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Assessing and predicting financial vulnerability of Italian households:
a micro-macro approach*

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Abstract

This study develops a micro-founded model to analyse the economic-financial conditions of Italian households. Initially, an indicator is constructed for the base year 2014, which identifies vulnerable households based on the budget constraint and the composition of their financial portfolio. Subsequently, the impact of the predicted trends of macro-economic variables on the indicator is calculated in order to monitor its evolution in the short term (2015-2017). The empirical analysis is based on the Survey of Household Income and Wealth of the Bank of Italy and on the macroeconomic forecasts of Prometeia. The macroeconomic scenario for the period 2015-2017 implies a progressive reduction in the percentage of vulnerable households for the full extent of the projection.

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1.   Introduction and literature review

In this study we propose an analysis of the economic-financial conditions of Italian households via the construction of an indicator which identifies financially vulnerable (or fragile) households based on the budget constraint and composition of their financial portfolio. The aim is to simulate the evolution of financial fragility in Italy in the short term. To this end we are using the data from the Bank of Italy's Survey on Household Income and Wealth (SHIW) relating to the years 2012 and 2014 and Prometeia's forecasts to 2017 of some macro-economic variables.

First the financial crisis and then that of sovereign debt brought to light the theme of the economic-financial vulnerability of households. Aggregate indicators, such as the ratio between the debt stock and disposable income indicated, even before the financial crisis, conditions of potential risk for the household sector in some countries. For example, OECD data (2015) indicate that in 2007 the United Kingdom and the United States had a debt to income ratio of 183.5% and 137% respectively, values which fell to 156% and 109.7% in 2014. Also in countries with traditionally low levels of debt, this ratio had gone up: in Italy for example, the debt/income ratio increased from 40% in 1996 to 68.3% in 2007, to reach 77.2% in 2014. Furthermore, the household survey data indicate that before the crisis Italy was among the countries with the lowest percentage of households with a mortgage (13%) compared to the UK (49%), the US (46%) and France and Germany (28%) (Brunetti et al., 2015). Despite the fact that the household sector in Italy is not thus characterised by significant financial indebtedness, a condition which "protected" it from the crisis more than in other countries, there are however areas of potential suffering which it is important to monitor, both for the stability of the economic system overall and also more specifically for the banking sector.[1]

With the financial crisis, particularly with the sub-prime crisis which erupted in the United States and spread throughout Europe, and the potential risk deriving from the over-borrowing of households, the appointed authorities defined the monitoring of certain indicators as priority in an attempt to contain the systemic risk resulting from this sector (e.g. EC, 2008). Thus, fixed coefficients or absolute limits were identified to be applied to debt agreements (for example the *loan to value* or *debt service to income* and *loan to income ratios*) which, acting as stabilizers, are aimed at containing the risk assumption by the financial system. From a macro-prudential perspective, economists and financial institutions thus started to monitor all information deriving from micro-economic data more closely in order to identify areas of possible distress among households by constructing financial vulnerability indicators (see, for example, Bank of Italy, 2015). In the recent past, the use of micro-founded indicators was recommended also by the so-called Stiglitz-Sen-Fitoussi Commission instituted in France in 2009. They emphasised the need to broaden the analysis of the economic performance of a country from macro-economic indicators, e.g. GDP and measures linked to it, to extra-income indicators capable of capturing aspects linked to wellbeing and social progress with the aim of obtaining a fuller picture of the socio-economic conditions of a country.[2] As far as the more strictly economic aspects are concerned, increasing emphasis started to be placed on the use of micro-economic data to identify and monitor, among other things, those segments of the population

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[1] Between 2008 and 2012 the percentage of households in debt with high levels of financial exposure, i.e. with a debt service to income ratio greater than 30%, did not show any significant increase, remaining at around 10% (our calculations on data from the Survey on Household Income and Wealth by the Bank of Italy).

[2] See: "Report of the Commission on the Measurement of Economic Performance and Social Progress" (2009), http://www.insee.fr/fr/publications-et-services/dossiers_web/stiglitz/doc-commission/RAPPORT_anglais.pdf (consulted 26-07-2016).

exposed to greater economic and financial fragility. The recent outcome of the pro Brexit British referendum and its immediate impact on the financial markets and consequently on household porfolios make it more topical than ever to be able to quantify the impact of exogenous shocks on the economic sectors.

In recent years, literature has proposed various indicators for the definition of financial exposure, or vulnerability, of households (see for example D'Alessio and Iezzi, 2013). Of these, some take into consideration only the credit position, for example the debt-service to income ratio or the debt stock to income ratio (Brown and Taylor, 2008; ECB, 2013; Jappelli et al., 2013; Michelangeli and Pietrunti, 2014); others use net wealth to identify vulnerable households (Brown and Taylor, 2008; Giarda, 2013). Other works analyse the presence of arrears in repaying the debt (Whitley et al., 2004; Georgarakos et al., 2010; Magri and Pico, 2012; Jappelli et al., 2013), the ability of the household to make ends meet (McCarthy, 2011), to deal with unexpected expenses (Lusardi et al., 2011) or the burden of housing costs including the mortgage payment (May and Tudela, 2005). Finally, measures have been proposed that use more than one condition to identify the state of vulnerability and as well as considering credit exposure (and thus debt) they also take into account flow of income and liquidity available to the household, as in Brunetti et al. (2015) for Italy and Ampudia et al. (2016) for the European countries.

Our work is part of a growing literature which studies the evolution of the conditions or vulnerability of households via the use of micro-founded models. The aim of this literature is to assess the impact of the trends in macro-economic variables on the economic-financial conditions of households typically measured over the short term. Examples of microsimulation models of this type are Albacete and Fessler (2010) and Albacete and Lindner (2013) for Austria, Galuščák et al. (2014) for the Czech Republic, Michelangeli and Pietrunti (2014) for Italy, and Ampudia et al. (2016) for the European countries. The specific objective of our analysis consists of identifying vulnerable households in a base year (2014) and projecting their evolution to 2017 following the variations in macro-economic conditions. To this end we use the SHIW data for 2012 and 2014 (latest years available) and the forecasts of Prometeia (2016) for an appropriate set of macro-economic variables. In order to identify the financially fragile households we chose to follow the approach of Ampudia et al. (2016) based on the European *Household Finance and Consumption Survey* (HFCS) of 2010 and apply it to the Italian case.

The condition of vulnerability is defined based on the financial margin (given by income minus debt repayment and expected expenditure) of a household and on the ability of the family itself to cope with periods when the financial margin is negative by liquidating financial assets. One of the advantages of this indicator is that it can be applied to all households, regardless of whether they have debts (mortgages or consumer credit). One of the disadvantages, however, is that imposing joint constraints on income, consumption and financial wealth determines low sample quantities in absolute terms.[3] This drove the decision to use the data from 2012 and 2014 in the form of pooling,

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[3] This is true especially for the survey year 2014 which is characterized by a lower percentage of indebted households and a smaller average amount of debt than 2012. The percentage of households in debt for personal and professional reasons is 23% in 2014, steadily falling from 27.7% in 2008, while the average value of overall debt dropped from 51175 euro in 2012 (it was 43792 euro in 2010) to 44143 in 2014 (see Tables E4 and E5 of various issues of the Bank of Italy's *Supplements to the Statistical Bulletin – Household Income and Wealth*). Beside the issue of the small sample size, we did not want to use a year of "minimum" as base year for the projections, since the data for 2015 and macroeconomic forecasts for the following years point towards an improvement of the credit market. For these reasons it seemed reasonable to work on the pooling 2012-2014.

where the monetary variables of 2012 were carried forward to 2014 with the consumption deflator. For simplicity this dataset is defined "2014". In "2014" we obtain a percentage of vulnerable households of 12.7% of the total number of households; if instead we limit the analysis to the subset of those in debt, we obtain a percentage of 15.4% of fragile households, which is the equivalent of 2.9% of the total population.

In order to project the indicator from 2014 to 2017 we approximate the evolution of the microeconomic variables which are part of its definition (disposable income, expected expenditure, financial assets and debt repayment) with the trends of the corresponding macro-economic variables. The improving macro-economico situation both for 2015 and for the forecast years implies a progressive reduction in the percentage of vulnerable households for the entire period of the projection.

The work is structured as follows. Section 2 presents in detail the definition of financial fragility used. Section 3 illustrates the dataset, with relative descriptive statistics of the sample. The projections to 2017 of the condition of financial vulnerability are presented in Section 4, while the conclusive considerations are in Section 5.

2.   The definition of financial vulnerability

In order to identify households in financial difficulty we use the indiciator proposed by Ampudia et al. (2016) according to which households are considered vulnerable if they satisfy these two conditions:

1. The financial margin is negative, in other words the available income is not sufficient to cover the expected expenses and/or the debt service;
2. The amount of financial assets held is not sufficient to cover the negative financial margin for a certain timescale.

The financial margin *FM* of each household *i* is defined as:

$$FM_i = Y_i - DP_i - EE_i \qquad\qquad (1)$$

where *Y* is disposable household income, *DP* is the overall debt repayment and *EE* represents the expected expenses. The disposable income is defined as net of imputed rents and gross of any interest expenses;[4] the overall debt repayment is the sum of the payments made for mortgages and/or consumer credit; lastly, the expected expenditure is defined as the total expenses for non-durable goods, rents, alimony payments to ex-spouses and insurance premiums.[5]

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[4] We use disposable income net of imputed rents since imputed rents are not "cash" income and cannot be used to cover a negative financial margin unless the household decides to sell their property.

[5] The definition of expected expenditure is taken from Brunetti et al. (2015) and is to be interpreted as the set of those expenses that cannot be reduced at least not without difficulty. We are aware of the fact that part of the food consumption could be reduced, but it is also true that we are working with data relating to years in which consumption was cut by households and that it would be difficult to reduce it further. It is also difficult and costly to pay off insurance policies. The average value of the expected expenses is also very close to the poverty line defined as the 60% of median disposable income adjusted for the household composition (the so-called equivalised income). It therefore seems a reasonable definition to identify the "necessary" expenses of a household. Ampudia et al. (2016) instead use the concept of "basic living costs" the value of which, in each country, is equal to a percentage (40%) of the median equivalised income.

The households who cannot cover these costs with their income could, however, still cover the debt service if they possess sufficient financial assets. Formally the conditions (i) and (ii) are as follows:

$$FM_i < 0$$

$$|FM_i| * d > FA_i$$

where *FA* is the amount of financial assets of the household and *d* is the number of days in which the financial margin *FM* is covered. The indicator of financial vulnerability Δ_i is thus expressed by the following double condition:

$$\Delta_i = \begin{cases} 1 \Leftrightarrow FM_i < 0 \; \cap \; |FM_i| * d > FA_i \\ 0 \Leftrightarrow FM_i \geq 0 \; \cup \; |FM_i| * d \leq FA_i \end{cases} \tag{2}$$

The vulnerable households are identified by Δ_i equal to unity. In order to obtain the vulnerability indicator, it is thus necessary to determine the parameter *d* of equation (2). In order to have consistency with the aggregate data of financial indebtedness of the banking system towards the household sector, and in line with Ampudia et al. (2016), parameter *d* is calibrated so that the *exposure at default* (EAD) obtained from the micro-economic data is closer to the ratio between the non-performing loans and the total credits of the sector, the *non performing loan ratio* (NPLR).[6] The calibration process, then, calculates the estimated *exposure at default* of all households, *EAD*$_{tot}$, as:

$$EAD_{tot} = \frac{\sum_{i=1}^{N} p_i D_i}{\sum_{i=1}^{N} D_i} \tag{3}$$

where p_i is the probability of default of the i-th household and D_i is its total debt.

Figure 1 Probability of default

number of days in which the financial margin is covered by liquid assets
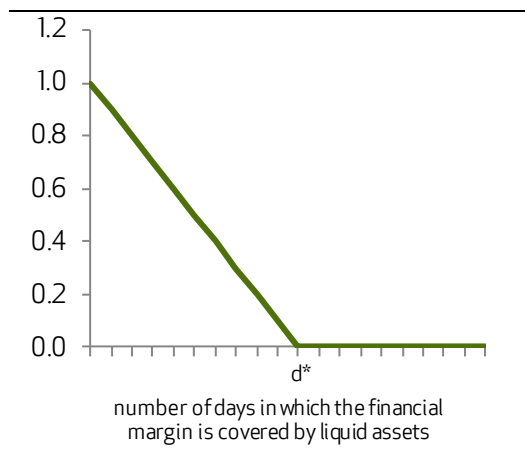
The probability of default is expressed as a linear function of the number of days of negative financial margin covered by the financial assets: in Figure 1 *d** is the number of days starting from which the probability of default reaches zero. The EAD reflects, therefore, the amount of debt held by vulnerable households compared to the debt of all households in a given period of time. In the period 2012-2014 the reference value of the NPLR is on average 11.7%.[7] The value of parameter *d* which allows us to obtain an EAD in line with this value is 170 days: this means that the households can afford to maintain a negative financial margin for almost six months by liquidating financial assets before going into default.[8]

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[6] Vulnerability is measured regardless of the type of intermediary that issued the credit, whereas we calibrate the NPLR of only the banking sector.

[7] Source: Bank of Italy, *Statistical Bulletin* (March 2016) for non-performing loans; Bank of Italy, *Supplements to the Statistical Bulletin - Monetary and Financial Indicators - Money and Banking* (March 2016) for the total credit to households.

[8] Ampudia et al. (2016) find a value for Italy of 3.9 months in 2010.

3.   Data and descriptive statistics

The data used for the analysis is taken from the Survey on Household Income and Wealth (SHIW) of the Bank of Italy, a sample survey which is carried out every two years – starting from the 1960s – on a sample group of around 8,000 families, representative of the Italian population.[9] Over the years, the survey has substantially broadened the information data set on the socio-demographic characteristics of all the members of the family (among which: gender, age, level of relationship with the head of the family, marital status, qualifications, region of residence, occupational status and sector of occupation), on incomes, consumption, wealth (financial and real), financial liabilities and other elements characterising the financial behaviour of the households. The information relating to consumption and wealth is measured only on a household level, whereas that relating to incomes is also gathered at the level of each single earner. In this work we use data relating to the demographic structure of the households, income, consumption, financial wealth and financial liabilities. In particular, for every household that has taken out a loan, it is possible to divide the debts by type and purpose (purchase of first house, restructuring or purchase of second house and consumer credit) and by type of interest rate applied (fixed or variable); the survey also supplies precious information relating to: the amount of debt at the time of the survey, the amount of the original debt, the remaining duration and the burden of repayment in the reference year.

Our analysis is carried out using data relating to 2012 and 2014, in the form of pooling, with the aim of expanding the sample size. This is because a household is defined as vulnerable if it satisfies at the same time conditions linked to disposable income and consumption and conditions of the financial assets held, which produces low sample quantities. In order to construct a sample defined in this way, the monetary aggregates (eg. income, consumption, debt, etc.) from the 2012 survey were carried forward to 2014 prices using the consumption deflator; for simplicity this sample is defined "2014".

Before proceeding with the analysis, it was necessary to make some corrections to the dataset: the first relates to interest rates, where these are not declared by the families; the second concerns possible inconsistencies between the information regarding debts declared by the family (mortgage repayment paid, residual amount, year the loan was taken out, duration and interest rate applied). The missing interest rates were imputed using the MICE technique (Rubin, 1978; Rubin, 1987); whereas, for the inconsistencies in the information on the debt, we recalculated the instalment paid in the year, but only for those households with a negative capital share (for details see Appendix A).[10]

Table 1 highlights some characteristics of the households and provides information on the vulnerability indicator. The total households of the sample receive on average an annual income, net of imputed rents, of almost €25,000, they hold financial assets worth around €26,000 and sustain annual expenses for consumption of almost €24,000, of which €18,000 is destined to pay consumption which is hard to curb (the expected expenditure). Moreover 24.2% of the households have a negative financial margin and 12.7% are in conditions of vulnerability, that is they do not have sufficient financial assets to cover 170 days of negative financial margin. The vulnerable households receive an average annual income (net of imputed rents) of around €11,000, have a negative annual

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[9] For a detailed description of the survey see Brandolini and Cannari (1994) and Faiella (2008).

[10] The calculation of the loan repayment follows the French ammortization schedule.

cash flow (income – expected expenditure) of over €6,000, declare financial assets of less than €500, and an average annual repayment of €1,400 (against the €1,100 of total households).

Furthermore, Table 1 shows that 18.6% of the total number of households declare having debts, 11.5% declare having a mortgage and 9.2% declare having consumer credit.[11] The income received by the households with debt is on average higher than the average of the sample; the financial assets held, as expected, are lower and the expected expenditure, inflated by the debt repayment, is greater than the average of the sample.

Table 1   Descriptive statistics and financial vulnerability
(pooling 2012-2014)

	average	st. dev.	min	max
total households				
% values				
vulnerable households	12.7	33.3	0	1
households with negative financial margin	24.2	42.8	0	1
households with debt	18.5	38.9	0	1
households with a mortgage	11.5	31.9	0	1
households with consumer credit	9.2	28.9	0	1
average values (euro)				
disposable income (net of imputed rents)	24888	19463	-26600	432999
annual debt payment	1119.0	3144	0	77400
expected expenditure	18000	10662	1200	240000
financial assets	25740	97487	0	5133000
total debt	9684	33319	0	500000
mortgages	9013	32908	0	500000
consumer credit	671	3192	0	152130
vulnerable households				
average values (euro)				
disposable income (net of imputed rents)	10703	8436	-26600	67000
annual debt payment	1408	3475	0	32713
expected expenditure	16306	11039	1200	240000
financial assets	472	1341	0	25769
total debt	11449	34587	0	411303
mortgages	10388	34226	0	411303
consumer credit	1061	4748	0	152130

Source: our calculations on SHIW data. Weighted statistics.

In the subset of the indebted households (Table 2), almost 32% of the households with debts have a negative financial margin and those in a state of financial vulnerability (indicator a) account for 2.9% of the total number of households, which corresponds to 15.4% of the indebted households.[12] This

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[11] The forms of debt considered in this analysis are mortgages for purchase of first house, purchase of second house, restructuring and finally consumer credit.

[12] Ampudia et al. (2016) obtain a percentage of indebted vulnerable households of 8.9%. The difference with our result may depend on several factors, most of which related to the difference in the year of analysis, 2010 in their study, 2012-2014 in ours. The year 2010 is characterized by very different economic conditions from 2012 and 2014 with reference to levels of income, consumption, debt and percentage of indebted households. In addition, we are using a different definition of

result is in line with the indications deriving from the indicator which identifies the fragile households via the impact of the debt service to income ratio - greater than 30% - and an income less than the median (indicator b): in this case, in fact, the percentage of fragile households is 14.4 of all the indebted households (equivalent to 2.6% of the population). However, if we only take into consideration the single condition of the debt service (indicator c), the percentage of households in a condition of financial fragility rises to 24.5% of all those in debt.[13]

Table 2   Indebted households in different conditions of financial vulnerability
(pooling 2012-2014)

| | | indebted vulnerable households | | |
| | | (indicator a) | (indicator b) | (indicator c) |
	total indebted households	financial vulnerability	debt-service ratio>0.3 &income<median	debt-service ratio>0.3
% values				
vulnerable households		15.4	13.0	24.5
with negative financial margin		31.9		
average values (euro)				
disposable income (net of imputed rents)	31726	17300	13161	22339
annual debt payment	6036	6284	6483	9716
expected expenditure	25428	24452	3754	24704
financial assets	21531	804	18321	10522
total debt	52379	51126	57351	89858
mortgages	48752	46387	53030	85632
consumer credit	3627	4739	4320	4226
Source: our calculations on SHIW data. Weighted statistics.				

Source: own calculations on SHIW data. Weighted statistics.

Figure 2   Distribution of the vulnerable households by household characteristics
(% values)
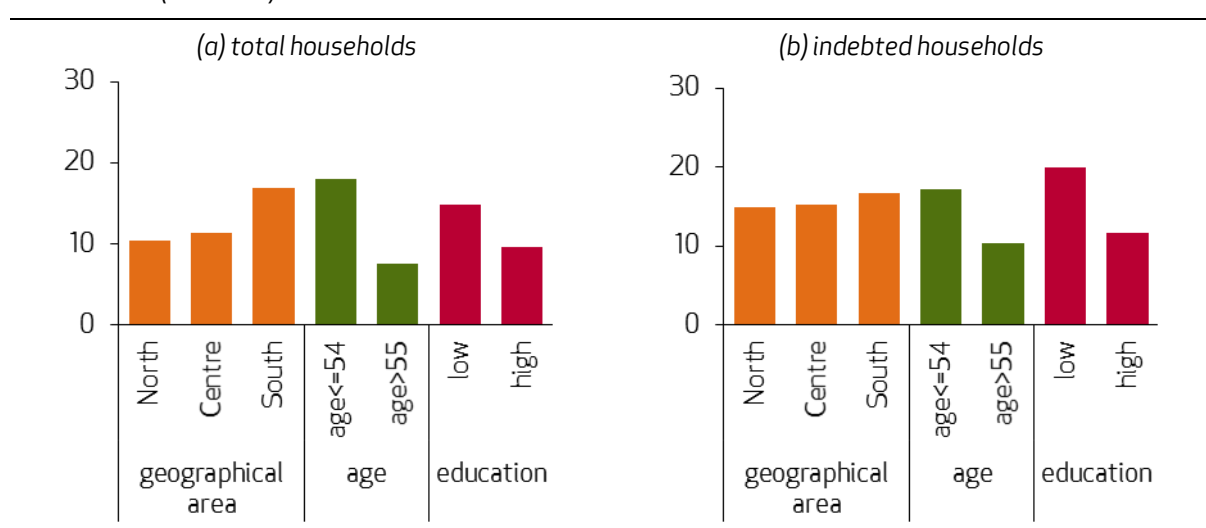
Source: our calculations on SHIW data. Weighted statistics.
Note: low education identifies heads of household with up to lower secondary education, high education identifies those with upper secondary education and above.

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disposable income (in Ampudia et al. disposable income is derived from gross income since disposable income is not available in their dataset) and basic living costs (our expected expenses).

[13] The conventional method of measurement of indicators (b) and (c) uses disposable income gross of imputed rents. For coherence with our indicator of financial fragility we use disposable income net of imputed rents also in the computation of these two indicators.

In general – both for the total number of households and for the sample of those in debt - the financially fragile households live in the Southern regions, their head of the family is younger than 55 years old and has a low level of education (Figures 2a and 2b).

4.   The projections of financial vulnerability from 2014 to 2017

The projections are intended to evaluate how the level of financial vulnerability of Italian households changes with the variation in macro-economic conditions from 2014 to 2017. Since the latest available year of the micro-economic data is 2014, the first step in the simulation consists of updating the indicator to 2015, the latest available macroeconomic historic data; then it is possible to proceed with the real forecast. Both steps entail making evolve the monetary variables which contribute to the definition of the vulnerability indicator (disposable income, expected expenditure, financial assets and debt repayment) according to the tendencies of the corresponding macro-economic variables.

Before proceeding with the projections, we have made some simplifying hypotheses. In particular, in line with the static environment of our model, we assume that the composition of the households in debt remains unchanged, in other words that there are no new loans issued or other variations due to the repayment of existing debts.[14] This implies that no amortisation process is implemented to carry forward the existing debts, and consequently the projection of the loan repayment to 2017 concerns only the interest quota for the variable rate component.[15] Given the short term horizon, the fixed rate mortgage payments and those of consumer credit are instead kept unchanged. Furthermore, in order to guarantee comparability over time, the number of days in which the negative financial margin is covered by the financial assets is kept constant at the level obtained from the calibration of 2014.

Table 3   Per-capita real growth rates of income, consumption and financial assets and variations in the average 3-month euribor rate

	disposable income	non-durable consumption	financial assets	average annual variations of 3-month euribor
	% var.	% var.	% var.	percentage points
2014-2015	0.4	0.3	2.8	-0.23
2015-2016	2.1	0.9	1.9	-0.26
2016-2017	0.9	0.7	2.3	-0.04

Source: our calculations on Istat, Bank of Italy and Prometeia forecast data.

As far as the evolution of the aggregate variables between 2014 and 2015 is concerned, we drew on historical data from the official sources (Istat and Bank of Italy), while for the projections to 2016 and 2017 we used the forecasts of the April 2016 edition of Prometeia's *Economic Outlook* (Prometeia, 2016). The trends of the average values of the micro-economic variables are approximated by the per-capita values in real terms of the equivalent macro-economic aggregates: disposable income,
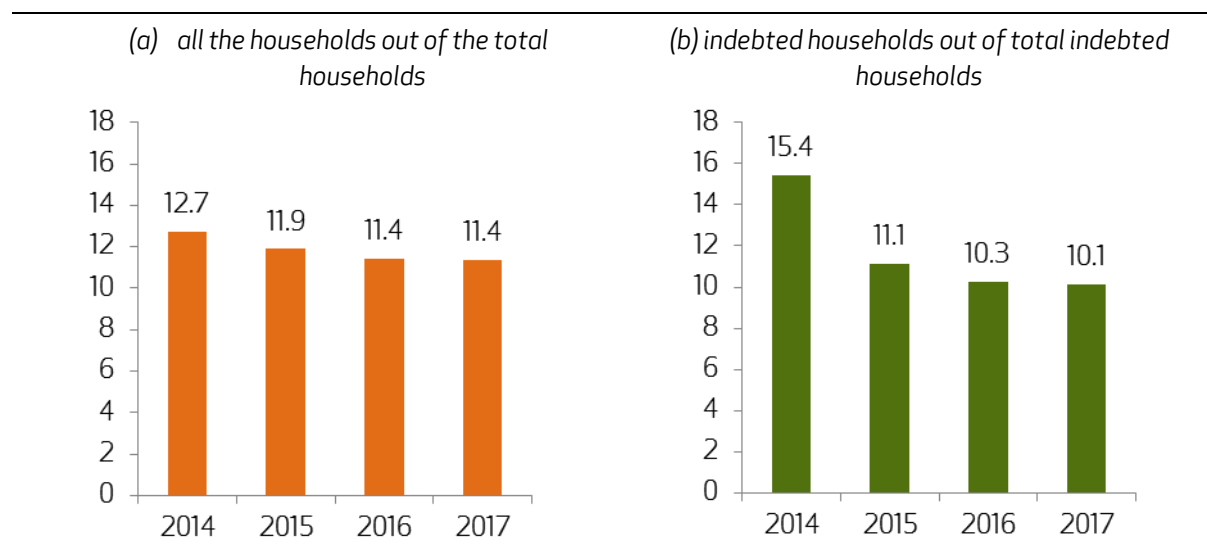
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[14] On the contrary Michelangeli and Pietrunti (2014) and Ampudia et al. (2016) formulate, the former an evolution in the composition of the households in debt and thus in the debt itself, the latter a re-composition of those employed and thus of the incomes (following Ampudia et al., 2014), inserting, accordingly, a dynamic component in their models.

[15] This can lead to an over-estimation of the loan repayment, but we believe that with a short term timescale like ours, any distortion is not significant.

non-durable consumption (the principle component of the item expected expenditure) and financial assets.[16] For the evolution of the interest quota of the loan repayment, the average annual variations of the 3-month euribor were used and applied to variable rate mortgages only. Table 3 shows the data used for the projections. In our scenario, the improving macro-economic conditions should bring a relaxing of the economic-financial conditions of the households and, with it, a reduction in the percentage of vulnerable households. The fall in interest rates and the increase in disposable income have contributed positively to improving the financial margin; at the same time, the increase in financial assets allows households to cover negative financial margins of a greater value. The component which has a negative impact on the financial margin is that of the expected expenditure, simulated via the trend of non-durable consumption which is forecast to grow. Overall, as we will see, the joint contribution of the four components on the financial conditions of the households is positive.

In Figures 3 to 5 we can see the results of the simulations, or rather the impact of the variations in the macro-economic variables on the percentage of vulnerable households. The values relating to 2014 are those obtained from direct calculations on the SHIW data, whereas the values from 2015 to 2017 incorporate the growth rates of the macro-economic variables. We would like to point out that the indicator used to identify vulnerable households carries the advantage of also analysing the conditions of those households who did not resort to any kind of borrowing.

Figure 3   **Evolution of the percentage of vulnerable households due to variations in all of the components: 2014-2017**

(% values)

| (a) all the households out of the total households | (b) indebted households out of total indebted households |

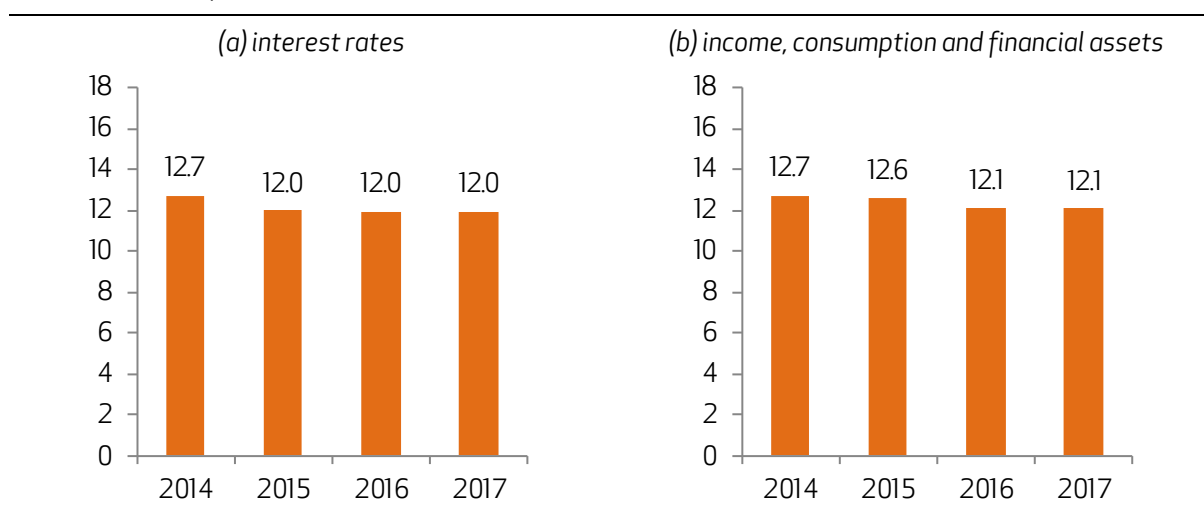*Source: our calculations on SHIW data.*

The simulations confirm a progressive reduction in the percentage of vulnerable households which, as a fraction of total households, goes from 12.7% in 2014 to 11.9% in 2015, settling at 11.4% in the two years 2016-2017 (Figure 3a). If, however, we evaluate the same impact on the sub-set of the households in debt, a reduction is forecast of those who are vulnerable, from 15.4% in 2014 to 11.1% in 2015; in 2016 the reduction is of another 0.8 percentage points bringing the vulnerable households in

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[16] Per-capita values were chosen in order to estimate better the trend of the average household values of the micro-economic variables. Values "per household" were not used in that, to our knowledge, forecasts of the number of households are not available.

debt to 10.3%, to reach 10.1% in 2017 (Figure 3b). The incidence of vulnerable households in debt out of the total number of households should pass from 2.9% to 2.1% in 2015 and reach 1.9% in 2016 and 2017.[17]

It is possible to analyse separately the impact on the level of household vulnerability (i) of variations in just the euribor and (ii) of variations in just the "income" variables (disposable income, expected expenditure and financial assets). The simulation exercise is carried out both on all households (Figure 4) and on the sub-set of the families in debt (Figure 5). With regard to overall households, the drop of interest rates, affecting only 5.9% of households (those with variable rate mortgages), causes a drop of only 0.7 percentage points between 2014 and 2015; in 2016 and 2017 the degree of vulnerability remains stable at 12%. The contribution of the other components is marginal, bringing the indicator down by as little as 0.1 percentage points in 2015 and by 0.6 percentage points in 2016 and 2017, reaching a value of 12.1%.

Figure 4   Overall households – Evolution in the percentage of vulnerable households due to variations in: (a) interest rates and (b) income, consumption and financial assets
*(% of total households)*

Source: our calculations on SHIW data.

When focusing on the indebted households, the greatest contribution to reducing vulnerability between 2014 and 2015 came from the reduction in the euribor which takes the indicator from 15.4% to 11.4%; the indicator settles at 11.2% in 2016 and 2017 (Figure 5a). Again, the contribution of the evolution of the other components is marginal and equal to 0.3 percentage points in 2015, reducing the indicator from 15.4% to 15.1%, while it is greater for 2016 (another 0.9 percentage points bringing the indicator to 14%) in virtue of the growth in disposable income; whereas 2017 is substantially in line with 2016 (Figure 5b). In brief, the reduction in the percentage of vulnerable families over the course of 2015 is mainly attributable to a decline in the interest rate; while from 2016 onwards, further reductions in the euribor have an almost neutral effect on the indicator, highlighting how in a context of extraordinarily low market rates households are more exposed to variations in income components.

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[17] This result is consistent with the simulations carried out by the Bank of Italy (2016), for which the quota of vulnerable households in 2016 would fall to below 2% (from 2.1% in 2014).

Figure 5   Indebted households – Evolution in the percentage of vulnerable households due to variations in: (a) interest rates and (b) income, consumption and financial assets
(% of total households in debt)

(a) interest rates

(b) income, consumption and financial assets
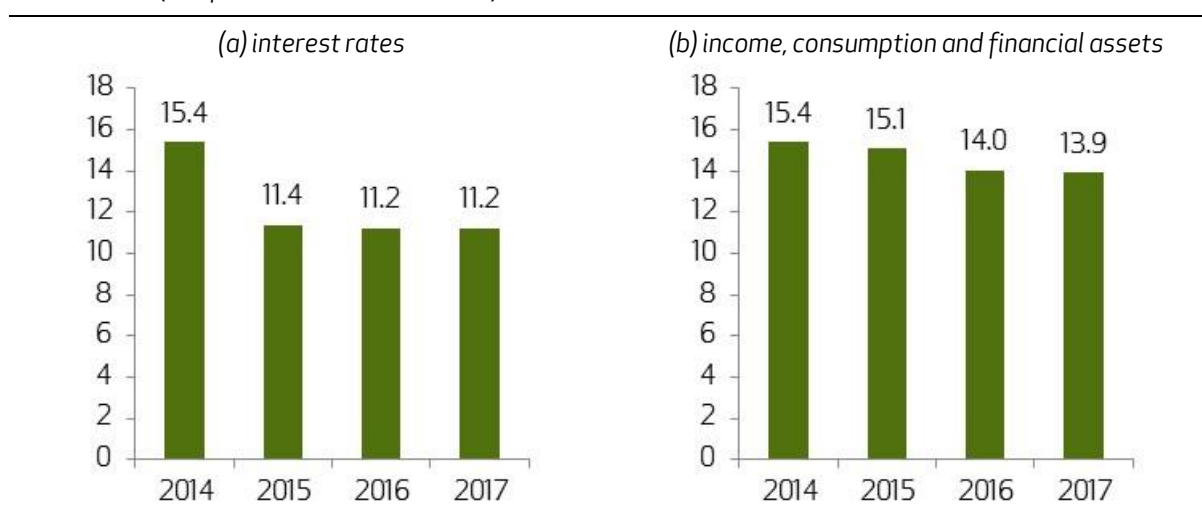
Source: our calculations on SHIW data.

5.   Conclusions

In this work we have built a micro-founded model in order to estimate the impact of variations in macro-economic variables on the vulnerability of Italian households. To this end the data of the Bank of Italy's Survey on Household Income and Wealth (SHIW) for years 2012 and 2014 were used. In order to identify financially fragile households, a measure was chosen that takes into account the budget constraint and the financial liquidity of the households (as in Ampudia et al., 2016). Thus households are defined as vulnerable if they have a negative financial margin and do not have sufficient liquidity to cover it for a given period of time (which we estimate at 170 days). One of the advantages of this indicator lies in the possibility of applying it to all households, regardless of their debt situation. On the other hand, one of the disadvantages is linked to the fact that imposing joint constraints on the income, consumption and financial wealth of households determines low sample quantities: this drove our choice to use the data from 2012 and 2014 in the form of pooling.

The analyses carried out on the sample selected identified a percentage of vulnerable households, with and without debts, of 12.7% of the total number of families. Whereas if we limit the analysis to the sub-set of the households in debt, the percentage of households in a condition of financial vulnerability increases to 15.4%, the equivalent of 2.9% of the total households.

The indicator constructed in this way was then projected to 2017 based on the trends of the macro-economic variables concerned (household disposable income, consumption, financial assets and market interest rates). The macro-economic scenario for the period 2015-2017 (Prometeia, 2016) indicates an improvement in the variables involved in the analysis: interest rates still slightly decreasing, and per-capita disposable income, consumption and financial assets on the increase (in real terms). If the evolution of interest rates and disposable income lead to an improvement in the financial margin and thus to a reduction in the level of vulnerability, the increase in consumption will act in the opposite direction, resulting in a reduction in the financial margin. Furthermore increasing financial assets allow households to cover higher levels of negative cash-flow.

Overall, the macro-economic scenario generates an improvement in the economic-financial conditions of Italian households and translates into a reduction in the number of vulnerable households. The percentage of vulnerable households falls thus from 12.7% in 2014 to 11.9% in 2015, to reach 11.4% in 2016 and 2017. Considering only the sub-set of households in debt, the incidence of vulnerable households in 2015 falls to 11.1% (from 15.4%) and descends to around 10% in the following two years. Confirming expectations, in 2015 households benefit above all from the reduction in interest rates on borrowing, an element driving the reduction in the percentage of vulnerable households. Subsequently, and especially in 2016, in a scenario of negative interest rates, however, the condition of household fragility is more closely linked to the evolution of income and financial wealth components.

The results obtained provide cues for evaluation also in view of the financial conditions of households and the effects on the riskiness of the banking system. In particular they highlight how, over the next few years, the main source of risk for financial vulnerability of Italian households is linked to the dynamics of disposable income. Further analysis would allow us to assess the impact of a different evolution of debt, also in terms of the type of interest rate applied, and to carry out stress test exercises taking into account alternative macro-economic scenarios.

Bibliography

Albacete, N. and P. Fessler (2010), "Stress testing Austrian households", Financial Stability Report 19, June, European Central Bank.

Albacete, N. and P. Lindner (2013), "Household Vulnerability in Austria - A Microeconomic Analysis Based on the Household Finance and Consumption Survey", Financial Stability Report 25, June, European Central Bank.

Ampudia, M., A. Pavlickova, J. Slacalek, and E. Vogel (2014), "Household heterogeneity in the euro area since the onset of the Great Recession", Working Paper 1705, European Central Bank.

Ampudia, M., H. van Vlokhoven and D. Zochowski (2016), "Financial fragility of Euro area households", *Journal of Financial Stability*, http://dx.doi.org/10.1016/j.jfs.2016.02.003.

Bank of Italy (2015), *Financial Stability Report*, no. 2, November, Bank of Italy, Rome.

Bank of Italy (2016), *Financial Stability Report*, no. 1, April, Bank of Italy, Rome.

Brandolini, A. and L. Cannari (1994), "Methodological appendix: the Bank of Italy's survey of household income and wealth". In: Ando, A., Guiso, L., Visco, I. (Eds.), *Saving and the Accumulation of Wealth: Essays on Italian Households and Government Behavior*. Cambridge University Press, Cambridge, pp. 369–386.

Brown, S. and K. Taylor (2008), "Household Debt and Financial Assets: Evidence from Germany, Great Britain and the USA", *Journal of the Royal Statistical Society, Series A*, 171(3), 615-643.

Brunetti, M., E. Giarda and C. Torricelli (2015), "Is Financial Fragility a Matter of Illiquidity? An Appraisal for Italian Households", *Review of Income and Wealth*, Online First, doi: 10.1111/roiw.12189.

D'Alessio, L. and S. Iezzi (2013), "Household over-indebtedness: definition and measurement with Italian data", Occasional Papers 149, Bank of Italy.

EC (2008), "Towards a common operational European definition of over-indebtedness", European Commission, Directorate-General for Employment, Social Affairs and Equal Opportunities, http://ec.europa.eu/social/BlobServlet?docId=5093&langId=en (consulted 26-07-2016)

ECB (2013), "The Eurosystem Household, Finance and Consumption Survey, Results from the first wave", Statistics Paper Series 2, European Central Bank.

Faiella, I. (2008), "Accounting for Sampling Design in the SHIW", Working Paper 662, Bank of Italy.

Galuščák, K., P. Hlaváč and P. Jakubík (2014), "Stress testing the private household sector using microdata", Working Paper Series 2, Czech National Bank.

Georgarakos, D., A. Lojschova and M. Ward-Warmedinger (2010), "Mortgage Indebtedness and Household Financial Distress", Working Paper 1156, European Central Bank.

Giarda, E. (2013), "Persistency of financial distress amongst Italian households: Evidence from dynamic models for binary panel data", *Journal of Banking and Finance*, 37(9), 3425-3434.

Jappelli, T., M. Pagano and M. Di Maggio (2013), "Households' Indebtedness and Financial Fragility". *Journal of Financial Management, Markets and Institutions*, 1, 26-35.

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

Magri, S. and R. Pico (2012), "L'indebitamento delle famiglie italiane dopo la crisi del 2008", Occasional Papers 134, Bank of Italy.

May, O. and M. Tudela (2005), "When is mortgage indebtedness a financial burden to British households? A dynamic probit approach", Working Paper 277, Bank of England.

McCarthy, Y. (2011), "Behavioural characteristics and financial distress", Working Paper 1303, European Central Bank.

Michelangeli, V. and P. Pietrunti (2014), "A Microsimulation Model to evaluate Italian Households' Financial Vulnerability", *International Journal of Microsimulation*, 7(3), 53-79.

OECD (2015), *Economic Outlook - Annex Tables*, Issue 2, OECD, Paris.

Prometeia (2016), *Economic Outlook* (*Rapporto di Previsione) - April 2016*, Prometeia Associazione per le Previsioni Econometriche, Bologna.

Rubin, D.B. (1978), "Multiple imputations in sample surveys - A phenomenological Bayesian approach to nonresponse", *Proceedings of the Survey Research Methods Section of the American Statistical Association*, 20-34.

Rubin, D.B. (1987), *Multiple imputation for non-response in surveys*, New York, NY: John Wiley.

Whitley, J., Windram, R., Cox, P. (2004), "An Empirical Model of Household Arrears", Working Paper 214, Bank of England.

Appendix A – The corrections made to the dataset

A.1   Imputation of missing interest rates

The SHIW collects information on interest rates applied to all types of debt. However, in some cases (7.1% on average) these values are missing, making the dataset of analysis incomplete.[18] Thus it was necessary to use an imputation technique for the missing data.

More specifically, we adopted the Multiple Imputation by Chained Equations (MICE) technique which is based on the hypothesis that the generating mechanism of the missing data is "missing at random" (MAR), ie. that the probability that an observation is missing depends solely on the data observed.[19] The idea which forms the basis of this method is that of generating more than one value ($m > 2$) to be imputed for all missing data, so that the matrices of the complete data to be analysed using standard methods and software are m. The results of the separate m analyses are then combined with appropriate rules so as to produce inferential results which take into account the uncertainty caused by the missing data.

We estimated each type of interest rate as a function of the logarithmic transform of disposable income, work position, age and number of earners in the household. The estimated relationships are used to impute missing values. The imputation does not susbstantially alter the distribution of the series: the average of the rates for fixed rate mortgages diverges only by 2 basis points in the overall series of imputed interest rates in comparison with the original one; for variable rate mortgages and consumer credit these differences settle respectively at 16 and 18 basis points.

In reference to consumer credit, as well as the imputation of the missing rates, we applied a further correction. Around 10% of the interviewees with this form of debt declare that they pay a zero annual percentage rate (APR): for these households it is impossible to split the mortgage repayment into the components of capital share and interest share. Thus, in these cases we decided to attribute an interest rate value equal to the minimum declared for the type of debt (first, second or third consumer credit).

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[18] The phenomenon is much more significant for consumer credit and affects 12.4% of cases, against 1.3% for fixed rate mortgages and 3.6% for variable rate mortgages.

[19] See Rubin (1978) and Rubin (1987).

A.2 The breakdown of the mortgage repayment into capital share and interest share

In order to formulate the projections of the financial vulnerability indicator based on the forecast trends in the interest rates, it is necessary to break down the debt repayment *DP* of the equation (1) into capital share and interest share. In fact it is only the interest share, relating to variable rate mortgages, which is influenced by variations in interest rates.

First of all, for each household *i*, the interest share is calculated as:

$$IS_i = r_i * D_i$$

where *r* is the interest rate applied to the loan and *D* is the overall debt. The capital share *CS* is calculated as the difference between the loan instalment *DP* (declared in the survey) and the interest share *IS*:

$$CS_i = DP_i - IS_i$$

The answers to the survey however in some cases show certain internal inconsistencies between the characteristics of the debt (payment made, residual amount, duration and interest applied) which lead to obtaining negative capital shares (this happens for 4.5% of those in debt with a variable rate mortgage). These cases were thus corrected by re-calculating first the new overall instalment based on the information contained in the survey and then obtaining the new capital share as the difference between the new instalment and the interest share. The new total repayment (*NR*) is re-calculated according to the French amortisation schedule as follows:

$$NR_i = D_i(1 + r_i)^A \frac{r_i}{(1 + r_i)^A - 1}$$

where *A* is the remaining duration of the mortgage.