Assessing the financial vulnerability of Italian households: a microsimulation approach

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Abstract

A microsimulation model to monitor Italian households' financial vulnerability is developed using household-level data from the Survey on Household Income and Wealth. Microeconomic information is then matched with macroeconomic data on debt and income in order to generate nowcasts and forecasts of the path of households' indebtedness and debt-service ratio. Within this framework, where households' debt and income are updated more frequently than by employing survey data alone, we find that the dynamics of income growth are the main driver of households' vulnerability. The share of vulnerable households (defined as those with a debt-service ratio above 30 per cent and income below the median) over the total population is projected to be about stable between 2012 and 2014, with a slight decrease in 2015 due to positive income growth. Their debt is also projected to decrease in those years.

Keywords: households' vulnerability; debt; stress test

JEL classification: D14, G10

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Introduction

The indebtedness of the household sector and its financial vulnerability are acquiring a growing importance from a financial stability viewpoint, mainly following the boom recorded in several OECD countries in the period 2000–2008 (OECD 2010) and the subsequent financial crisis.

With the aim of closely monitor households' vulnerability, we build a microsimulation model using Italian households' data available from the Survey on Household Income and Wealth (SHIW). The survey offers a comprehensive picture of the household sector, providing information on households' idiosyncratic characteristics, such as income, balance sheet, age, education and occupation.

The main issue with survey data is their low frequency and, hence, the delay with which new information becomes available (in the case of the SHIW, the data is biennial and new data become available with about a year's delay). In this paper we provide a methodology that integrates microeconomic household data with higher frequency and more timely macroeconomic data on income, interest rates and total debt. Such a toolkit enables us to assess the financial conditions of the household sector in a timely manner and it can be used to evaluate the impact of scenarios of stress or other possible policy interventions.

In line with other studies (IMF, 2011, 2012, 2013; ECB, 2013), we take as a reference indicator of the health of the household sector the debt-service ratio (DSR), defined as the share of debt payments to income, and we identify as vulnerable those households with a DSR above a given threshold. Moreover, as households with low income are more severely affected by negative shocks, in this paper we focus on households with income below the population median. Following a previous study on Italian households (Magri and Pico, 2012), we identify as vulnerable households with DSR greater than 30 per cent and income below the median.

Our main results are as follows.[2] In a baseline scenario, with almost flat interest rates and positive income growth (up to 2.9 per cent in 2015), the share of vulnerable households with income below the median is projected to be about stable over the next few years and equal to 2.7 per cent in 2015. A small decrease in 2015 in the number of vulnerable households would be mainly due to the expected income growth. A slow deleveraging process for vulnerable households is expected to take place, partially supported by an inward shift in credit supply and banks' selectiveness in granting loans, with the their share of total debt reverting to 2010 levels.

We also perform two stress test simulations: a projected zero income growth in 2015 and a 100 basis points increase in interest rate. We find that the share of vulnerable households increases more under the former, although even such a case does not represent a major change from baseline projections. We are then led to conclude that Italian households with debt do not represent a major threat for the financial stability of the economic system.

[2] See Michelangeli and Pietrunti (2014) for details on a backtesting exercise.

The paper is organized as follows: Section 2 presents the data, Section 3 gives a description of the model, Section 4 sets out the results and Section 5 concludes.

1. Data

In our exercise we make use of both microeconomic variables (taken from the 2002–12 waves of the SHIW) and of a set of macroeconomic variables.

Microeconomic variables

The SHIW contains detailed information both on households' individual characteristics such as age, education, employment status of the head of household, and on income and debt.[3] Debt is classified in three different categories: mortgage debt on the primary residence, mortgage debt on other real estate, and consumer credit.

For each debt category, we observe the outstanding amount, the initial amount borrowed, the year when the loan was granted, the total length of the contract, the amount of the annual instalment, the interest rate, and – in case of mortgage debt – whether it is adjustable rate or fixed rate.

Our starting point is the 2012 SHIW wave, the most recent available. Some descriptive statistics of the sample are provided. The fraction of households with a mortgage debt on a primary or secondary residence was about 12.4 per cent of the population. The starting value of the debt on the primary residence was about €115,000, while households had average outstanding debt of about €78,000. With respect to the type of mortgage contracts, the sample is roughly equally split in fixed and variable rate mortgages. If we extend the analysis to all kinds of real estate debt, that proportion remains about the same. About 10 per cent of households had consumer credit debt.

The SHIW is an unbalanced panel where only half of each wave's sample is retained in the next wave of the survey. To overcome the difficulty arising from tracking households from one wave to the next, we make use of a simulation strategy similar to the one described in Djoudad (2010): to simulate the income process we group observations according to their income class, while to simulate new mortgage originations we gather observations in groups according to other socioeconomic characteristics (age, education, occupation).

Macroeconomic data

As shown in the next section, the model is built in such a way to match the aggregate data on total income and amount of total debt. Table 1 presents the macro variables used in the model.

First, we extract the time series on income growth from the national accounts (*Contabilità Nazionale*, CN). According to the CN definition, income includes imputed rents and captures the standard of living of households. Nominal income

[3] For a general description of the survey, see http://www.bancaditalia.it/statistiche/indcamp/bilfait;internal&action= setlanguage.action?LANGUAGE=en.

growth was negative in 2013, while it is projected to be positive and equal to 2.4 per cent and 2.9 per cent respectively in 2014 and 2015.

We also use projections on lending volumes to households for house purchase as input of our model. These projections are based on a macro-econometric model developed at the Bank of Italy for internal purposes. The dynamics of variable of interest, which represents the volume of loans in banks' balance sheets plus an estimate of securitized loans, imply a negative growth in total debt in 20013 and 2014 and a slightly positive growth (below 2 per cent) in 2015.

As a last macro input, we make use of the projections of data on the three-month Euribor. Historical data and projections obtained from futures contracts imply an almost flat value for the Euribor rate with one-period changes close to zero across the whole simulation. Such a variable affects the value of the instalments of variable interest rate mortgage and the ones of new originations. We choose the three-month Euribor rate as mortgage rates in Italy are typically computed by applying a spread to such rate.[4]

Macroeconomic aggregates

percentages Table 1

	2013	2014	2015
Income growth rate at current prices	0.1	2.4	2.9
Total debt growth	-1.0	-0.3	1.8
3m Euribor	0.21	0.27	0.32

2. The Model

This section describes the evolution of households' income and debt over time.

2.1 Income growth dynamics

In this paper we make use of two slightly different definitions of income for two different goals. The variable entering in the denominator of the DSR is the "disposable income gross of financial charges and net of imputed rents". Such a variable is the one that more closely resembles the actual monetary income available to the household for current expenses.

[4] The bank spread is assumed to remain fixed across simulation periods. This is generally true for existing contracts, apart from the case of mortgage refinancing.

The second definition of income is "disposable income" and we employ it to match the model statistics with the macro data.

To compute the income growth dynamics we group households' disposable income into four classes of equal frequency (Djoudad, 2010).[5]

The process for the income growth for each class *j* is given by:

$$\log\left(\frac{y^{k}_{j,t}}{y^{k}_{j,t-1}}\right) \sim \mathrm{N}(\mu^{i}_{j}, \sigma^{i}_{j}) \qquad \text{for } j=1,2,3,4 \text{ and } k=d,g \tag{1}$$

where *k* alternatively stands for disposable income (*d)* or disposable income gross of financial charges and net of imputed rents (*g*).

We estimate mean and variance of each class with the SHIW data from 2002 to 2008.

The estimated parameters are reported for each of the four income classes in Table 2.

Macroeconomic aggregates Estimated mean and standard deviation for the income processes

Table 2

	y^d growth		y^g growth	
	μ^d	σ^d	μ^g	σ^g
1st-25th percentile	0.035	0.034	0.039	0.025
25th-50th percentile	0.029	0.023	0.029	0.025
50th -75th percentile	0.026	0.026	0.025	0.023
75th -100th percentile	0.025	0.024	0.023	0.024

The dynamics of the two processes are rather similar: in both cases means are positive and slightly larger for low income households, which are the ones who benefit the most from a gradual economic recovery. The standard deviation, in line with other studies (see, for instance, Djoudad, 2010), is highest for lower groups and lowest for the upper groups.

We assign a random income shock to each household in each period, while ensuring that the mean and the variance for each class remain fixed at the values reported in Table 2. In this way we generate heterogeneity among households while keeping aggregate dynamics under control. As a last step, in order to match the dynamics predicted by our macroeconomic data, we correct income growth in each period by an adjustment factor.

[5] To get household equalized income we divide household disposable income by a factor that captures its number of components. In each period, the thresholds for each class of equalized income is calculated and each household is assigned to a specific class.

2.2 Debt growth dynamics

Households can hold both mortgage and consumer credit debt. By evaluating existing debts and accounting for loan originations and terminations, we can compute the evolution of total debt for each household over time.

For existing loans, the instalment payment is computed according to a French amortization schedule, which is the standard schedule for mortgages in Italy. Such amortization schedule allows the per-period payment to change following any modification in the interest rate.

For each household *i*=1,..., *N*, with *N* equals to the total number of indebted households, and for each type of debt *y,* the outstanding debt evolves as follows:

$$MDebt_{y,i,t+1} = MDebt_{y,i,t} - RP_{y,i,t} \tag{2}$$

where $RP_{y,i,t}$ is the annual payment of the principal. Let $R_{y,i,t}$ be the scheduled total annual repayment, which incorporates the payment of the principal and of the interest, and is computed according to the formula:

$$R_{y,i,t} = MDebt_{y,i,t}(1+r_{y,i,t})^{A}\frac{r_{y,i,t}}{(1+r_{y,i,t})^{A}-1} \tag{3}$$

where $r_{y,i,t}$ is the interest rate, *A* is the residual duration of the contract. The annual payment for interest $RI_{y,i,t}$ is given by:

$$RI_{y,i,t} = r_{y,i,t}MDebt_{y,i,t} \tag{4}$$

Thus, the principal repayment could be calculated as follows:

$$RP_{y,i,t} = R_{y,i,t} - RI_{y,i,t} \tag{5}$$

While mortgage loans $MDebt_{y,i,t}$ can be either variable or fixed rate, we assume that for consumer debt $CDebt_{y,i,t}$ the annual payment $R_{y,i,t}$ remains constant in the periods of the simulation. This assumption is reasonable given the span of the simulation period.

New originations induce a composition effect by modifying the number and average characteristics of indebted households. In order to capture the increased bank selectiveness after the 2008 financial crisis, to estimate the projected number of originations we start from the last three waves (2008, 2010, 2012) of the panel component of the SHIW. A mortgage origination occurs if a household has a mortgage debt equal to zero at time *t*-1 and a positive mortgage debt at time *t* ($MDebt_{y,i,t-1} = 0, \quad MDebt_{y,i,t} > 0$). Using the household groups constructed previously, we count the number of originations at time *t-1* for each group *k*, $\theta_{k,t-1}$, and we maintain it constant for the next period *t* ($\theta_{k,t} = \theta_{k,t-1}$). According to the SHIW historical data, about half of mortgages are variable rate ones. Hence, we maintain the same proportion for new originations: about 50 per cent of new originations are variable-rate mortgage and about 50 of them are fixed ones. Each household with a new mortgage is assigned an amount of debt equal to the average debt of the group to which it belongs. Total debt associated with loans

originations has been adjusted to match the macroeconomic data on total debt growth.

Mortgage terminations, *ceteris paribus*, bring a reduction in the total debt and, like mortgage originations, may induce a change in the characteristics of the pool of indebted households. Benefiting from the microeconomic households data available in the SHIW, we have information on the loan length for each household. Hence, given our model structure, we can project the evolution for each type of debt by taking into account its loan termination.

The total outstanding debt is given by the sum of mortgage loans and consumer credit loans:

$$Debt_{y,i,t} = \sum_{y} (MDebt_{y,i,t} + CDebt_{y,i,t}) \tag{6}$$

Therefore, the annual payment is given by the total annual payments on mortgage debt and consumer credit:

$$R_{i,t} = \sum_{y} R_{y,i,t} \tag{7}$$

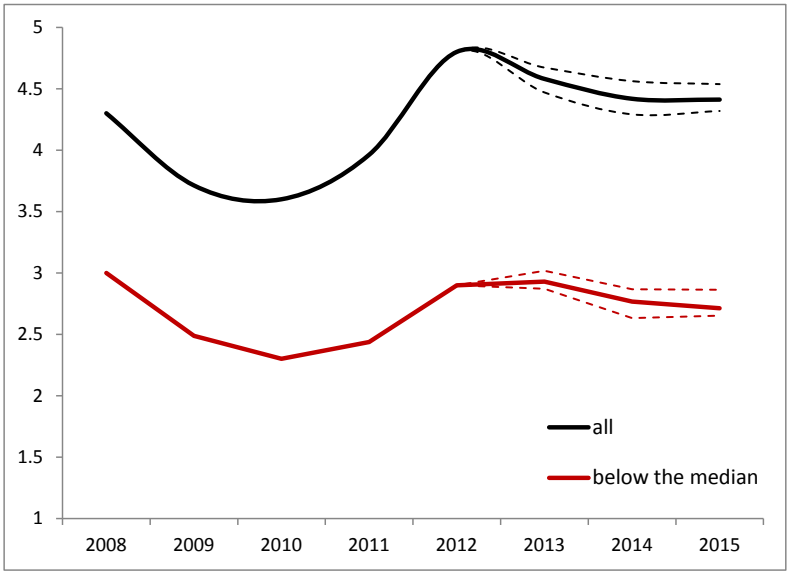
3. Results

In the baseline scenario, the share of vulnerable households in the total population is expected to slightly decrease from 4.8 per cent in 2012 to 4.4 per cent in 2015 (Figure 1). Likewise, the share of the most vulnerable households, namely those with income below the median, moves from 2.9 per cent to 2.7 per cent in the same period. In 2013, the reduction in the share of vulnerable households follows from the cut in the interest rate, which implies lower mortgage instalments both for households holding a variable-rate mortgage and for new borrowers. The reduction in the share of vulnerable households can be partially attributed to negative credit growth. Instead, in the years 2014–2015, the positive income growth is the main factor leading to the decrease in the fraction of vulnerable households. Although we expect a moderate growth in credit, banks are likely to be selective in granting loans to households; consequently, these two divergent effects may not affect in a significant way the share of vulnerable households in the economy.

We then construct two stress test scenarios to evaluate how the share of vulnerable households changes (see Figure 2 and Tables in the Appendix for detailed results). First, the effects of an increase of 100 basis points in the Euribor rate in 2015 (from 0.3% to 1.3%) have been evaluated. It induces an increase in the payment of the mortgage instalments for households with a variable-rate mortgage as well as for new borrowers: the share of all vulnerable households and of those with income below the median reaches respectively 4.6 per cent and 2.9 per cent in 2015. Second, income growth is set equal to zero in 2015, affecting the income of all households. In this scenario, the all vulnerable households and of those with income below the median moves respectively to 4.7 per cent and 3.0 per cent in 2015.

Percentage of vulnerable households in the population

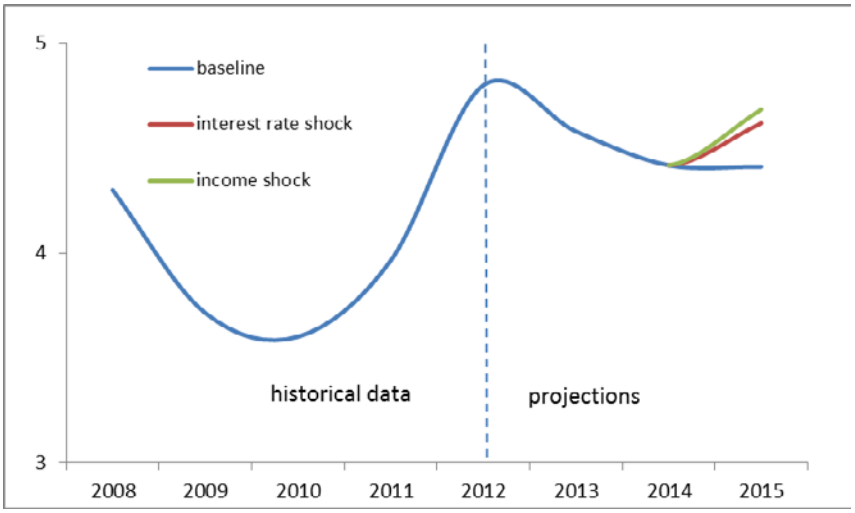
Figure 1



Note: results are based on 50 simulations of the model. The solid line represents median results; the dashed lines are results at both the 10th and the 90th percentiles. Data for 2009 and 2011 are interpolated via cubic splines.

Percentage of vulnerable households under alternative scenarios

Figure 2



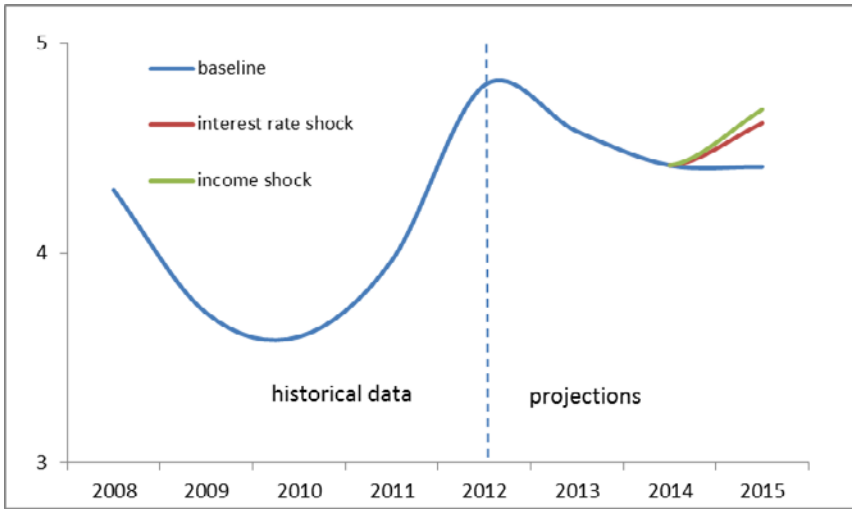
However, in order to evaluate the threat posed by the household sector to the financial stability of the system it is relevant to project the debt at risk, namely the debt held by vulnerable households. Given that households with income below the median represent the most vulnerable ones, we will focus on their debt (Figure 3).

In the baseline scenario, the share of total debt held by households with income below the median decreases from 20 per cent to about 16 per cent in 2015, in line with the 2010 data. Instead, under the first and second stress scenarios, the debt at risk is projected to be respectively 17.1 per cent and 17.3 per cent in 2015.

Those results suggest that there is no major threat for the financial stability coming from the Italian household sector: both the number of vulnerable households and their debt are relatively low.

Percentage of total debt held by vulnerable households with income below the median

Figure 3



Conclusions

In this paper, we presented a microsimulation model to evaluate and monitor the financial vulnerability of the household sector. Starting from the microeconomic data on Italian households as reported in the SHIW and augmenting them with macroeconomic projections on income, debt and interest rate, we were able to estimate households' indebtedness and debt-service ratio over time.

In the baseline scenario, the most vulnerable households, namely those with DSR greater than 30 per cent and income below the median, are projected to equal 2.7 per cent of the population in 2015, holding about 16 per cent of the total debt of the household sector.

All in all and under alternative and reasonable scenarios of stress, the model results suggest that the household sector does not pose major threat to the financial stability of the system: the number of vulnerable households and their debt are relatively small and almost stable in the next few years.

Appendix:
A1. Detailed results

1. Baseline scenario

	2012	2013	2014	2015
Percentage of vulnerable households over total households				
1st-25th percentile	1.5	1.6	1.6	1.6
25th-50th percentile	1.4	1.4	1.2	1.1
below the median	*2.9*	*2.9*	*2.8*	*2.7*
50th -75th percentile	1.2	1.0	0.9	0.8
75th -100th percentile	0.7	0.7	0.7	0.8
Total	4.8	4.6	4.4	4.4
Percentage of debt held by vulnerable households				
1st-25th percentile	9.5	10.4	9.7	9.2
25th-50th percentile	10.2	9.1	7.9	7.0
below the median	*19.7*	*19.3*	*17.4*	*16.0*
50th -75th percentile	7.9	6.4	5.9	5.2
75th -100th percentile	9.8	9.1	8.7	8.2
Total	37.5	34.7	31.8	29.5

Note: households are divided into classes according to their equalized income gross of imputed rents. The reported values have been approximated to the first decimal.

2. Stress test scenarios

a) Interest rate shock

	2012	2013	2014	2015
Percentage of vulnerable households over total households				
1st-25th percentile	1.5	1.6	1.6	1.7
25th-50th percentile	1.4	1.4	1.2	1.2
below the median	*2.9*	*2.9*	*2.8*	*2.9*
50th -75th percentile	1.2	1.0	0.9	0.9
75th -100th percentile	0.7	0.7	0.7	0.8
Total	4.8	4.6	4.4	4.6
Percentage of debt held by vulnerable households				
1st-25th percentile	9.5	10.4	9.7	9.7
25th-50th percentile	10.2	9.1	7.9	7.6
below the median	*19.7*	*19.3*	*17.4*	*17.1*
50th -75th percentile	7.9	6.4	5.9	5.7
75th -100th percentile	9.8	9.1	8.7	8.7
Total	37.5	34.7	31.8	31.4

b) Income shock

	2012	2013	2014	2015
Percentage of vulnerable households over total households				
1st-25th percentile	1.5	1.6	1.6	1.7
25th-50th percentile	1.4	1.4	1.2	1.3
below the median	*2.9*	*2.9*	*2.8*	*3.0*
50th -75th percentile	1.2	1.0	0.9	0.9
75th -100th percentile	0.7	0.7	0.7	0.7
Total	4.8	4.6	4.4	4.7
Percentage of debt held by vulnerable households				
1st-25th percentile	9.5	10.4	9.7	9.5
25th-50th percentile	10.2	9.1	7.9	8.0
below the median	*19.7*	*19.3*	*17.4*	*17.3*
50th -75th percentile	7.9	6.4	5.9	5.5
75th -100th percentile	9.8	9.1	8.7	8.2
Total	37.5	34.7	31.8	31.2

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