables. Across countries there are differences in the time it takes to recover the collateral in case of a default. In the Netherlands the duration of a typical foreclosure is five months while in Italy it can last 56 months (Bover et al., 2013). This leads to differences across countries in the time a loan remains classified as non-performing when it is in default, making it more problematic to compare NPL ratios across countries. Third, in some countries the value of collateral affects the loan classification, for instance a loan in arrears may be considered as performing if it is adequately collateralised. Fourth, the level of NPLs is also influenced by loan restructurings. The higher the intensity of loan modifications, the lower the NPL ratio will be.

All these factors act in the direction of increasing the discrepancy between the NPL ratio and our measure of default. Furthermore, they add an additional layer of discrepancy in the NPL ratios between the countries. These caveats should be kept in mind when analysing the results of the calibration. At the same time, they all speak for using the micro data in estimating the stress test elasticities of households.

3.3 Calibration

In order to establish a link between the micro data on defaults as we define it (Δ_i^q) and macro data (NPL^q) we follow a two-step approach. First we define two additional measures, which aim to capture gross and net amount of debt of distressed households in the HFCS data, namely the Exposure at Default (EAD) for the entire debt of distressed households and Loss Given Default (LGD) for the entire net debt, i.e. after deducting the value of the collateral. In our context, both these measures should be understood as expected values, since each distressed household defaults with a specific probability which we implicitly determine by calibrating the measure. Second, we calibrate the two remaining parameters of the distress statistic, namely the fraction of income that will constitute basic living costs in country q, φ^q , and the number of months, *M,* of paying the negative financial margin out of the stock of liquid assets (see section 3.1), so that EAD expressed as the fraction of debt in distress over total debt for country q mimics as best as possible NPL^q.[26] By determining M, we implicitly determine a probability distribution of default. Households with no

[25] In October 2013, the EBA published the technical standards on supervisory reporting on non-performing exposures and forbearance (EBA, 2013). This is an important step in the direction of the harmonisation of NPL definitions and classification practices across jurisdictions. The first harmonised data will be published end-2014.

[26] We could also compare LGD with actual loan losses that banks face, i.e. after deducting collateral. However, on account of the lack of data on loan loss provisions on household debt by country, we leave this exercise for future.

liquid assets will default with a probability of one, while households with liquid assets greater than M times its negative financial margin are not in distress and therefore their probability of default equals zero. All households in between these two extremes are assigned a probability of default (p_i^q) based on a linear function determined by those two cases (see figure 6 for a graphical representation).

Figure 6 here

We define EAD as follows:

$$EAD^q = \frac{\sum_{i=1}^{N} p_i^q D_i^q}{\sum_{i=1}^{N} D_i^q} \quad \text{(eq. 5)}$$

where D_i^q is the total debt of household *i* in country *q* and p_i^q is the probability that the distressed household defaults. EAD reflects the "expected" amount of debt held by financially vulnerable households as a percentage of the debt held by all households in the country.

We define Loss Given Default (LGD) as follows:

$$LGD^q = \frac{\sum_{i=1}^{N} p_i^q (D_i^q - W_i^q) C_i^q}{\sum_{i=1}^{N} D_i^q} \quad \text{(eq. 6)}$$

where W_i^q stands for the assets that the bank can recover in case of a default of household *i*. C_i^q is a binary indicator which takes the value 1 if the debt of household *i* is higher than the assets which can be recovered and 0 otherwise. LGD measures the potential losses to the banks coming from the household sector.

The optimisation criterion for the calibration is minimising the cross country mean absolute error between EAD and NPL.[27] The parameters that result from this calibration are a basic living cost of 33%[28] of the median income in Germany[29] and ½ of a month for the period in which the negative cash flow of a household is covered with its liquid assets.

Figure 7 here

Figure 7 shows the EAD and NPL for each country, where the EAD follows from the definition of our metric as obtained in the calibration. For most countries the results of the EAD match relatively well the NPL ratio, but there are also few countries for which the discrepancy between the EADs and the NPL ratios are meaningful. In Austria, France, Italy and Portugal the EAD underestimates the NPL substantially. For Italy, this is mostly likely caused by the overestimation of the non-performing loan ratio as discussed in section 3.2. We do not have an explanation for the underestimation of Austria,

[27] We exclude Slovenia, Malta and Luxembourg from the calibration. Those countries have a relatively low sample size for the purpose of this calibration. For example, although Luxembourg has 580 indebted households in the HFCS, it has only an NPL of 0.3%. This would mean there are about 2 vulnerable households in the HFCS in Luxembourg, which would make the calibration too sensitive to sampling errors.

[28] This number may seem to appear as relatively low compared with the poverty line of 40%-70% of median income as used by the European Commission (2011). However, since in our application the basic living costs do not include housing costs (see footnote 16), this number seems reasonable.

[29] The basic living costs in other countries follows from this percentage. See footnote 18 for more details.

France and Portugal. On the other hand we overestimate Spain, which is most likely caused by the underreporting of the NPL in Spain as discussed in section 3.2.

Figure 8 here

One of the results of the calibration is that only those households having very little liquid assets are considered as distressed. For instance, a household having sufficient liquid assets to cover 1 month of the flow of negative financial margin is not considered as distressed. In the first place this is caused by the nature of this calibration in which we match our results with the non-performing loan ratio. A loan is in general considered as non-performing if debt payments are behind more than 3 months, so this will relate to households having little liquid assets. Furthermore, many households report very few liquid assets in the HFCS, as can be seen in figure 8 where the distribution of the number of years of which liquid assets can cover the negative flow of financial margin per country is shown. It seems that households have either a lot of liquid assets or very few. So in order to get a sufficiently small number of households being in distress this second condition of our metric has to be tight.

Figure 9 here

Figure 9 shows the percentage of households in distress and the breakdown across the two conditions of our metric. First, from these graphs we can infer why we underestimate the NPL for France, Portugal and Austria. It seems that the second condition is too restrictive for both France and Portugal. For those two countries the percentage of households possessing liquid assets below ½ month of negative financial margin (conditional on households having a negative financial margin) is, together with the Netherlands, the lowest across the sample of countries. This means that potentially distressed households in France and Portugal have relatively many liquid assets. In contrast, in Austria it seems that the first condition is too restrictive as in this country the percentage of indebted households having a negative financial margin is the lowest. Thus, the basic living costs as calibrated for Austria may underestimate the true basic expenses of Austrian households.

By allowing M to vary across countries, we could perfectly match NPL^q ratios with our measure of EAD^q for each q. However, due to the fact that NPL definitions differ substantially across countries, this would result in large differences in the definition of a distressed household in each country. And this would defeat our main purpose of proposing a reliable micro-based metric of distress. In other words, due to a non-comparability of NPLs ratios, when measuring the level of distress across countries we put more trust into our measure of distress than the NPL ratios, not least because it is based on micro data. Once harmonised data on NPL are available, our metric of distress could be recalibrated.

Figure 9 provides also some useful insight into the two dimensions of our metric, namely solvency versus liquidity. For instance, considering the first dimension, in Portugal the percentage of indebted households with a negative financial margin is the highest, while the second dimension shows the lowest percentage for Portugal, indicating that the Portuguese households have relatively more liquid assets than households in other countries. In this respect Greece is an inverse picture of Portugal. This is because many Greek households seem to have enough income to cover their basic expenses and debt payments, but not too many liquid assets to cover the discrepancy between their expenses and their income.

4. Stress testing euro area households

Having defined and calibrated a measure of household distress, in this section we present the results of stress tests which aim at assessing cross-country sensitivity to various types of adverse shocks. In particular, we begin with analysing the impact of an interest rate shock, an asset price shock and an income shock, as defined in section 2, on the percentage of distressed households. Then we turn to quantifying the risk that these households pose to the financial system by calculating the changes in EAD and LGD following the shocks. We also consider some combinations of these shocks.

Table 1 here

Table 1 reports the changes in the number of distressed households after the shocks as compared to the baseline across countries.[30] In line with the results reported in section 2, in general the interest rate shock has a more adverse impact than the income shock, but not for all countries. For instance, in France the number of distressed households increases only by 0.5% after the interest rate shock while the income shock leads to an increase by 4.6%. To the contrary, in Portugal the number of households in distress increases also by 4.6% after the income shock, but the interest rate shock leads to an increase in the number of households in distress by 21.6%. Spain seems to be the most vulnerable country to adverse shocks, for instance a combined interest and income shock would lead to an increase in the proportion of households in distress by 35.9% as compared to the baseline. These figures are mostly a reflection of the restrictiveness of past banks' lending policies and/or households' risk aversion, which ultimately determines the effective buffer of income and liquid assets of indebted households.

Table 2 here

We turn now to the analysis of the impact of the shocks on the EAD, which acts as a yardstick for NPLs. Table 2 shows the relative increase in the EAD after the shocks as compared to the baseline. The impact of the interest rate shock is consistently higher than the impact of the income shock. In addition, there is a substantial heterogeneity across countries in the impact of both shocks. An increase in the interest rate by 300 basis points would lead to an increase in the stock of non-performing loans by almost 50% in Spain, while in France it would only increaseby 10.3%. Although the effect of the income shocks is generally contained, it is still meaningful for some countries, in particular in Greece where the EAD increases by 7.2% after the shock. A combined interest and income shock has the strongest impact in Portugal, Greece and Spain – in all these countries the stock on non-performing loans would increase by more than 30% as a result. It is important to note that the debt distribution plays a role in determining the vulnerability to shocks. All in all, intuitively, the shock has the strongest impact in countries with adjustable rate mortgages and in countries where households hold relatively more debt.

Table 3 here

We focus now on the impact of the shocks on the LGD, which is our key measure to analyse potential credit losses that banks could incur in the aftermath of household defaults. In particular, it provides useful insight into potential threats to the banks posed by a house price shock. Since our metric of distress does not take account of real assets, the shock to house prices does not affect the

[30] We exclude Austria and the Netherlands from the analysis due to small sample sizes of distressed households.

percentage of households in distress or the EAD. But it does affect the LGD since this measure does take account of the collateral. Table 3 presents the changes in the LGD assuming that banks can seize in case of a default liquid assets plus the value of the house if the household has a mortgage. It is self-evident that the house price shock impacts the level of LGDs substantially, with Belgium in the lead - a 30% decline in house prices leads to a more than doubling of LGD compared to the baseline. This is an indication that for many Belgian borrowers already in the baseline the value of their house is only slightly above their debt level (or the loan-to-value ratio is slightly below one). As a result, many households fall 'under water' in the aftermath of the shock. Turning to the impact of the combined shock, i.e. the interest, income and house price shock, on losses facing banks, a huge cross country divergence is noticeable. Losses of Spanish banks incurred from the household sector would increase by 140%, whereas they would only increase by 11.7% for the French banks.

Figure 10 here

Figure 10 puts together the effects of the combined shock on all three measures of distress. Furthermore, since there are substantial differences across jurisdictions in the scope of the assets that can be seized by banks in the case of a default, we give a range of possible losses the banks could face. To this end, we calculate three levels of LGDs depending on the scope of the assets that can be recovered by banks ranging from (1) all assets thorough (2) liquid assets plus the value of real estate in case having a mortgage to (3) liquid assets plus a value of the real estate after a haircut[31]. In France and Germany there is little difference between the three variations of the LGD. In particular, there is hardly any effect of the introduction of a haircut on the value of the collateral. This suggests that the debts of the German and the French households are sufficiently covered with assets. To the contrary, the additional haircut on the value of the collateral may significantly increase losses faced by banks in Greece, Cyprus in Spain.

Figure 11 here

One of the potential applications of the proposed stress testing framework is the impact of the fragmentation of the financial markets in the euro area as observed in the aftermath of the crisis on the household sector in different countries. MFI interest rates across euro area countries have diverged substantially in the time period after the start of the financial crisis. We investigate the elasticities of the household sector to the changes in the interest rates. However, it is important to keep in mind that, in most of the countries, the HFCS was conducted in 2010 and therefore it may not accurately mirror the current situation of the household sector. Figure 11 depicts the percentage of households at different interest rate changes. There are large differences between countries. In France and Germany there is almost no link between the change in the interest and potential household defaults due to the large proportion of fixed rate mortgages in both countries. However, in Spain the interest rate changes have a large impact on the percentage of household in distress. Furthermore, in most countries the effect is not linear. For instance, in Spain an increase in the interest rate leads to a significant increase in the percentage of households in distress, however this percentage is only slightly reduced when the interest rate decreases.

[31] The haircut reflects the usual liquidity premium in the case of a forced sale. We devalue the property by 20%. This is slightly less conservative than the 27% haircut reported by Campbell, Giglio and Pathak (2011) for forced sales in Massachusetts, USA.

Figure 12 here

While modelling behavioural reactions of the households and the banks to the shocks is outside the scope of this paper, the remaining of this section offers some insight into the effects of loan restructuring on the LGDs. In case a household is in distress and therefore the likelihood of default on a loan is high, a bank can decide to restructure the loan. Such restructurings aim at the reduction of the debt-service burden by the extension of the maturity of the loan and/or the level of interest rate or, rarely, also the debt level. In this way, the restructuring of a loan may prevent the household from actual default. Restructurings affect bank income in two opposite ways. From the one hand, they reduce income stream from interests, but they also increase the likelihood that the whole loan will be repaid. Figure 12 shows, for each country, the baseline LGD (before the shocks) and the LGD after the joint interest and income shock. For the latter one, we show how it is affected by loan restructurings, where restructuring is defined as a percentage decrease in monthly debt service expenses. Such a reduction increases household financial margin, and therefore some households can avoid being in distress after the loan restructuring. Hence, the higher the reduction in the monthly instalment, the lower is the LGD. For each country, the figure shows, where the two lines cross, at which level of the reduction in the monthly instalment the LGD after the shocks equalises with the LGD in the baseline. There is substantial heterogeneity across countries, with levels ranging from less than 10% reduction in the monthly instalment in France to 40% in Germany. There are various reasons for these disparities. For example, in the case of France, the relatively low percentage reduction in the instalment that is needed to equalize both LGDs is mainly caused by the contained increase in LGD after the shocks in this country. In contrast, in the case of Germany while the effect of the shock in the LGD is also relatively small, a large reduction in the instalment is necessary to equalise both LGDs. This is because while a relatively low percentage of households in Germany fall in distress, they tend to be deep in their negative financial margins. Therefore, a substantial reduction in the monthly debt service expenses is needed for the LGD after the shocks to drop materially. In Spain, where the LGD doubles in the aftermath of the shocks, a 30% reduction in the instalment would be sufficient to eliminate the effects of the shocks. Interestingly, a restructuring of 10% would already halve the impact of the shocks on LGD. This shows how important the non-linear effects arising from the distribution of debt burden across countries are in assessing the household sector credit risk.

To conclude, in this section we reported the impact of various macroeconomic shocks on the household probability of default and the expected losses to be incurred by the financial sector as calculated using this framework. All in all, the impact of the shocks differs substantially across countries. Furthermore, we argued that, for some countries, relatively small reductions in monthly instalments in the context of loan restructuring could mitigate the impact of the shocks.

5. Alternative measures of distress

In this section we benchmark our metric of distress against other possible measures that could be obtained from the HFCS. Let us first recall that one of the aims of this paper was to put forward a metric of distress which could be used for stress testing. For this purpose measures constructed using some HFCS questions on households' missed or late payments would not be particularly useful. Against this background, the goal of this section is to compare our metric in the baseline with

other metrics constructed using particular questions in the HFCS, rather than to define another metric which can be used for stress-testing purposes.

We first explore a question in the HFCS on late or missed debt payments over the past 12 months. This question was part of the questionnaire only in Spain, Portugal and Luxembourg. For both Spain and Portugal we performed a probit regression with a dummy for this question as a dependent variable. Table 4 shows the summary statistics of the regressors and table 5 the average marginal effects following from the regression. We use variables on income and net wealth quintiles as dummies with the value of 1 if the household is in the specific quintile and 0 otherwise. Furthermore, high school and college are dummies referring to the highest completed education of the reference person, where elementary education is the reference category. Self-employed, unemployed, retired and other are also dummy variables referring to the main labour status of the reference person, where other refers to students, permanently disabled, military service or fulfilling domestic tasks. The reference category is being employed. Financial sector is a dummy which is 1 if the reference person works in the financial sector (NACE: K). Public sector is a dummy which is 1 if the reference person works in the public sector (NACE: O, P and Q). The reference category for the age of the reference person is below 30 years old. Our metric of distress is significant in both regressions, suggesting that it is a good indicator of potential default. In addition, it is noteworthy that households with credit card debt or a drawn overdraft facility are more likely to default. One explanation to this could be that these households use a credit card or an overdraft facility because they face liquidity problems. Also self-employed seem to be more likely to default, which could be caused by self-employed households taking up loans for their businesses. If our metric of distress is removed from the equations as the explanatory variable, income quintiles become significant. Hence, our metric of distress seems to capture well the income effect while it captures the wealth effect to a lesser extent.

Table 4 and 5 here

Another indication of distress that we compare to our metric is based on the following set of questions in the HFCS. First, a question asked on whether during the past 12 months the household's regular expenses were higher than the household's income, just about the same or lower than its income. Second, the households that reported they had spent more than their income are asked what they did to meet those expenses. Possible answers are: selling assets, getting a credit card / overdraft facility, getting some other loan, spending out of savings, asking help from relatives or friends, leaving some bills unpaid or other means. Recall the results of the regression reported in Table 5 above. Having credit card debt, an overdraft facility or having another collateralized loan significantly increases the likelihood of being late with payments. Therefore, we assume that someone who finances its extra expenses by one of those instruments is in distress. Furthermore, a household that leaves bills unpaid or asks friends and relatives for support is also likely to be in distress. Therefore, we also included them in the alternative metric. Note that the meaning of these two questions overlaps to a large extent with the two dimensions of our metric, namely the solvency and the liquidity. The first question addresses the issue of solvency position of the household, while the second question considers the liquidity dimension. We use these two questions to construct alternative measures of distress.

Figure 13 here

Figure 13 compares the NPL ratios and the EADs as calculated using our metric (EAD1) to three alternative measures of EAD calculated in the following way. First, we calculate EADs of those households who have expenses above income and finance this by means of a loan or by asking help from friends or relatives or leaving some bills unpaid (EAD2)[32]. Second, for Spain and Portugal we calculate the EADs for households who had late or missed payments in the past 12 months (EAD3). Finally, for Portugal we have an additional follow-up question, whether the household was at the moment of the survey behind with its debt payments (EAD4). The alternative metric (EAD2) tends to be higher than the EAD calculated using our metric and higher than the NPL ratio for all countries. For Cyprus, Germany and Spain the discrepancy between the two metrics is large. EAD3 overestimates the NPL ratios. This makes sense, since the NPL comprises the debt of those households who are at the moment more than 3 months delayed with their payments, while it does not consider those who were behind with the instalment at a certain point over the last 12 months but are on time with their debt payments at the moment. In this regard, the EAD based on the question asked in Portugal on whether a household is behind with its payments at the moment (EAD4) is not much different than the NPL ratio in that country. The EAD based on this measure more precisely reflects the NPL ratio than the EAD according to our metric for Portugal.

All in all, it seems that our measure of distress mimics fairly well the aggregate data on NPLs. Using alternative definitions of distress leads to substantially different levels of EADs, which do worse at this matching exercise.

6. The use of LTVs as a macroprudential policy tool.

Having analysed the impact of different shocks on the losses to financial institutions across the euro area countries, an obvious question arises whether these losses can be mitigated by the use of a macroprudential policy instrument, in particular by imposing a cap on the loan-to-value (LTV) ratio. In the context of the establishment of the SSM and acquisition of some macroprudential powers by the ECB, the use of what has always been considered a microprudential policy instrument is also being considered for macroprudential purposes. Nevertheless, it is important to bear in mind that LTV ratios will be outside the realm of the SSM, as they are neither imposed by the CRD IV nor the CRR.[33]

In order to assess the impact of an LTV ratio cap we conduct the following experiment. We assume that the LTV ratio cap is in place at the time of the loan origination and reduces the amount of the original loans that exceed a given threshold so that the LTV ratio cap becomes binding. Then we assume that the current amount of debt (and current debt payments) is lowered proportionally to the reduction of debt at the loan origination due to the LTV cap. Lower debt level increases the household's financial margin and also, potentially, decreases the level of distress. We acknowledge that this is a very simplistic approach that ignores all kind of behavioural aspects and the general equilibrium type of influence that such a cap could have on other variables, for instance the house prices. Nevertheless, we think such experiment could provide useful insight into potential

[32] For France and Italy this measure cannot be calculated, since in France the question comparing income and expenses was not asked, while in Italy the question on the source of money to meet the higher expenses was not asked.

[33] Only the instruments explicitly mentioned by the CRR or explicitly mentioned by the CRD IV and implemented into the national legislations can be used as macroprudential instruments by the SSM.

effectiveness of LTV ratio caps as a tool for enhancing bank's resilience.[34] Also, note that we only have data on the initial LTV for mortgages related to the main residence of the household and thus the following analysis focuses on this subsample. Because of this, the numbers we provide can be considered as lower bounds for the reductions of LGD.

Until now, we have used the LGD as a measure of quantifying the losses for the banks. The imposition of an LTV ratio cap affects the aggregated LGD in two ways, first, through the reduction of the number of and the losses suffered by vulnerable households (the numerator of the LGD ratio) and, second, through lower debt exposure of households (the denominator of the ratio). Since the LGD shows losses as a percentage of total debt, the reduction of LTVs can result in increases in LGDs just because total debt is reduced. While this effect could indeed be in place, as LTV ratios caps set too low may trim too much of good credit, this can blur the picture. Hence, we choose to show the results of our experiment in the level of total losses for the baking system.

Figure 14 here

Figure 14 shows the effect of different values of a given LTV ratio cap on the level of losses resulting from household defaults for the banks. The level of losses is expressed as an index which is 100 for no LTV ratio cap. Establishing an LTV ratio cap reduces the losses suffered by the banks, but the effects are non-linear, the major reduction in losses occurs when the LTV ratio cap is set in the range between 70% and 110%. This shows that the number of distressed households with an initial LTV above this upper bound is small, and that the lower bound is already capturing most of the households that could be prevented from entering in distress by setting an LTV ratio cap. However, establishing an LTV ratio cap reduces demand for mortgages. As a result banks lend less and have lower revenues from extending mortgages. To illustrate this effect, Figure 14 also shows the level of banks' net revenues[35] resulting from lending to the household sector. Also here the level of revenues is shown as an index which is 100 for no LTV ratio cap. Combining both results reveals there is an optimal level of LTV ratio cap that minimises losses for banks. This is because after a certain threshold, which may vary across countries, lowering the LTV ratio cap even further would not reduce credit losses much, but could reduce bank income. This effect is in addition to a potential drop in good credit, which could also adversely impact the economy.

7. Conclusion

In this paper we put forward a metric of household distress, which is constructed by combining the data on income, expenditure, assets, debt and collateral from the Household Finance and Consumption Survey. It is a micro-level yardstick of default and can be aggregated, for instance, at a country level to calculate credit risk indicators such as Probability of Default (PD), Exposure at Default (EAD) or Loss Given Default (LGD) and their distributions. We demonstrate how these indicators could be calibrated using macro-data and used for stress-testing, for which a scenario can

[34] We pool all our observations together, as we could not conduct this exercise on a country by country basis due to sample size problems.

[35] For the purpose of this exercise, we assume here that net revenues equal the debt level times credit margin (charged interest rate – cost of funding).

consist of an unemployment shock, an interest rate shock, a house price shock or any combination of them.

The use of micro-level data for the purpose of measuring household credit risk could shed some more light on the vulnerabilities in that sector. We find that, overall the risks posed by the household sector to the stability of the financial system in the euro area are generally contained. Under the worst case scenario of a combined interest rate, income and house price shock, the potential losses for the banking system are not higher than 5% of total household debt in any euro area country. However, there is substantial heterogeneity across countries, and the relative impact of the shocks on banks losses is significant in many countries. Moreover, the impact of shocks depends also on the type of shock. In particular, countries where adjustable-rate mortgages predominate are more affected by an interest rate shock, while in countries where households hold relatively more debt these are in general more vulnerable to any type of shock. Nevertheless, one caveat requires due consideration: low LGDs as calculated using our metric heavily depend on the value of the collateral. Hence, any factors hindering the seizure of the collateral or lowering its value, such as an inefficient legal system, moratoria on foreclosures, deadlocks in the courts, may significantly increase losses to the banking sector.

Overall, the effect of the shocks depend on both the households' initial distribution of assets, liabilities and income and the institutional factors prevailing in each country. For example, in countries where fixed-rate mortgages dominate, the impact on banks' losses of an interest rate shock is negligible. In the case of the house price shock, countries with high initial LTV ratios are affected the most.

We also demonstrate how the framework could be used for macroprudential purposes, in particular the calibration of LTV ratio caps. We show that the reduction of losses for the banking sector from the imposition of LTV ratio caps can be substantial and exhibits a non-linear behaviour. However, too much restriction also has a negative impact on the banking sector revenues due to the cut off of good credit.

Our results call for a systematic monitoring of the risks stemming from the household sector by the regulators. We propose a framework which could prove useful for this purpose.

References

Albacete, N., and Lindner, P., 2013. “Household vulnerability in Austria – a microeconomic analysis based on the household finance and consumption survey”, *Financial stability report 25 – June 2013, Oesterreichische Nationalbank (Austrian Central Bank),* pages 57-73.

Ampudia, M., Pavlickova, A., Slacalek, J. and Vogel, E., 2014. “Household Heterogeneity in the Euro Area Since the Onset of the Great Recession”, *ECB Working Paper Series*, No 1705.

Barisitz, S., 2013. "Nonperforming Loans in Western Europe – A Selective Comparison of Countries and National Definitions", *Focus on European Economic Integration, Oesterreichische Nationalbank (Austrian Central Bank)*, pages 28-47.

Beck, T., Kibuuka, K., and Tiongson, E., 2010. “Mortgage finance in Central and Eastern Europe – opportunity or burden?”, *World Bank Policy Research Working Paper* 5202.

Bover, O., Casado, J.M., Villanueva, E., Costa, S., Du Caju, P., McCarthy, Y., Sierminska, E., Tzamourani, P., and Zavadil, T., 2013. "The distribution of debt across euro area countries: the role of individual characteristics, institutions and credit conditions", *Banco de España Working Papers,* no. 1320.

Campbell, J.Y., Giglio, S., and Pathak, P., 2011. "Forced Sales and House Prices", *American Economic Review, American Economic Association,* vol. 101(5), pages 2108-31.

Casolaro, L., Gambacorta, L., and Guiso, L., 2006. “Regulation, formal and informal enforcement, and the development of the household loan market: lessons from Italy”. In: Bertola, G., Disney, R., and Grant, C., (Eds.) *The economics of consumer credit*. Cambridge, MA, the MIT Press, pp. 93-134.

Dübel, H., and Rothemund, M., 2011. “A New Mortgage Credit Regime for Europe – Setting the Right Priorities”, CEPS Special report.

ECB, 2009. “Housing Finance in the Euro Area”, Task Force of the Monetary Policy Committee of the European System of Central Banks, European Central Bank Occasional Paper No. 101, March 2009.

EBA, 2013. “Final draft implementing technical standards on supervisory reporting on forbearance and non-performing exposures under article 99(4) of Regulation (EU) No 575/2013”.

Ehrmann, M., and Ziegelmeyer, M., 2013. “Household Risk Management and Actual Mortgage Choice in the Euro Area”, *ECB Working Paper Series* No. 1631.

European Commission 2011. “The measurement of extreme poverty in the European Union”.

Henry, J., and Kok, C., 2013. “A macro stress testing framework for assessing systemic risks in the banking sector”, *ECB Occasional Paper,* No. 152, October 2013.

Herrala, R., and Kauko, K., 2007. “Household Loan Loss Risks in Finland – Estimations and Simulations with Micro Data”, *Bank of Finland Research Discussion Papers* 5/2007.

Household Finance and Consumption Network (2013a). “The Eurosystem Household Finance and Consumption Survey – Results from the First Wave”, *ECB Statistics Paper* No. 2.

Household Finance and Consumption Network (2013b). “The Eurosystem Household Finance and Consumption Survey – Methodological Report for the First Wave”, *ECB Statistics Paper* No. 1.

iff/ZEW, 2010. “Study on interest rate restrictions in the EU”, *Final Report for the EU Commission DG Internal Market and Services*, Project No. ETD/2009/IM/H3/87, Brussels/Hamburg/Mannheim.

IMF, 2012. “Spain: vulnerabilities of private sector balance sheets and risks to the financial sector technical notes”, *IMF Country Report*, No. 12/140, June 2012.

Kleimeier, S., and Sander, H., 2006. “Expected versus unexpected monetary policy impulses and interest rate pass-through in euro-zone retail banking markets”, *Journal of Banking & Finance,* Vol 30, pages 1839-1870.

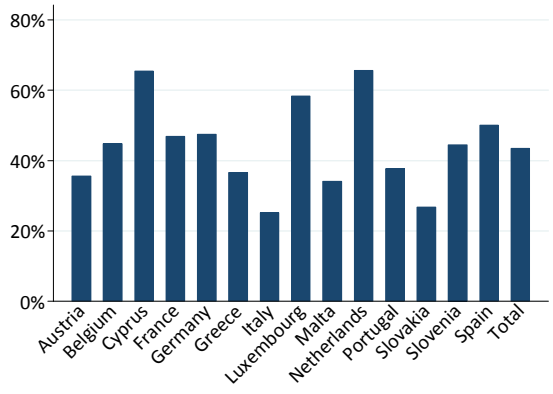
Laderchi, C.R., Saith, R., Stewart, F., 2003. "Does it Matter that we do not Agree on the Definition of Poverty? A Comparison of Four Approaches", *Oxford Development Studies, Taylor & Francis Journals*, vol. 31(3), pages 243-274.

Persson, M., 2009. “Household indebtedness in Sweden and implications for financial stability – the use of household-level data”, *BIS Papers* No. 46.

Sugawara, N. and Zalduendo, J., 2011. “Stress-Testing Croatian Households with Debt-Implications for Financial Stability”, *World Bank Policy Research Working Paper* 5906.

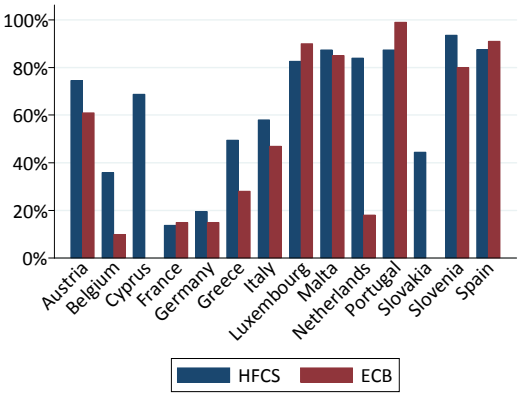
Zajączkowski, S. and Żochowski, D., 2007. “The distribution and dispersion of debt burden ratios among households in Poland and its implications for financial stability”, *a chapter in Proceedings of the IFC Conference on "Measuring the financial position of the household sector*", Basel, 30-31 August 2006 - Volume 2, 2007, vol. 26, pp 62-74.

Figure 1 Percentage of indebted households



Source: HFCS.

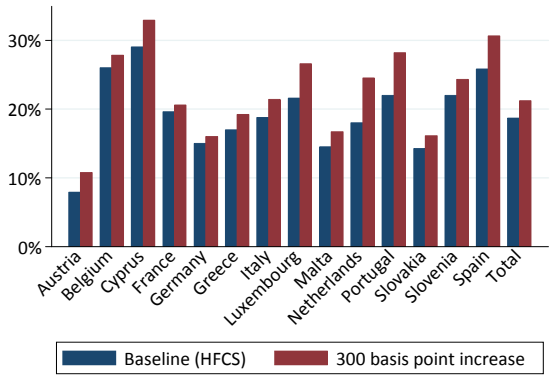
Figure 2 Share of adjustable rate lending for household main residence mortgages



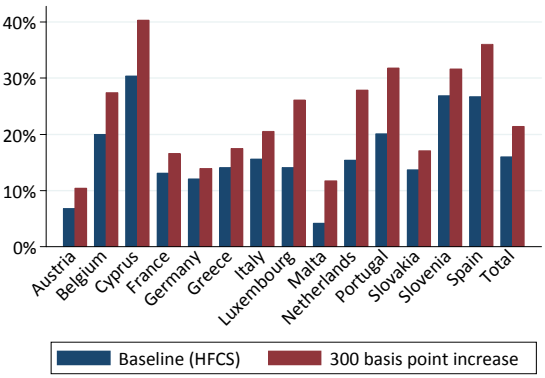
Sources: HFCS & ECB (2009).
Notes: The ECB (2009) data refers to new loans for house purchase in 2007.

Figure 3 Effect of a 300 basis point increase in the interest rate on the debt-service-to-income ratio

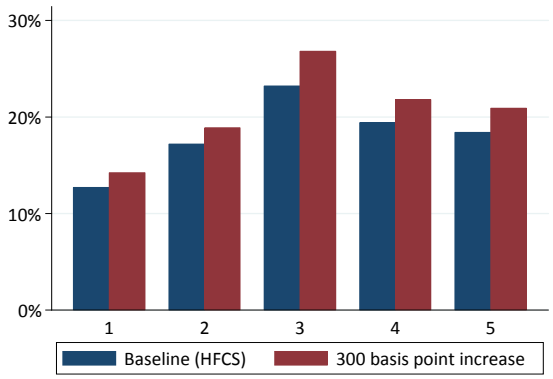
3.1 Median ratio across countries, conditional on households having debt



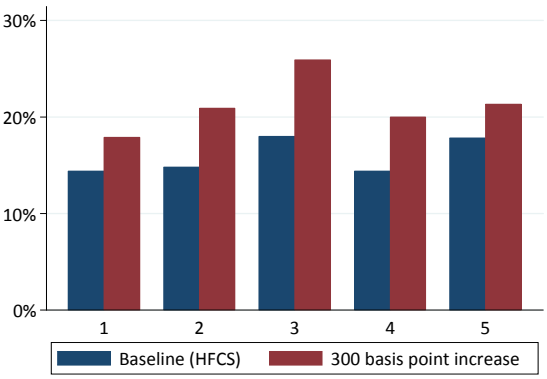
3.2 Percentage of indebted households with a ratio greater than 0.4 across countries



3.3 Median ratio across net wealth quintiles, conditional on households having debt



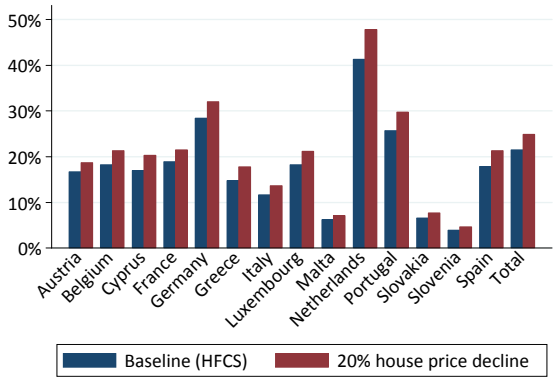
3.4 Percentage of indebted households with a ratio greater than 0.4 across net wealth quintiles



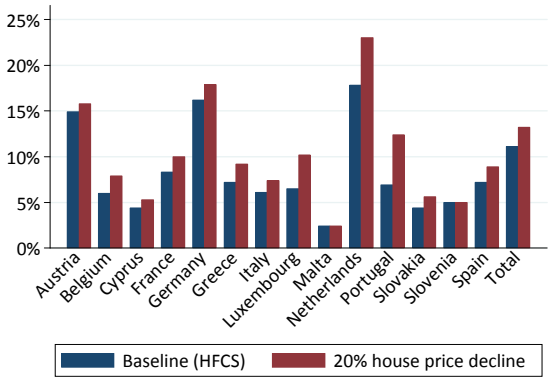
Sources: HFCS, OECD & own calculations.

Figure 4 Effect of a 20% house price decline on the debt-to-asset ratio

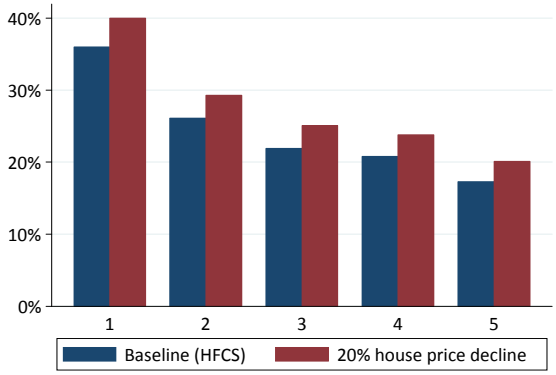
4.1 Median ratio across countries, conditional on households having debt



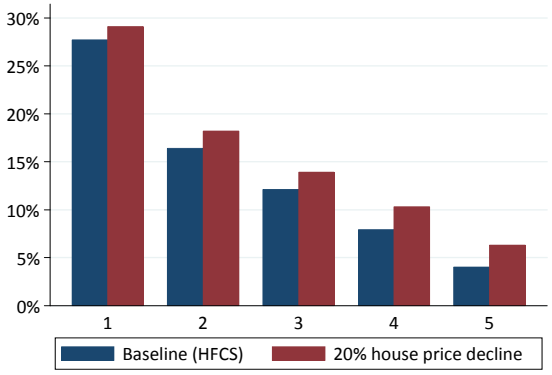
4.2 Percentage of indebted households with a ratio greater than 1 across countries



4.3 Median ratio across income quintiles, conditional on households having debt



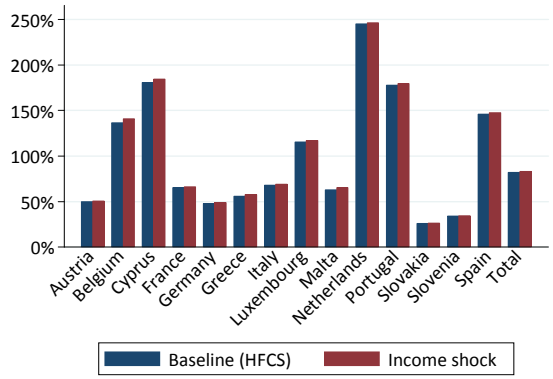
4.4 Percentage of indebted households with a ratio greater than 1 across income quintiles



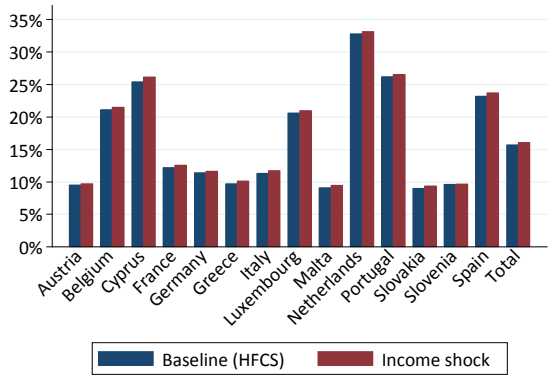
Sources: HFCS & own calculations.

Figure 5 Effect of an income shock on the debt-to-income ratio

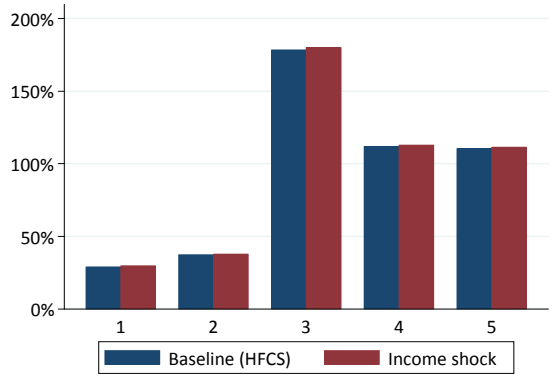
5.1 Median ratio across countries, conditional on households having debt



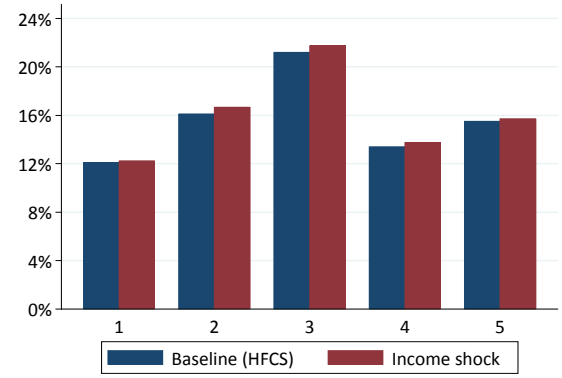
5.2 Percentage of indebted households with a ratio greater than 4 across countries



5.3 Median ratio across net wealth quintiles, conditional on households having debt



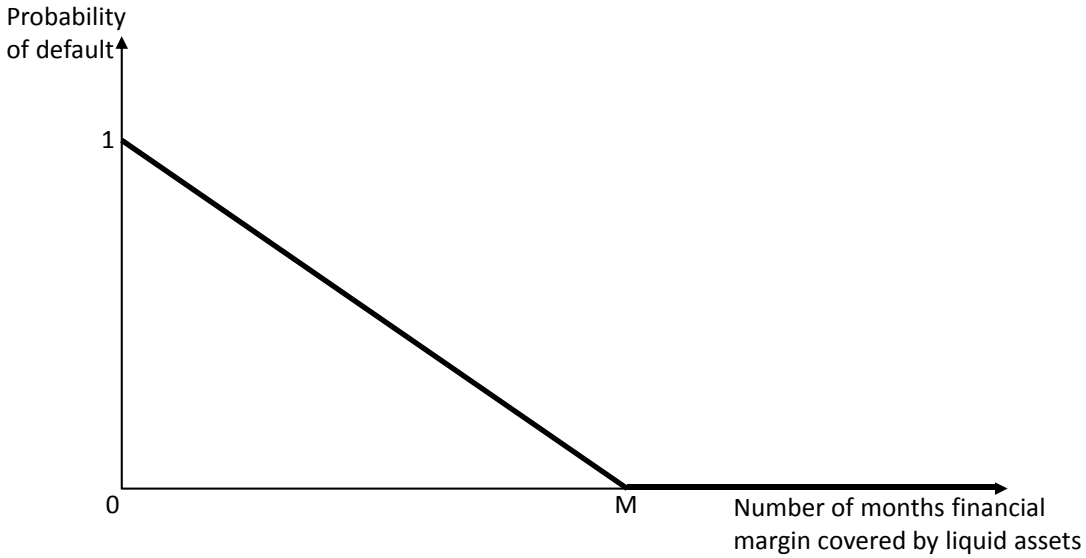
5.4 Percentage of indebted households with a ratio greater than 4 across net wealth quintiles



Sources: HFCS, OECD & own calculations.

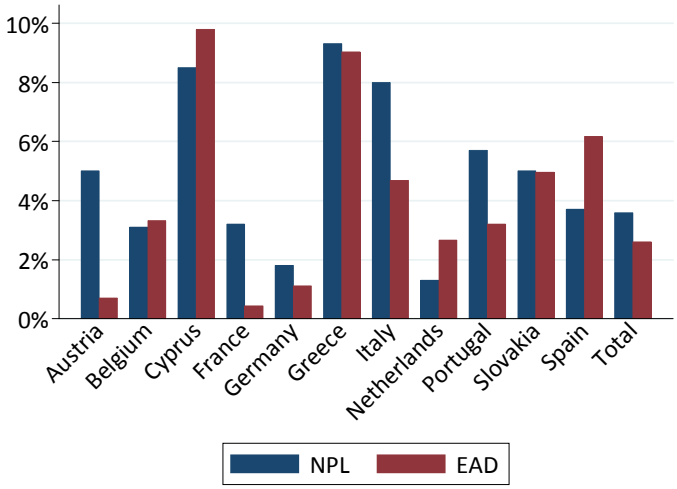
Notes: the income shock is defined as a 5 percentage point increase in the unemployment rate. Those who lose their job are assumed to receive unemployment benefits.

Figure 6 Determination of the probability of default



Notes: the probability of default is a function of the number of months the negative flow of financial margin is covered with liquid assets, given that the household has a negative financial margin.

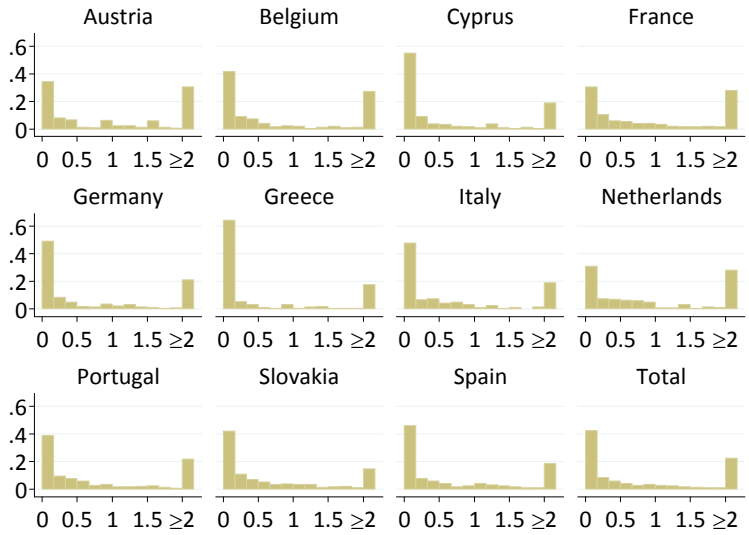
Figure 7 Results of the calibration



Sources: HFCS, National Central Banks, ECB Consolidated Banking Data, Haver & own calculations.

Notes: the NPLs are the non-performing loan ratios of the household sector as reported by various central banks and ECB consolidated banking data. Due to the unavailability of data for Austria, Germany, and Luxembourg, we decompose the total NPL ratio into portfolio specific NPL ratios using the structure of the loan portfolio and the credit spread, equal to the difference between the interest rates in individual market segments and the risk free rate (12 month EURIBOR), as weights. For Italy, we use adjusted 2011 NPL ratio increasing it by the same factor as the increase in the total NPLs ratio between 2011 and 2012 as reported in consolidated banking data. The HFCS is not conducted in the same year across countries. The NPL values refer to the end of the year in which the HFCS was conducted. The EADs are the expected exposure at defaults following from our definition of distress.

Figure 8 Distribution of number of years of negative flow of financial margin being covered by liquid assets

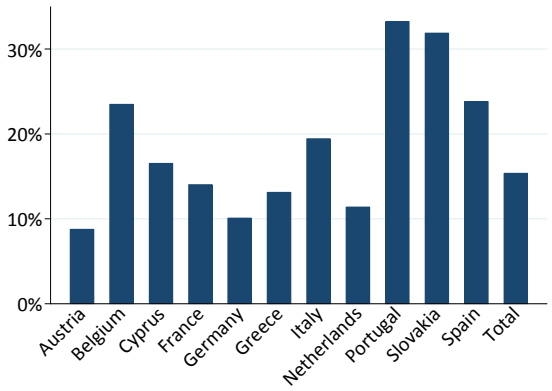


Sources: HFCS & own calculations.

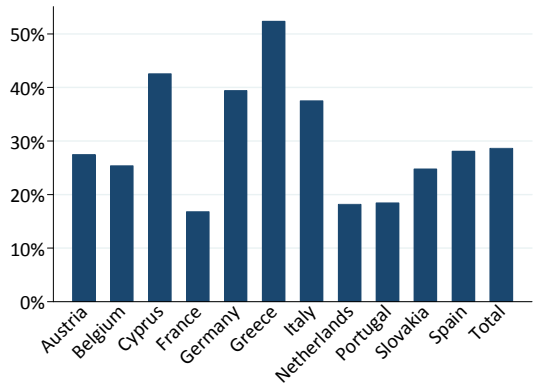
Notes: The data is censored at 2. The fraction is plotted.

Figure 9 Breakdown of financial vulnerable households

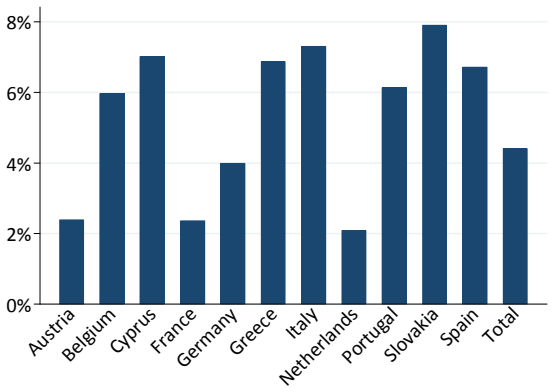
9.1 Percentage of indebted households having a negative financial margin



9.2 Percentage of households with liquid assets below ½ month of negative flow of financial margin



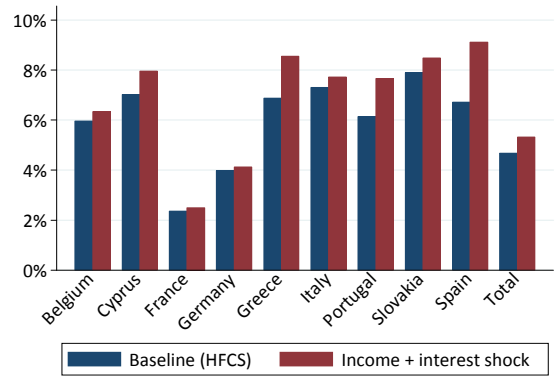
9.3 Percentage of indebted households having a positive probability of default



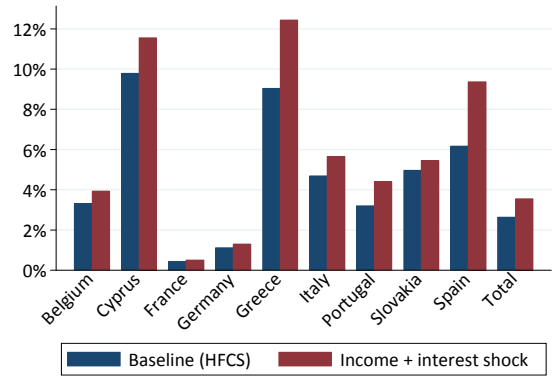
Sources: HFCS & own calculations.

Figure 10 Effects of the shocks

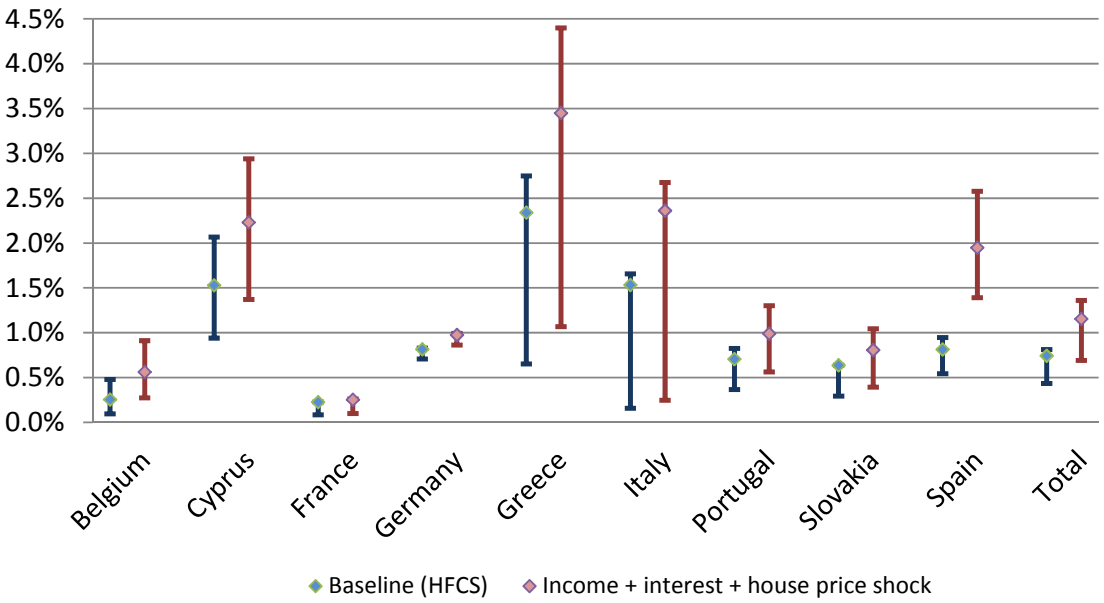
10.1 Percentage of indebted households with a positive probability of default



10.2 Expected exposure at default



10.3 Expected loss given default

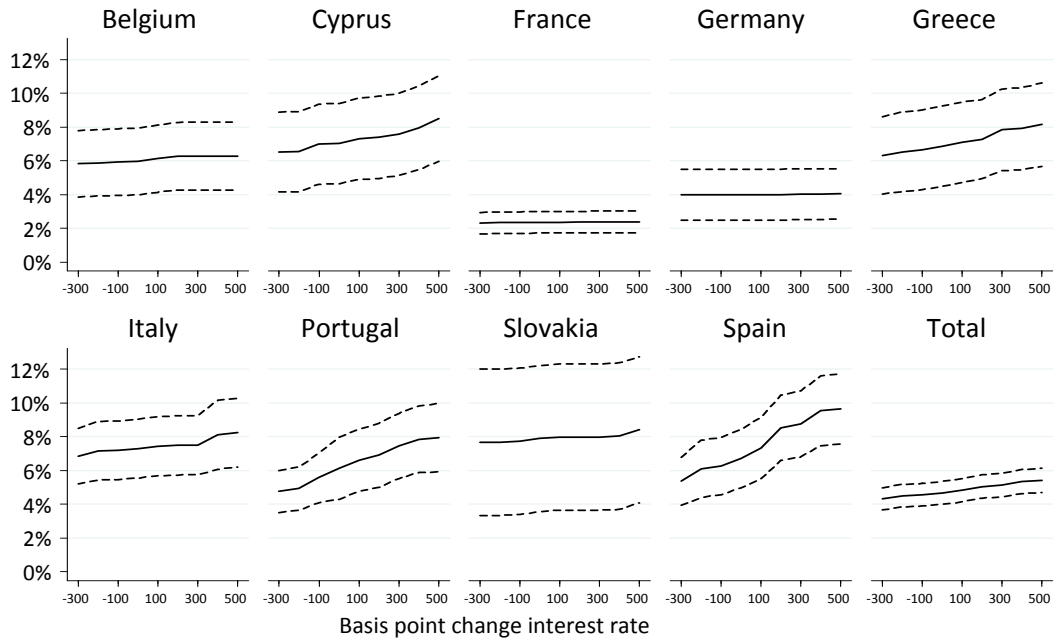


Sources: HFCS & own calculations

Notes: the interest rate shock is a 300 basis points increase in the interest rate. The income shock is defined as a 5 percentage point increase in the unemployment rate. Those who lose their job are assumed to receive unemployment benefits. The house price shock is a decline of 20% of the value of real estate.

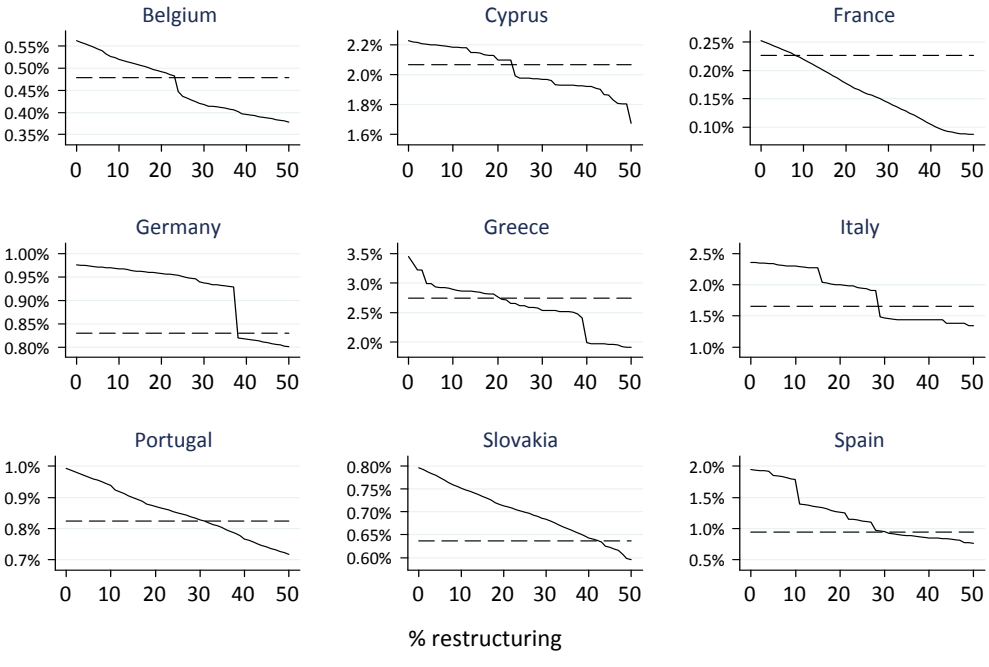
The graph showing the loss given default gives three different estimates based on different assumptions on which assets the bank can recover in case of a default. The lower end of the line is the loss given default if the bank can recover all assets the household has. The diamond indicates the loss given default if the bank is assumed to recover the liquid assets + the value of the collateral if the household has a mortgage. The top end of the line is based on these same assumptions plus now the value of the real estate is downgraded by 20% to account for the tendency that forced sales lead to a lower price than the value is.

Figure 11 Percentage of indebted households with a positive probability of default for different changes to the interest rate



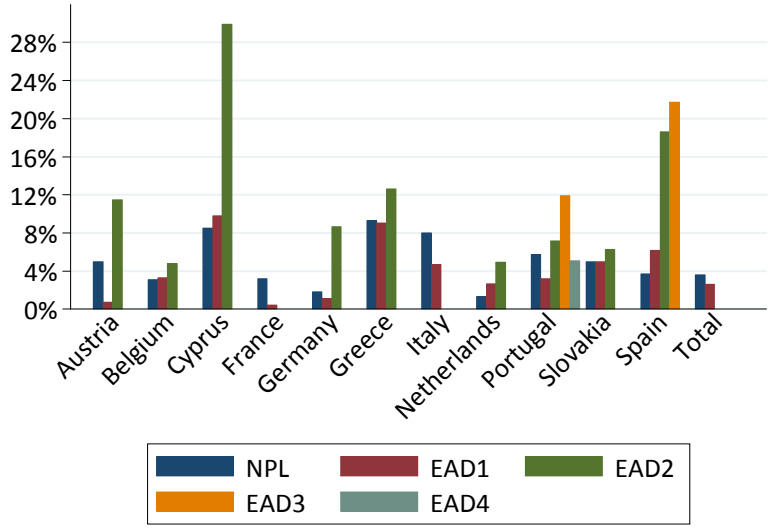
Sources: HFCS & own calculations.
Note: the dashed lines represent the 95% confidence intervals.

Figure 12 Expected LGD dependent on level of restructuring



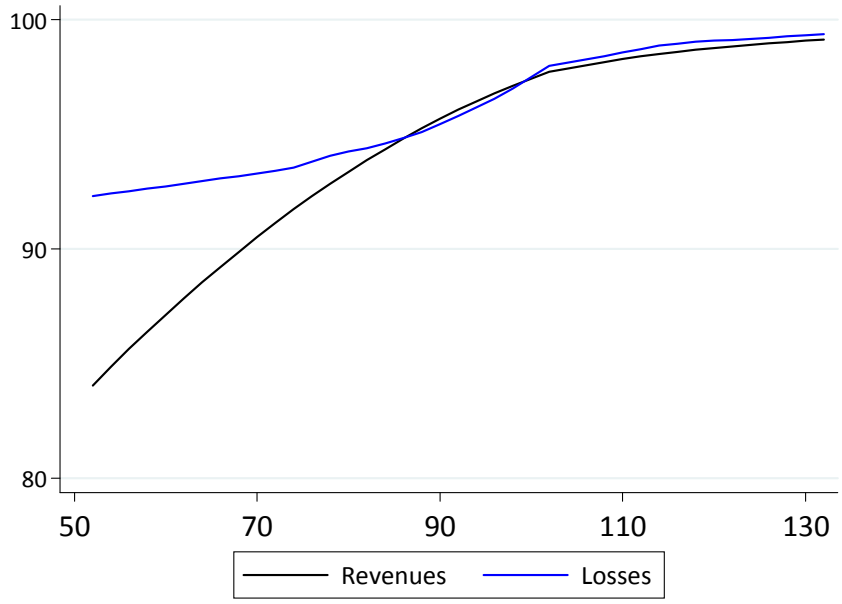
Sources: HFCS & own calculations.
Notes: The solid line shows how the LGD after the income + interest shock is affected by loan restructurings. The x-axis shows the percentage reduction of the monthly debt service expenses. The dashed line shows the baseline LGD (before the shocks) and is not affected by restructuring. In addition, for the calculation of the LGD we assume a haircut on the collateral of 20%.

Figure 13 Exposure at default for different definitions of distress



Sources: HFCS, various Central Banks, Consolidated Banking Data & own calculations.
Notes: the NPLs are the non-performing loan ratios of the household sector as reported by various Central Banks and consolidated banking data. EAD1 refers to the exposure at default using our metric. EAD2 refers to the exposure at default if those who have expenses above income, and finance this by means of a loan, asking help from friends or relatives or leaving some bills unpaid, are considered as distressed. EAD3 refers to the exposure at default if those who have been behind with their debt payments over the past 12 months are considered in distress. EAD4 refers to the exposure at default if those who are at the moment of the survey behind with their debt payments are considered as distressed.

Figure 14 Revenues and losses of banks dependent on a maximum imposed loan to value ratio (index)



Sources: HFCS, Haver Analytics & own calculations.
Notes: the index is set to 100 in case there is no LTV ratio cap (i.e. the baseline). Revenues are net and calculated as debt level times (lending rate – cost of funding). Losses equal to the denominator of the LGD. The figure shows the aggregate results for Belgium, Cyprus, Germany, Spain, Greece, Italy, Portugal and Slovakia. France is excluded since the initial value of the house is not collected there.

Table 1 Effect of shocks on the percentage of indebted households having a positive probability of default (absolute levels and relative changes)

Country	Belgium	Cyprus	France	Germany	Greece	Italy	Portugal	Slovakia	Spain	Total
Baseline	6.0%	7.0%	2.4%	4.0%	6.9%	7.3%	6.1%	7.9%	6.7%	4.7%
Interest rate shock										
100 bps increase	6.1% [2.9%]	7.3% [4.2%]	2.4% [0.0%]	4.0% [0.0%]	7.1% [3.2%]	7.4% [1.9%]	6.6% [7.6%]	8.0% [1.0%]	7.3% [9.1%]	4.8% [3.1%]
200 bps increase	6.3% [5.1%]	7.4% [5.3%]	2.4% [0.2%]	4.0% [0.4%]	7.3% [6.0%]	7.5% [2.6%]	6.9% [12.5%]	8.0% [1.1%]	8.5% [27.2%]	5.1% [8.0%]
300 bps increase	6.3% [5.4%]	7.6% [7.8%]	2.4% [0.5%]	4.0% [0.8%]	7.8% [14.1%]	7.5% [2.9%]	7.5% [21.6%]	8.0% [1.1%]	8.8% [30.5%]	5.1% [9.7%]
Employment shock										
3 p.p. increase unemployment rate	6.0% [0.6%]	7.2% [2.2%]	2.4% [3.2%]	4.0% [1.2%]	7.3% [5.7%]	7.4% [1.2%]	6.3% [3.1%]	8.2% [3.8%]	7.0% [4.3%]	4.8% [2.4%]
5 p.p. increase unemployment rate	6.0% [1.1%]	7.3% [4.5%]	2.5% [4.6%]	4.1% [2.5%]	7.5% [9.9%]	7.4% [1.9%]	6.4% [4.6%]	8.4% [6.1%]	7.1% [6.4%]	4.9% [3.9%]
Combined shock										
300 bps increase + 5% increase unemployment rate	6.3% [6.5%]	8.0% [13.4%]	2.5% [5.5%]	4.1% [3.7%]	8.5% [24.4%]	7.7% [5.8%]	7.7% [25.0%]	8.5% [7.5%]	9.1% [35.9%]	5.3% [13.8%]

Sources: HFCS & own calculations.

Notes: The numbers in brackets are the relative changes compared to the baseline.

Table 2 Effect of shocks on the expected exposure at default (absolute levels and relative changes)

Country	Belgium	Cyprus	France	Germany	Greece	Italy	Portugal	Slovakia	Spain	Total
Baseline	3.3%	9.8%	0.4%	1.1%	9.0%	4.7%	3.2%	5.0%	6.2%	2.6%
Interest rate shock										
100 bps increase	3.5% [4.1%]	10.5% [7.4%]	0.5% [3.8%]	1.1% [1.2%]	9.6% [5.9%]	5.2% [11.7%]	3.5% [8.0%]	5.1% [1.8%]	7.2% [17.2%]	2.9% [11.1%]
200 bps increase	3.7% [12.3%]	10.8% [10.0%]	0.5% [7.2%]	1.2% [12.0%]	9.9% [9.4%]	5.4% [15.3%]	3.9% [20.9%]	5.1% [3.3%]	8.6% [39.3%]	3.3% [24.7%]
300 bps increase	3.9% [16.2%]	11.1% [13.5%]	0.5% [10.3%]	1.3% [12.9%]	11.7% [30.0%]	5.5% [17.5%]	4.2% [32.4%]	5.2% [4.5%]	9.1% [47.6%]	3.4% [30.9%]
Employment shock										
3 p.p. increase unemployment rate	3.4% [1.3%]	10.0% [1.9%]	0.4% [1.6%]	1.1% [1.7%]	9.4% [3.7%]	4.8% [1.9%]	3.3% [3.1%]	5.1% [2.3%]	6.3% [2.8%]	2.7% [2.4%]
5 p.p. increase unemployment rate	3.4% [2.1%]	10.2% [4.0%]	0.4% [2.8%]	1.2% [3.4%]	9.7% [7.2%]	4.8% [3.1%]	3.4% [4.7%]	5.2% [4.5%]	6.4% [3.9%]	2.7% [3.7%]
Combined shock										
300 bps increase + 5 p.p. increase unemployment rate	3.9% [18.6%]	11.5% [18.0%]	0.5% [13.7%]	1.3% [16.5%]	12.4% [37.7%]	5.6% [20.7%]	4.4% [37.3%]	5.5% [9.8%]	9.4% [51.8%]	3.6% [34.9%]

Sources: HFCS & own calculations.

Notes: The numbers in brackets are the relative changes compared to the baseline.

Table 3 Effect of shocks on the expected loss given default (absolute levels and relative changes)

Country	Belgium	Cyprus	France	Germany	Greece	Italy	Portugal	Slovakia	Spain	Total
Baseline	0.25%	1.53%	0.23%	0.81%	2.34%	1.53%	0.71%	0.64%	0.81%	0.74%
Interest rate shock										
100 bps increase	0.26% [2.6%]	1.53% [0.2%]	0.23% [3.1%]	0.82% [0.8%]	2.37% [1.4%]	2.08% [35.5%]	0.72% [1.9%]	0.66% [4.0%]	0.95% [16.7%]	0.83% [11.4%]
200 bps increase	0.29% [14.0%]	1.54% [0.8%]	0.24% [5.9%]	0.94% [15.0%]	2.37% [1.5%]	2.17% [41.6%]	0.74% [5.5%]	0.69% [8.6%]	1.42% [74.9%]	0.97% [31.0%]
300 bps increase	0.30% [16.4%]	1.56% [2.1%]	0.24% [8.4%]	0.94% [15.8%]	2.73% [16.6%]	2.22% [44.9%]	0.76% [7.5%]	0.72% [12.3%]	1.46% [79.5%]	1.00% [34.1%]
Employment shock										
3 p.p. increase unemployment rate	0.26% [0.6%]	1.54% [0.7%]	0.23% [1.1%]	0.82% [0.8%]	2.39% [2.2%]	1.60% [4.8%]	0.72% [1.3%]	0.70% [9.2%]	0.86% [5.1%]	0.76% [2.6%]
5 p.p. increase unemployment rate	0.26% [0.9%]	1.55% [1.6%]	0.23% [1.7%]	0.83% [1.4%]	2.43% [4.0%]	1.64% [7.1%]	0.72% [2.1%]	0.72% [13.7%]	0.88% [7.7%]	0.77% [4.0%]
House price shock										
10% decline	0.35% [38.5%]	1.78% [16.5%]	0.23% [0.1%]	0.82% [1.0%]	2.50% [7.0%]	1.57% [2.7%]	0.75% [6.6%]	0.64% [0.0%]	0.88% [7.7%]	0.77% [4.0%]
20% decline	0.48% [88.7%]	2.07% [35.2%]	0.23% [0.3%]	0.83% [1.9%]	2.75% [17.5%]	1.66% [8.2%]	0.82% [16.8%]	0.64% [0.0%]	0.95% [16.2%]	0.81% [9.2%]
30% decline	0.63% [150.1%]	2.37% [55.2%]	0.23% [1.1%]	0.84% [2.9%]	3.12% [33.5%]	1.80% [17.8%]	0.91% [29.3%]	0.70% [9.4%]	1.10% [35.7%]	0.88% [18.1%]
Combined shock										
5 p.p. increase unemployment rate + 20% decline house price	0.48% [91.0%]	2.10% [37.5%]	0.23% [2.1%]	0.84% [3.5%]	2.87% [22.7%]	1.77% [15.3%]	0.85% [21.0%]	0.73% [14.7%]	1.03% [26.9%]	0.85% [14.1%]
300 bps increase + 5 p.p. increase unemployment rate + 20% decline house price	0.56% [121.5%]	2.23% [45.8%]	0.25% [11.7%]	0.97% [19.7%]	3.45% [47.5%]	2.36% [54.1%]	0.99% [40.2%]	0.81% [26.6%]	1.95% [139.4%]	1.15% [55.2%]

Sources: HFCS & own calculations.

Notes: The numbers in brackets are the relative changes compared to the baseline. The bank is assumed to recover liquid assets plus the value of the house if the household has a mortgage.

Table 4 Summary statistics

	Spain					Portugal				
Variable	Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max
Income quintile 1	6197	0.27	0.44	0	1	4404	0.50	0.50	0	1
Income quintile 2	6197	0.21	0.41	0	1	4404	0.24	0.43	0	1
Income quintile 3	6197	0.22	0.41	0	1	4404	0.12	0.33	0	1
Income quintile 4	6197	0.18	0.38	0	1	4404	0.08	0.28	0	1
Income quintile 5	6197	0.13	0.33	0	1	4404	0.06	0.23	0	1
Net wealth quintile 1	6197	0.11	0.31	0	1	4404	0.20	0.40	0	1
Net wealth quintile 2	6197	0.10	0.31	0	1	4404	0.25	0.43	0	1
Net wealth quintile 3	6197	0.25	0.43	0	1	4404	0.32	0.47	0	1
Net wealth quintile 4	6197	0.28	0.45	0	1	4404	0.15	0.36	0	1
Net wealth quintile 5	6197	0.26	0.44	0	1	4404	0.09	0.28	0	1
Debt level	2452	65070	99123	30	1.18E+07	1585	4.62E+04	5.06E+04	0	610000
Debt service (monthly)	2369	671	905	0	2.00E+05	1467	368	301	5.0	6640
Debt-service-to-income ratio	2364	0.36	2.72	0	384.0	1467	0.30	0.34	0	3.7
Debt-to-asset ratio	2443	0.72	5.65	0	266.7	1576	0.63	2.77	0	90.7
Debt-to-income ratio	2446	2.65	9.38	0	1272.7	1585	3.04	4.56	0	111.2
Household size	6197	2.7	1.2	1	9	4404	2.71	1.28	1	16
# of dependent children	6197	0.60	0.9	0	7	4404	0.62	0.89	0	11
Elementary education	6197	0.54	0.5	0	1	4404	0.76	0.43	0	1
High school	6197	0.20	0.4	0	1	4404	0.13	0.34	0	1
College	6197	0.26	0.4	0	1	4404	0.11	0.31	0	1
Employed	6197	0.47	0.5	0	1	4404	0.46	0.50	0	1
Self-employed	6197	0.11	0.3	0	1	4404	0.10	0.30	0	1
Unemployed	6197	0.09	0.3	0	1	4404	0.07	0.25	0	1
Retired	6197	0.24	0.4	0	1	4404	0.34	0.47	0	1
Other	6197	0.09	0.3	0	1	4404	0.03	0.16	0	1
Financial sector	6197	0.02	0.1	0	1	4404	0.01	0.10	0	1
Public sector	6197	0.16	0.4	0	1	4404	0.16	0.37	0	1
Has mortgage	6197	0.33	0.5	0	1	4404	0.27	0.44	0	1
Has non collateralized loan	6197	0.27	0.4	0	1	4404	0.13	0.34	0	1
Has credit card or overdraft debt	6197	0.08	0.3	0	1	4404	0.07	0.26	0	1
Female	6197	0.27	0.4	0	1	4404	0.35	0.48	0	1
age $\leq$ 30	6197	0.06	0.2	0	1	4404	0.07	0.25	0	1
30 < age $\leq$ 45	6197	0.33	0.5	0	1	4404	0.28	0.45	0	1
45 < age $\leq$ 60	6197	0.29	0.5	0	1	4404	0.29	0.45	0	1
60 < age	6197	0.32	0.5	0	1	4404	0.36	0.48	0	1
Metric of distress	6197	0.03	0.2	0	1	4404	0.01	0.10	0	1

Source: Eurosystem Household Finance and Consumption Survey, authors' calculations.

Table 5 Determinants of having late or missed payments in Spain and Portugal

	ES		PT	
	dy/dx (*100)	s.e. (*100)	dy/dx (*100)	s.e. (*100)
Income quintile 2	3.07	3.68	-2.19	2.61
Income quintile 3	1.72	3.79	-3.15	3.71
Income quintile 4	-1.44	4.55	-1.91	4.61
Income quintile 5	0.30	6.20	1.51	5.23
Net wealth quintile 2	-11.91***	4.49	-1.57	3.35
Net wealth quintile 3	-8.54*	4.44	-7.02**	3.29
Net wealth quintile 4	-14.46***	4.94	-12.29***	4.23
Net wealth quintile 5	-21.74***	5.10	-12.09**	6.11
Debt level	0.00	0.00	0.00	0.00
Debt service (monthly)	0.00	0.00	0.00	0.85
Debt-service-to-income ratio	-3.44	5.17	9.61*	5.82
Debt-to-asset ratio	0.16	0.85	0.04	0.35
Debt-to-income ratio	2.06**	0.90	-0.72	0.49
Household size	1.73	1.94	-0.57	1.34
# of dependent children	-0.32	2.14	2.47	1.63
High school	4.56	2.97	-1.02	2.69
College	-3.73	2.81	-6.82*	3.78
Self-employed	10.64***	3.37	5.25*	3.16
Unemployed	12.92***	2.99	5.88	3.72
Retired	0.79	4.57	1.56	3.27
Other	8.46	5.44	5.67	9.00
Financial sector			-9.15	8.45
Public sector	-5.05	3.50	-0.39	2.56
Has mortgage	-0.45	3.54	1.68	3.92
Has non collateralized loan	6.12**	2.66	8.10**	3.17
Has credit card or overdraft debt	10.34***	3.08	12.67***	3.83
Female	0.03	2.82	1.55	3.00
$30 < age \leq 45$	-6.10	4.59	-4.92	3.22
$45 < age \leq 60$	-4.12	4.96	-5.39	3.87
$60 < age$	-7.62	5.73	-3.06	7.72
Metric of distress	21.52***	4.78	17.72**	6.90
Pseudo-R2	0.23134		0.23612	
No. of observations	2318		1464	

Notes: The table reports weighted average marginal effects multiplied by 100. The reported numbers are based on weighted regressions and use 5 implicates. The standard errors are based on the 1000 replicates. For Spain the variable Financial sector is dropped due to perfect predictability (i.e. all working in the financial sector had no late or missed payments). The levels of statistical significance are *** p<0.01, ** p<0.05, * p<0.10.