# IS FINANCIAL FRAGILITY A MATTER OF ILLIQUIDITY?
# AN APPRAISAL FOR ITALIAN HOUSEHOLDS

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We investigate household financial fragility in Italy, providing three main contributions. First, we propose a novel characterization of financial fragility that is not necessarily linked to indebtedness, distinguishes between expected and unexpected expenses, takes portfolio composition into account, and is free of subjectivity bias. Second, we use it to assess the importance of household portfolio composition for determining the difficulties related to coping with unexpected expenditures, besides socio-economic and demographic factors. Third, we test its ability to forecast future conditions of financial distress. The empirical analysis is based on the Bank of Italy Survey on Household Income and Wealth. The results highlight the relevance of portfolio choices as determinants of financial distress, that is, they provide evidence that homeownership increases the likelihood of financial fragility while the presence of a mortgage decreases it. Moreover our measure is shown to act as an early warning indicator of distress.

## 1. INTRODUCTION

Household finance has attracted increasing attention in recent years (Campbell, 2006; Tufano, 2009; Haliassos *et al.*, 2011). A great deal of research is concerned with household portfolio choices based on theoretical models, which

consider a multi-period setting and account for typical uninsurable household risks such as labor income and longevity.[1] Population ageing and a progressive shift from public to private pension schemes are highlighting that households should take a long-term perspective when planning their portfolio composition, aspects that have encouraged this research topic. However, the 2007–08 financial crisis has revealed the short-term financial problems of households and spurred studies on this issue, which is normally referred to as "household financial fragility."

There are a variety of definitions of household financial fragility demonstrated by the growing and diverse literature which quantifies it using a range of different indicators. Some of the indicators proposed capture the household's ability to service debt, and consist of measures such as debt-to-income ratio, debt service ratio, and mortgage income gearing (e.g., Brown and Taylor, 2008; Faruqui, 2008; Keese, 2009; Jappelli *et al.*, 2013). Other indicators of distress are based on net wealth, saving, and consumption (e.g., Brown and Taylor, 2008; Fuenzalida and Ruiz-Tagle, 2009; Giarda, 2013), responses to the question of how to "make ends meet" (Christelis *et al.*, 2009; McCarthy, 2011), and to questions related to confidence in the ability to cope with unexpected expenses (Lusardi *et al.*, 2011).

Each of these financial distress measures has some limitations. On the one hand, indicators based on indebtedness measures can capture the fragility of indebted households only, but on the other hand the other distress measures tend to identify only poor households as financially fragile and do not address other kinds of financial distress (e.g., related to portfolio choices). Moreover, some of the available indicators, mainly those based on the responses to questions about economic difficulties/confidence, etc., may be affected by rather strong subjectivity bias.

The aim of this paper is to provide a new characterization of household financial fragility that overcomes the limitations related to existing measures, and to investigate its determinants. Specifically, besides standard socio-economic and demographic factors, such as income, age, gender, and financial literacy, we assess the role played by household portfolio composition by considering its illiquidity due to homeownership and the presence of mortgages. The objective of our analysis is to address a set of related questions: Does financial fragility change, according to a regular pattern, over the life-cycle? Is this condition also a function of household's portfolio choices, namely are households' portfolios too illiquid due to the over-representation of housing? Does our proposed characterization provide an "early warning" indicator of future financial distress?

Our analysis contributes based on data from the Bank of Italy Survey on Household Income and Wealth (SHIW) for the period 1998–2012. We investigate: (i) the determinants of our novel characterization of financial fragility which is simultaneously free from subjectivity bias and not necessarily linked to indebtedness; and (ii) its role as an indicator providing early warning of future financial difficulties. Italy particularly lends itself to this kind of investigation because of the composition of its households' portfolios: on average, Italians hold portfolios with

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[1]For a survey of this literature, see Brunetti and Torricelli (2010a).

high levels of housing and low levels of indebtedness and financial diversification, and also the country's very pronounced population ageing is exacerbating the situation of "house rich and cash poor" elderly households. The data (Bank of Italy, 2014) show that in 2012, 68 percent of Italian households are homeowners (rising to 76 percent if only pensioners are selected), less than 25 percent have any form of formal or informal debt, and only 12 percent have a mortgage on their main dwelling.[2] Around 95 percent of households have a bank or post office account, but only 7 and 10 percent, respectively, of households hold investments in government bonds or corporate bonds or mutual funds, and only 4 percent are shareholders.[3]

The rest of the paper is organized as follows. Section 2 reviews the literature on household financial fragility and provides the rationale for a new measure. Section 3 illustrates our novel characterization of financial fragility, and Section 4 describes the estimation methodology and the dataset. The results of the empirical analysis are reported in Section 5, with the roles of financial literacy and risk-aversion discussed in Section 5.1. The forecast ability of our indicator is investigated in Section 6, and Section 7 concludes by summarizing the main findings.

## 2. Related Literature and Motivation

In this section we review the more recent literature on financial fragility, sometimes termed vulnerability or distress, and highlight the main features of the indicators proposed and their possible limitations. The literature on financial fragility is very diversified in that it uses two broad categories of indicators, objective and subjective, and it places the attention on different groups of households. The distinction between the objective and subjective indicators lies in the instrument used to define fragility: this can be a quantitative measure (i.e., debt-to-income ratio, debt service ratio, mortgage income gearing, net wealth, savings, etc.) or a qualitative one (i.e., responses to questions about the degree of difficulty in making ends meet, declared perception of the mortgage or the housing cost burden, etc.). For the households analyzed, some indicators, whether objective or subjective, are by definition available only for subgroups of the population, such as the indebted or homeowners, while others apply to the whole population (e.g., measures such as wealth and savings).

Regardless of the use of objective or subjective indicators, the dominant concern in the literature is to measure the financial distress of indebted households. Some authors study the ability of households to service debt, secured and/or unsecured, using measures such as debt-to-income ratio, debt service ratio, and mortgage income gearing. Examples here are Brown and Taylor (2008), Faruqui

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[2]The structure of the figures is the same over the years of our analysis. For instance, in 1998, indebted households accounted for 25 percent of households, or 12 percent taking account only of mortgages. Homeowners accounted for 66 percent of households (and 70 percent of pensioners); around 94 percent of households had bank or postal deposits, but only 12 percent were government bond holders, 13 percent were corporate bond or mutual funds holders, and 8 percent were shareholders (Bank of Italy, 2000).

[3]Deidda (2013a) finds Italian households do not use portfolio diversification as a device to reduce the total exposure to risk.

(2008), Keese (2009), and Jappelli *et al.* (2013). This literature responds to the increased level of household debt related to house purchase during the real estate boom period: among others, Kida (2009) employs indicators based on the loan-to-value ratio and mortgage installment arrears, while Gan and Hill (2009) study the difference between purchase affordability (related to borrowing capability) and repayment affordability (related to the mortgage burden). Other analyses are based on the responses to questions concerning the financial burden due to housing costs (May and Tudela, 2005; Beck *et al.*, 2010; Georgarakos *et al.*, 2010) or mortgage or other debt repayment arrears (Duygan-Bump and Grant, 2009; Magri and Pico, 2009).

A few studies are concerned with forms of financial hardship not necessarily due to indebtedness. Some of these use indicators based on net wealth, saving, and consumption (e.g., Brown and Taylor, 2008; Fuenzalida and Ruiz-Tagle, 2009; Giarda, 2013), while others exploit subjective indicators such as difficulties in making ends meet (Christelis *et al.*, 2009; McCarthy, 2011), perception of a high housing cost burden (Brandolini *et al.*, 2010; Deidda, 2013b), poor living standards (Worthington, 2006), or confidence in the ability to cope with unexpected expenses (Lusardi *et al.*, 2011).

In order to motivate the proposal of a new financial fragility measure, we perform a preliminary cross-country comparison of some measures of financial distress, which highlights the shortcomings of both subjective indicators and measures related to indebted households. The analysis, reported in Table 1, is based on European Union Statistics on Income and Living Conditions (EU-SILC) and the U.S. Survey of Consumer Finances (SCF).[4] First, we observe that the degree of indebtedness varies considerably across countries.[5] For instance, the share of households with a mortgage (Column 1) ranges from 46 percent in the U.S. and 40 percent in the U.K., to as low as 13 percent in Italy. A similar ranking applies to the case of other loans (Column 2), as also reported in Crook (2006) for the same countries but a different period. Thus, in cases such as Italy, the use of indicators of financial fragility based on indebtedness would relate to only a small portion of the population. Table 1 also highlights the existence of a perception bias. In relation to the indicator "difficulty in making ends meet" (Column 3), the country ranking is almost reversed. Also, housing costs are perceived as a source of financial burden by 51 percent of French households, and 97 and 99 percent, respectively, of Spanish and Italian households (Column 4), while the share of housing costs in households' total income is comparable across all three countries (Column 5).

The geographical scope of the analyses is quite broad, and some papers provide comparative evidence (e.g., European Central Bank, 2005; Jappelli *et al.*, 2013), although sometimes restricted to the sample aged over 65 (Christelis *et al.*, 2009). However, existing studies that use survey data consider just one wave, or a time span that does not cover a complete economic cycle. In relation to the methodology, financial fragility is usually modeled as a dichotomous variable,

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[4]The analysis is performed for the year 2007. The results are consistent for 2004/2005 and 2010; however, for 2010, not all the indicators are available.

[5]For an analysis of international differences in assets and liabilities, see, for example, Christelis *et al.* (2013).

TABLE 1

OBJECTIVE AND SUBJECTIVE INDICATORS OF FINANCIAL DISTRESS: STATISTICS ACROSS COUNTRIES (%)

| | (1) Households With a Mortgage | (2) Households With Other Loans | (3) Households Declaring Difficulty in Making Ends Meet | (4) Households Declaring Financial Burden Due to the Housing Costs | (5) Share of Housing Costs in Disposable Household Income |
|---|---|---|---|---|---|
| US | 46.3 | 54.3 | – | – | – |
| UK | 39.9 | 51.8 | 36.5 | 65.5 | 32.1 |
| Germany | 28.3 | 44.7 | 19.5 | 79.5 | 37.3 |
| France | 27.8 | 45.7 | 53.4 | 50.8 | 21.3 |
| Spain | 30.5 | 24.4 | 56.7 | 96.5 | 17.8 |
| Italy | 13.1 | 15.9 | 75.3 | 98.8 | 19.6 |

*Source*: authors' calculations on European Union Statistics on Income and Living Conditions (EU-SILC) 2007 for European countries and Survey of Consumer Finances (SCF) 2007 for the US.

where fragile households are those meeting a certain condition, for instance a loan to value ratio above a certain threshold, negative net wealth, arrears in debt repayments, or low confidence in ability to cope with unexpected expenses. Hence, the estimations usually employ univariate binary choice models.

In sum, measures based on self-reported financial distress may suffer from subjectivity and perception bias, while the quantitative indicators so far used rely too much on indebtedness, which, by construction, confines the condition of financial fragility to this specific subset of households. These concerns are the motivation for our study to propose a new measure of financial fragility.

## 3. Financial Fragility: A New Characterization

The above discussion highlights the importance of characterizing financial fragility as a measure that: (i) is objective, and therefore possibly perception-bias free; (ii) does not refer to a specific household group, especially in relation to the indebtedness position; (iii) relates to the portfolio composition; and (iv) takes the short-run into account and allows a distinction between the roles played by expected and unexpected expenses.

In order to define a comprehensive framework to analyze the financial-economic situation of households and to provide a novel definition of financial fragility, we classify households according to two conditions:

(1) Whether income is sufficient to meet expected expenses.
(2) Whether liquid assets are sufficient to cope with potential unexpected expenses.

For each household $i$ in the sample, this structure gives rise to two dichotomous variables, $y_{i1}$ and $y_{i2}$:

$$(1) \qquad y_{i1} = 1 \; if \; income \geq expected \; expenses; \qquad 0 \; otherwise$$

$$(2) \qquad y_{i2} = 1 \; if \; liquid \; assets \geq unexpected \; expenses; \quad 0 \; otherwise$$

The four variables involved in the above definitions are specified as follows:

- *Income* is measured as the household's total yearly disposable income including payroll and self-employment income, pensions, transfers, and income from property.
- *Expected expenses* represent the household's planned yearly expenditure, and can be measured as the sum of yearly non-durable consumption, rent and/or mortgage payments, maintenance payments, and insurances contributions (life, health, and indemnity).
- *Liquid assets* are measured as the sum of cash, and bank and post office deposits.[6]

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[6]In general market liquidity refers to the ability of an asset to be transformed into cash in a short time without causing a significant movement in the price and with minimum loss of value. For the purposes of this paper we want liquid assets to be characterized by a high level of liquidity which justifies the exclusion of other relatively liquid assets such as mutual funds.

TABLE 2
CLASSIFICATION OF HOUSEHOLDS ACCORDING TO INCOME AND LIQUIDITY CONDITIONS

| | | | |
|---|---|---|---|
| (Case i) | *Unconstrained* | if | Income ≥ Expected Expenses<br>&<br>Liquidity ≥ Unexpected Expenses |
| (Case ii) | *Financially Fragile* | if | Income ≥ Expected Expenses<br>&<br>Liquidity < Unexpected Expenses |
| (Case iii) | *Overconsuming but liquid* | if | Income < Expected Expenses<br>&<br>Liquidity ≥ Unexpected Expenses |
| (Case iv) | *Constrained* | if | Income < Expected Expenses<br>&<br>Liquidity < Unexpected Expenses |

- *Unexpected expenses* are non-planned outflows, such as restoration of household capital stocks, including cars, housing and their appliances, and other household durables, unexpected medical expenses, or temporary income losses, for example resulting from a job change, a wage reduction, or employment layoff or temporary cessation; the measurement of unexpected expenses is described in Section 4.2.

Depending on whether households satisfy one, both, or neither of the above two conditions, they can be classified into four groups, which we label: (i) unconstrained, (ii) financially fragile, (iii) overconsuming but liquid, and (iv) constrained (Table 2).

According to this framework, we have a new characterization that depicts as "financially fragile" all households that earn sufficient income to at least cover all expected expenses, but that might be unable to cope with unexpected expenses. Thus, our measure does not aim to capture difficulties arising from insufficient income or over-indebtedness, but is aimed at capturing cases of "non-optimal" portfolio allocation, where non-optimal means a portfolio that is too exposed to liquidity risk. In other words, our financially fragile households are not necessarily poor, rather their liquid assets are too small, so that economic and financial troubles in the near future will be unavoidable if there are unexpected expenses. It follows that our characterization could act as an early warning indicator of financial distress.

## 4. METHODOLOGY AND DATA

### 4.1. *The Estimation Strategy*

An appropriate strategy to study the determinants of our indicator of financial fragility consists of estimating a bivariate probit model, which allows us to jointly model the two states outlined in equations (1) and (2) and to estimate the

probabilities of the four household conditions defined in Table 2, that is, the probability of each household $i$ meeting neither condition (case i), either one or the other condition (cases ii and iii), or both conditions (case iv):[7]

$$\textit{case (i):} \quad p_{00} = Pr[y_{i1} = 0; \, y_{i2} = 0]$$

$$\textit{case (ii):} \quad p_{10} = Pr[y_{i1} = 1; \, y_{i2} = 0]$$

$$\textit{case (iii):} \quad p_{01} = Pr[y_{i1} = 0; \, y_{i2} = 1]$$

$$\textit{case (iv):} \quad p_{11} = Pr[y_{i1} = 1; \, y_{i2} = 1]$$

Formally, this means simultaneously estimating the following two equations:

$$(3) \qquad y_{i1} = 1 \; if \; (y_{i1}^* = \mathbf{x}_{i1}'\boldsymbol{\beta}_1 + \varepsilon_{i1}) > 0; \quad 0 \; otherwise$$

$$(4) \qquad y_{i2} = 1 \; if \; (y_{i2}^* = \mathbf{x}_{i2}'\boldsymbol{\beta}_2 + \varepsilon_{i2}) > 0; \quad 0 \; otherwise$$

with the two error terms distributed as bivariate normal, $(\varepsilon_{i1}, \varepsilon_{i2}|\mathbf{x}_{i1}, \mathbf{x}_{i2}) \sim BVN(0, 0, 1, 1, \rho)$, where $\rho$ is the correlation between the two errors, $-1 < \rho < 1$. Variables $y_{i1}^*$ and $y_{i2}^*$ are the latent variables underlying the observables $y_{i1}$ and $y_{i2}$ and are a function of the same set of covariates, therefore $x_{i1} = x_{i2} = x_i$. Estimation of the system of equations is carried out via maximum likelihood.

Since we are interested in the determinants of financial fragility (case *ii*), we focus on the probability of this state, that is:

$$(5) \qquad Pr(y_{i1} = 1; \, y_{i2} = 0 \,|\, \mathbf{x}_i) = \Phi_2(\mathbf{x}_i'\boldsymbol{\beta}_1; -\mathbf{x}_i'\boldsymbol{\beta}_2; -\rho)$$

where $y_{i1}$ and $y_{i2}$ are defined in equations (3) and (4) and $\Phi_2$ is the bivariate normal distribution.

The vector of explanatory variables $\mathbf{x}_i$ in both equations, contains the following groups of control variables:

- *Demographic*: number of household components, gender, age and age squared, marital status, and level of education of the head of household, defined as the individual responsible for the household's financial and economic choices.
- *Economic*: occupational status of the household head (dummies for employee, self-employed, retired, unemployed), and quartiles of household yearly disposable income and of net wealth.

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[7]In deciding on an estimation strategy we ruled out certain models. More specifically, as the four categories cannot be ranked appropriately, the use of an ordered model is inappropriate. Second, an unordered model, namely a multinomial logit model, turned out to be unsuitable since it requires the so-called Independence of Irrelevant Alternatives (IIA) assumption, which, as in most empirical applications, is also violated in our case based on both the Hausman and the Small–Hsiao tests (see Long and Freese, 2006, p. 243). Finally, although our ultimate aim is to focus on the determinants of financial fragility, the use of a simple univariate probit model is also inappropriate since it would compare financially fragile households with a set of non-homogeneous households consisting of the other three types.

- *Portfolio*: a dummy for having a mortgage, and an indicator for the illiquidity of the portfolio due to housing, defined as the ratio between residential home value and household total assets.
- *Fixed*: year of interview and area of residence.

Estimation of equation (5) requires some careful consideration. Since financial fragility depends upon the amount of liquidity held (specifically the unavailability of a liquidity buffer) and since the set of regressors includes portfolio variables, we can expect some simultaneous equation bias to be affecting the estimation process. Indeed, liquidity is just one of the portfolio components and it is reasonable to expect that the amount of liquidity held is determined jointly with the amount of other portfolio components, whether assets (such as housing) or/and liabilities (such as mortgages). By contrast, we could expect the decision process on the ex-ante substitutability between holdings of liquidity and housing to be low, resulting in no simultaneous equation issues, since housing decisions are long-term decisions while liquidity holdings are, by definition, adjustable over short horizons. However, a safer solution is to search for specifications that reduce the risk of simultaneous equation bias because the amounts or percentages of liquid/illiquid assets involved are choice variables.

Moving along the long-term/short-term dichotomy implicit in housing and liquidity decisions, and to control for this possible endogeneity issue, we estimate the model over a sub-sample of households whose liquidity decisions can reasonably be assumed not to be determined by the same unobservable factors which, in principle, might determine housing and mortgage decisions. Therefore, we exclude from the sample households whose housing decisions are relatively recent. This leaves us with two groups of households: those who are not homeowners and those who bought their main home several years earlier. For both groups it is reasonable to assume that homeownership is not endogenous with the unavailability of the liquidity buffer. For the former group, by definition there is no substitutability between housing wealth and liquidity. For the latter group, their current financial planning is reasonably assumed not to be affected by the past decision to buy a home and/or to incur debt as long as those decisions are sufficiently in the past. This rules out the simultaneity of the decisions, and the risk that the same unobservables may affect both financial fragility and the two portfolio controls.

We selected households who bought their main residence, outright or with mortgage, 10 or more years earlier. We believe that this is a sufficient time span to rule out any form of simultaneity between the decision to buy a house and the decision on how much liquidity to hold. At the same time, since the median duration of mortgages in Italy is 15 years, the choice of a minimum 10-year time span allows us still to observe an acceptable percentage of indebted households.[8] Detailed descriptive statistics are reported in Section 4.2. For the sake of completeness, and to control for consistency of results between the subsample and the whole sample, Appendix C presents summary statistics and estimation results for the whole sample.

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[8]Robustness of the estimation results for the 10-year subsample is checked against two subsamples where the choice of buying the main home was taken at least 8 and 12 years earlier respectively (results, consistent with the ones reported for the 10-year subsample, are available upon request).

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### 4.2. *Dataset and Descriptive Statistics*

Our dataset spans the period 1998–2012 and draws on data from eight waves of the SHIW (1998, 2000, 2002, 2004, 2006, 2008, 2010, and 2012), each involving around 8,000 households. The SHIW basic sample unit is the household, defined as "a group of cohabiting people who, regardless of their relationships, satisfy their needs by pooling all or part of their incomes." For each household member, the SHIW provides plenty of demographic information, such as age, level of education, gender, and marital status. In addition to demographics, the SHIW provides economic information at the household level, including net wealth (real and financial assets net of financial liabilities) and the amounts invested in a variety of financial assets, including cash and deposits, which represent the liquid assets in our analyses.[9] From the original sample we drop households declaring negative consumption (7 observations), those reporting no information on either real or financial wealth (3 observations), and households where the household head is under 20 or over 90 years of age (425 observations). To control for possible endogeneity, we select households who have owned their main residence for 10 or more years, yielding a final sample of 52,793 observations (84.4 percent of the original sample).

As described in Section 3, unexpected expenses are meant to capture unplanned outflows, such as the restoration of household capital stocks or temporary income losses. We quantify them as worth €1500 in real terms.[10] This amount, over the full period of our sample, represents the household's average yearly consumption in durable goods and median monthly disposable income. It is also in line with Lusardi *et al.* (2011), which likewise addresses the issue of quantifying unexpected expenses, and suggests a figure of $2000 for the U.S., £1500 for the U.K., C$2000 for Canada, and €1500 for France, Germany, Italy, Portugal, and the Netherlands. Appendix B checks the robustness of our estimation results to the choice of threshold for unexpected expenses.

Table 3 reports descriptive statistics of the variables used in the analysis; their detailed description is presented in Appendix A. More than three in four households meet conditions (1) and (2), 76.2 and 75.1 percent, respectively. As a result, most Italian households (61.0 percent) can be defined as unconstrained, 14.1 percent as overconsuming but liquid, with an average share of financially fragile of 15.1 percent. Average age is quite high, 57.5 years, reflecting the composition of the Italian population and its ageing process, which results in a high percentage of household heads who are retired (44.4. percent). The majority of households have a male head (61.6 percent) who is married (61.8 percent). In relation to educational attainment, the highest percentage (30.9 percent) is household heads with lower secondary level (compulsory education), with only 8.3 percent of household heads with a university degree. Average disposable income is €33,507 at 2012 prices (the

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[9]The amount of cash held by households is not available in the 2006, 2010, and 2012 waves. For this reason we imputed missing values by regressing cash, for all available years, on a set of controls, such as year and region of residence, as well as income, wealth, and consumption in linear and quadratic terms.

[10]To express all monetary amounts in real terms, we use the consumption deflator (base 2012 = 100) provided by Istat.

TABLE 3

DESCRIPTIVE STATISTICS OF THE VARIABLES USED IN THE BIVARIATE PROBIT MODEL

|  | Mean | St. Dev. | Min | Max |
|---|---|---|---|---|
| **Household type** |  |  |  |  |
| Sufficient income (condition 1) | 0.76170 | 0.42605 | 0 | 1 |
| Sufficient liquidity (condition 2) | 0.75128 | 0.43227 | 0 | 1 |
| Unconstrained | 0.61047 | 0.48765 | 0 | 1 |
| Financially fragile | 0.15123 | 0.35828 | 0 | 1 |
| Overconsuming but liquid | 0.14081 | 0.34783 | 0 | 1 |
| Constrained | 0.09749 | 0.29662 | 0 | 1 |
| **Controls** |  |  |  |  |
| *Demographic* |  |  |  |  |
| Male | 0.61561 | 0.48645 | 0 | 1 |
| Age | 57.45952 | 15.91170 | 20 | 90 |
| Married | 0.61814 | 0.48585 | 0 | 1 |
| Single | 0.12535 | 0.33112 | 0 | 1 |
| Divorced | 0.06939 | 0.25412 | 0 | 1 |
| Widow | 0.18712 | 0.39001 | 0 | 1 |
| Level of education 1 (no education) | 0.07112 | 0.25702 | 0 | 1 |
| Level of education 2 (primary school) | 0.27827 | 0.44815 | 0 | 1 |
| Level of education 3 (secondary school) | 0.30906 | 0.46211 | 0 | 1 |
| Level of education 4 (college) | 0.25866 | 0.43790 | 0 | 1 |
| Level of education 5 (graduate) | 0.07829 | 0.26863 | 0 | 1 |
| Level of education 6 (post-graduate) | 0.00460 | 0.06770 | 0 | 1 |
| Household size | 2.51916 | 1.28634 | 1 | 11 |
| *Economic* |  |  |  |  |
| Income (€) | 33,507 | 28,198 | −53,559 | 743,700 |
| Wealth (€) | 242,892 | 523,429 | −875,424 | 3.09E+07 |
| Employee | 0.31431 | 0.46424 | 0 | 1 |
| Self-employed | 0.13598 | 0.34277 | 0 | 1 |
| Retired | 0.44398 | 0.49686 | 0 | 1 |
| Unemployed | 0.02949 | 0.16918 | 0 | 1 |
| *Portfolio* |  |  |  |  |
| Having a mortgage | 0.02978 | 0.16999 | 0 | 1 |
| Illiquidity due to housing | 0.48017 | 0.41424 | 0 | 1 |

All statistics are computed using sample weights.

median value is €26,633, reflecting the standard asymmetry detected in income distribution), while average (median) net wealth is €242,892 (€130,873) in real terms. The sample shows a low level of indebtedness, with only 3 percent of households holding a mortgage.[11] Finally, Italian households' portfolios typically are quite illiquid, since, on average, 48 percent of households' total assets are represented by the residential home (this is consistent also with the high homeownership rates in our sample of 61.9 percent).

A comparative inspection of the descriptive statistics in Tables 3 and C.1 shows that the structure in the original sample is generally maintained: households

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[11]Be reminded that the sample selects households who have been homeowners for 10 years or more, so that the percentage of households with a mortgage is lower than the already low value observed over the whole sample (8.6 percent) reported in Table C.1.

meeting condition (1) are substantially unchanged (76.4 and 76.2 percent), households meeting condition (2) increase by 1.5 percentage points (from 75.1 to 76.6 percent), and consequently, financially fragile households decrease slightly from 15.1 to 14.2 percent. Average income stays in the range €34,500–35,000, while net wealth is in the range €240,000–255,000; the percentage of male household heads goes from 61.6 to 62.3 percent, and average age drops from 57 to 55 years.

## 5. Estimation Results

Estimation of the bivariate model in equations (3) and (4) generates four outcomes corresponding to the four household states (cases *i* to *iv*). Since we are interested in the determinants of financial fragility, we report only the results relating to case *ii* (equation 5). The estimation results are reported in Table 4 and are expressed in terms of marginal effects of each control on the probability of

TABLE 4

BIVARIATE PROBIT REGRESSION: MARGINAL EFFECTS OF BEING FINANCIALLY FRAGILE

|  | Marg. Eff. | Std. Err. |  | Marg. Eff. | Std. Err. |
|---|---|---|---|---|---|
| *Demographic controls* | | | *Economic controls* | | |
| Age | −0.00048 | 0.00082 | Income | | |
| Age squared | 0.00023 | 0.00071 | 2nd quartile | −0.01231 | 0.00517** |
| Male | −0.00966 | 0.00466** | 3rd quartile | −0.02952 | 0.00646*** |
| Marital status | | | 4th quartile | −0.04480 | 0.00799*** |
| Single | 0.01565 | 0.00651** | Net wealth | | |
| Divorced | 0.03434 | 0.00828*** | 2nd quartile | −0.18388 | 0.01013*** |
| Widow | 0.02578 | 0.00646*** | 3rd quartile | −0.21474 | 0.01075*** |
| Education | | | 4th quartile | −0.22680 | 0.01079*** |
| Primary school | −0.06046 | 0.00890*** | Employee | −0.00291 | 0.00712 |
| Secondary school | −0.10400 | 0.00973*** | Self-employed | 0.00992 | 0.00922 |
| College | −0.13739 | 0.00998*** | Retired | 0.00098 | 0.00758 |
| Graduate | −0.13603 | 0.01151*** | Unemployed | 0.02923 | 0.01175** |
| Post-graduate | −0.15660 | 0.02259*** | | | |
| Household size | 0.00900 | 0.00202*** | | | |
| *Fixed* | | | *Portfolio controls* | | |
| 2000 | 0.03696 | 0.00696*** | Having a mortgage | −0.04740 | 0.00869*** |
| 2002 | 0.02802 | 0.00677*** | Illiquidity due to housing | 0.20123 | 0.00828*** |
| 2004 | 0.00962 | 0.00659 | | | |
| 2006 | 0.01654 | 0.00708** | | | |
| 2008 | 0.04120 | 0.00695*** | | | |
| 2010 | 0.03271 | 0.00717*** | | | |
| 2012 | 0.03785 | 0.00691*** | | | |
| Number of obs | 52,793 | | | | |
| Wald chi2(70) | 10,874.150 | | | | |
| Prob > chi2 | 0.00000 | | | | |
| Log pseudo-likelihood | −1.18E+08 | | | | |
| Rho = 0.064607 | | | | | |
| Wald test of rho = 0: chi2(1) = 16.2372; Prob > chi2 = 0.0001 | | | | | |

Regressions are run using sample weights and include dummies for area of residence (not shown).

Marginal effects are computed as the weighted average of the marginal change in each household's probability when each of the explanatory variables changes from 0 to 1 if dichotomous, or by a marginal amount if continuous.

*significant at 10%; **significant at 5%; ***significant at 1%.

observing financially fragile households.[12] In terms of model specification, the null for the presence of a correlation between the error terms of the two equations is not rejected, with the $\rho$ coefficient equal to 0.0646 and statistically significant at the 1% level of significance, implying correlation between the two equations and, therefore, confirming the appropriateness of a bivariate specification.

The estimated marginal effects for the *demographic* explanatory variables show that, on average, male-headed households have a lower probability of being financially fragile, which is in line with the literature; the opposite is observed for larger households. With respect to married households, financial fragility is positively associated with households where the household head is divorced, single, or widowed. The negative gradient of education is highly relevant: consistent with the literature on financial literacy—which uses educational attainment as its proxy— higher education likely leads to better financial planning and has been shown to be positively associated with net worth (Van Rooij *et al.*, 2012). The marginal effects of age and age squared are not statistically significant, suggesting the absence of life-cycle effects. This result is in line with the studies by Georgarakos *et al.* (2010) and Giarda (2013), for example, but contrasts with work that finds financial problems to be related to age (e.g., Brown and Taylor, 2008; Duygan-Bump and Grant, 2009; Beck *et al.*, 2010; Lusardi *et al.*, 2011).

For the *economic* dimension, financial fragility is decreasing in income and wealth quartiles. Regarding occupational status, financial fragility does not seem to be associated with any employment status, but is much more likely if the household head is unemployed.

Both controls for household *portfolio* choices are highly significant. Interestingly, households with mortgages, that is, indebted to a bank, are less likely to be financially fragile, a result that reflects that reliance on formal credit generally implies better financial planning. Also, it should be noted that, in Italy, households with access to credit are typically highly selected by banks, consistently with the low debt-to-income ratio of Italian households which is around 15 percent over the period analyzed (Bank of Italy, 2014). Finally, in line with expectations, having a highly illiquid portfolio—high value of housing relative to total assets—increases the likelihood of liquidity distress.[13] To sum up, housing purchases have a negative effect on the household's ability to cope with unexpected financial needs. This negative effect is partly offset if the house purchase is accompanied by a mortgage, since a mortgage forces the household to adopt a better financial strategy to meet future unexpected outcomes.

Since homeownership is often one of the main factors associated with financial fragility, we further investigate this feature in connection with marital status,

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[12]The marginal effects are computed as the (sample weighted) average of the marginal change in each household's probability when each of the explanatory variables changes from 0 to 1 if dichotomous, or by a marginal amount if continuous.

[13]The role of housing as a buffer is controversial. Benito (2009) finds evidence of it in a study of U.K. household responses in a period (1993–2003) of house price inflation and reduction in mortgage rates. In contrast, assuming constant house prices, Hurst and Stafford (2004) show that households with liquid assets prefer to draw on them to smooth a shock. As a robustness check, we tried an alternative measure of portfolio illiquidity which includes all real assets held by households, not just residential housing. The results, available upon request, remain unchanged.

re-estimating the model to include the interaction between marital status and portfolio illiquidity. The results (available upon request) show that, while all other conclusions remain unchanged, the interaction term between widowhood and illiquidity is negative and statistically significant, while the interactions with other marital statuses are never significant.

Among the *fixed* controls, the time dimension indicates some degree of procyclicality of this condition, possibly due to overall portfolio cyclicality. In fact, household portfolios tend also to be riskier in terms of liquidity during stock market booms (as Brunetti and Torricelli, 2010b, show for Italy) and too illiquid during real estate market booms.

In order to check the robustness of our results to the liquidity threshold, which is set to €1,500 in real terms as discussed in Section 4.2, we re-estimate the model using different liquidity thresholds, from €1000 up to €5000, a range that can reasonably be used to discriminate between a liquidity buffer and an amount worth investing. The results reported in Appendix B confirm that, regardless of the threshold, our conclusions hold.

### 5.1. *Financial Literacy and Risk-Aversion*

Information on the household head's financial knowledge is retrievable for the 2006 to 2010 waves. The questions vary slightly from wave to wave, so although a more sophisticated measure of financial literacy could be computed for each individual wave, we focus simply on the two questions common to the three waves. One concerns mortgages: the respondent is asked to indicate the type of mortgage (fixed rate, adjustable rate, or adjustable rate with constant installments) involving a fixed (in advance) number and amount of installments to repay the debt. The other question concerns real interest rates: respondents are asked to indicate the amount of goods they can buy (the same, less, or more) at the end of the year if they leave €1000 in a bank account, for a year, at an annual interest rate of 1 percent in nominal terms, when annual inflation is 2 percent. We can thus create a categorical variable that takes the value 0 for households giving an incorrect answer to both questions (low financial literacy), 1 for those answering one correctly (medium financial literacy), and 2 for those answering both questions correctly (good financial literacy). The results reported in Table 5 (Column 1) show that the higher the degree of financial literacy, the lower the probability of financial fragility. Again, even under this specification, estimates of the portfolio controls are mostly unchanged compared to those in Table 4.

The SHIW also provides information on the degree of risk aversion, but only from the 2004 wave. Household heads are asked to indicate the preferred financial investment among a set of four possible choices (1 = high risk, high returns; 2 = reasonable risk, good returns; 3 = low risk, reasonable returns; 4 = no risk, low returns). We can then define a dummy variable for being risk averse, which takes the value 1 if the respondent indicates the fourth possibility (the most risk-averse choice) and 0 otherwise. The results reported in Table 5 (Column 2) show that financial fragility is only mildly associated with risk aversion.

TABLE 5

| | Model With Financial Literacy (1) | | Model With Risk Aversion (2) | |
|---|---|---|---|---|
| | Marg. Eff. | Std. Err. | Marg. Eff. | Std. Err. |
| Having a mortgage | −0.05268 | 0.01458*** | −0.05230 | 0.00982*** |
| Illiquidity due to housing | 0.16797 | 0.01495*** | 0.17920 | 0.01026*** |
| Financial literacy | | | | |
|   Medium | −0.04747 | 0.00983*** | – | – |
|   Good | −0.07283 | 0.00963*** | – | – |
| Being risk averse | | | 0.01041 | 0.00485** |
| Number of obs. | 33,666 | | 16,836 | |

    Regressions are run using sample weights. The table shows only the results for the regressors of interest.
    Marginal effects are computed as the weighted average of the marginal change in each household's probability when each of the explanatory variables changes from 0 to 1 if dichotomous, or by a marginal amount if continuous.
    *significant at 10%; **significant at 5%; ***significant at 1%.

## 6. Financial Fragility as an Early Warning Indicator

This section tests the ability of our characterization of financial fragility to forecast future conditions of financial distress, that is, its ability to act as an early warning indicator. We use the following three questions from the SHIW to define three indicators of "distress":

(1) Is your household income sufficient to see you through to the end of the month? (i) with great difficulty, (ii) with difficulty, (iii) with some difficulty, (iv) fairly easily, (v) easily, (vi) very easily.

(2) Does the household have debts with relatives or friends not living with the household? (i) yes, (ii) no.

(3) Considering all loans of whatever type, was the household behind with payments by more than 90 days at any time during the previous year? (i) yes, (ii) no.

Using the responses to the first question (available only from 2002), we create the variable "great difficulty" which takes the value 1 if the household declares "managing to the end of the month with great difficulty" and 0 otherwise. We next consider debts with relatives or friends since, as Lusardi *et al.* (2011) mention, informal channels for credit are often used by households to cope with unexpected financial shocks; we build the variable "having informal debt," which equals 1 if the household has borrowed from friends or relatives and 0 otherwise. Similarly, from the responses to the third question (available only from 2008), we create the variable "arrears," which is equal to 1 if the household has been in arrears with debt repayments for more than 90 days (which is related to the definition of default provided by the Basel capital regulation) and 0 otherwise. Note that the first two indicators are available for all households, while the latter is available only for the indebted ones; also the first indicator is subjective while the last two are objective. Table 6 reports some descriptive statistics for these three indicators.

TABLE 6

DESCRIPTIVE STATISTICS OF THE EX-POST DISTRESS VARIABLES

|  | Mean | St. Dev. | Min | Max | Obs. |
|---|---|---|---|---|---|
| Making the ends meet with great difficulty | 0.1497 | 0.3568 | 0 | 1 | 20,314 |
| Having informal debt | 0.0220 | 0.1468 | 0 | 1 | 23,259 |
| Had arrears for 90 days or longer | 0.0698 | 0.2548 | 0 | 1 | 1,660 |

All statistics are computed on the longitudinal component of the SHIW using sample weights. The variable "Making the ends meet with great difficulty" is available only from 2002. The variable "Had arrears for 90 days or longer" is available only from 2008.

To gauge the potential early warning nature of our measure, we estimate two probit models for each of the three indicators of distress, on the longitudinal component of the SHIW:[14] (i) one that includes all the controls, as in Table 4 ("baseline" model), and (ii) one augmented by the lagged value of our indicator of financial fragility ("augmented by FF" model).

The forecasts produced by the two models are evaluated both in- and out-of-sample.[15] The forecast performances are compared using three instruments: the Cumulative Accuracy Profile (CAP) curve, the Accuracy Ratio (AR), and the Log Probability Score (LPS). The CAP curve depicts the percentage of distress events captured by the model (vertical axis) versus the model score (horizontal axis). The estimated model lies between the ideal and the *naïve* models: the ideal model is able to discriminate perfectly (it increases linearly up to the distress rate in the sample and then stays at 1); the *naïve* or non-informative model corresponds to a random assignment of the probability of distress and is represented by the 45° line. The AR is the ratio of the performance improvement of the model being evaluated over the *naïve* model, to the performance improvement of the ideal model over the *naïve* model, and ranges between 0 and 1. The CAP and the AR are widely used in the credit risk literature (for a discussion, see Engelmann *et al.*, 2003). The LPS is used widely in the forecasting literature and is a non-negative loss function, hence the lower it is, the better the forecast performance.[16]

Figures 1 and 2, respectively, report the in-sample and out-of-sample CAP curves, which allow graphical comparison of the forecast ability of the following models: the ideal model (dashed line), the naïve model (dot-dashed line), the baseline model (dotted line), and the model "augmented by FF" (solid line). Starting with in-sample performance (Figure 1), when the distress event is defined by the condition "making ends meet with great difficulty," the model "augmented by FF" performs always at least as well as the baseline model, since the solid line either coincides with or is above the dotted line. Moreover, the distance between the two curves is slightly higher in the central part of the graph, where uncertainty about the classification of households in terms of financial distress risk is higher. In

[14]The longitudinal dataset includes 9,100 households that stay in the sample for at least two consecutive waves, for a total of 23,259 observations.

[15]In the out-of-sample case two-thirds of randomly selected households are used for estimation and the remaining one-third for forecast evaluation.

[16]Alternative measures of forecast performances are the Quadratic Probability Score (QPS), the Global Squared Bias (GBS), and the Kuipers Score (KS). All the results presented in this section hold when using these measures of forecast ability. For additional details on measures of forecast evaluation, see Berg and Pattillo (1999) and Lahiri and Wang (2013), among others.
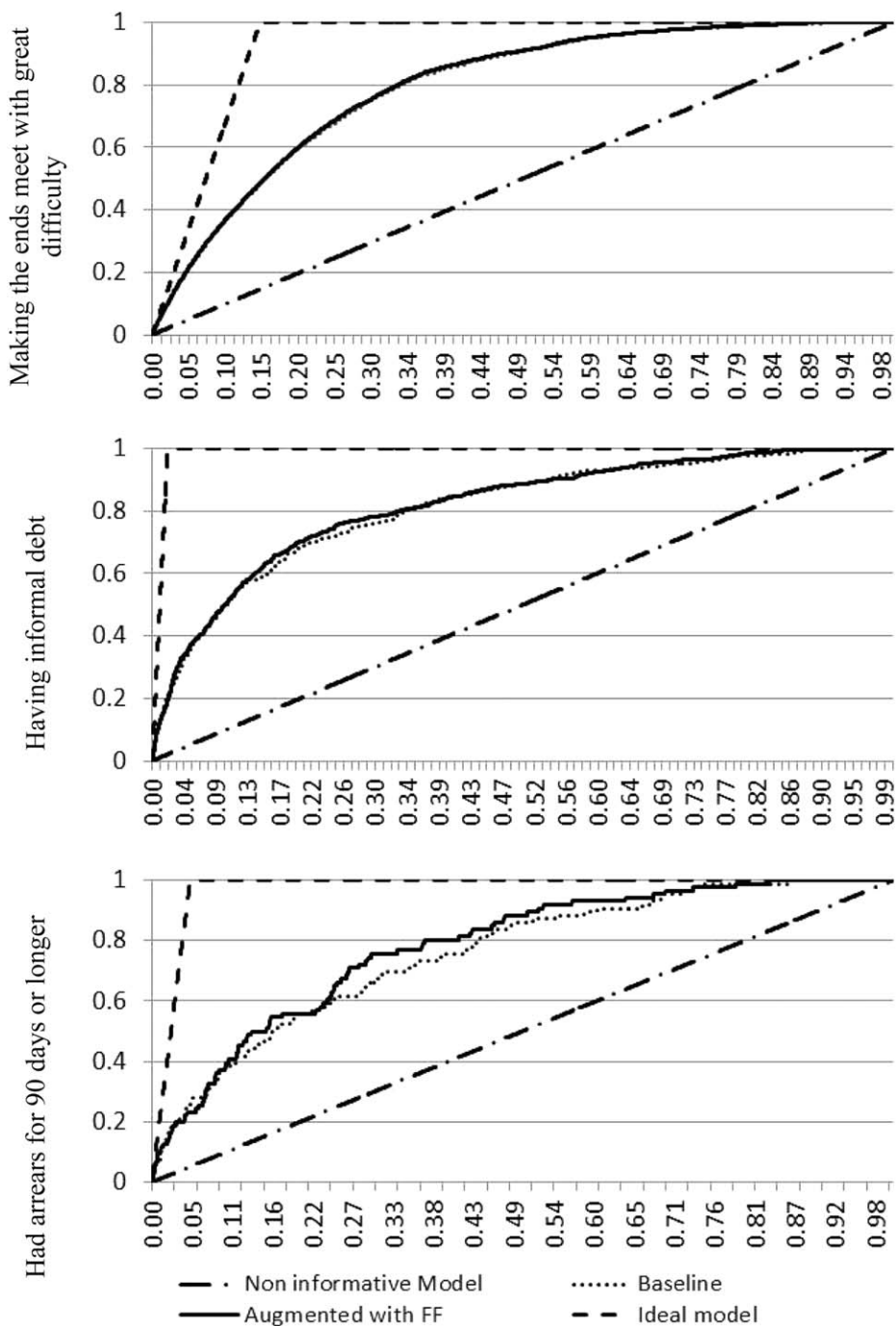
Figure 1. In-Sample Cumulative Accuracy Profile (CAP) Curves

CAP curves depict the percentage of distress events captured by the model (vertical axis) versus the model score (horizontal axis).
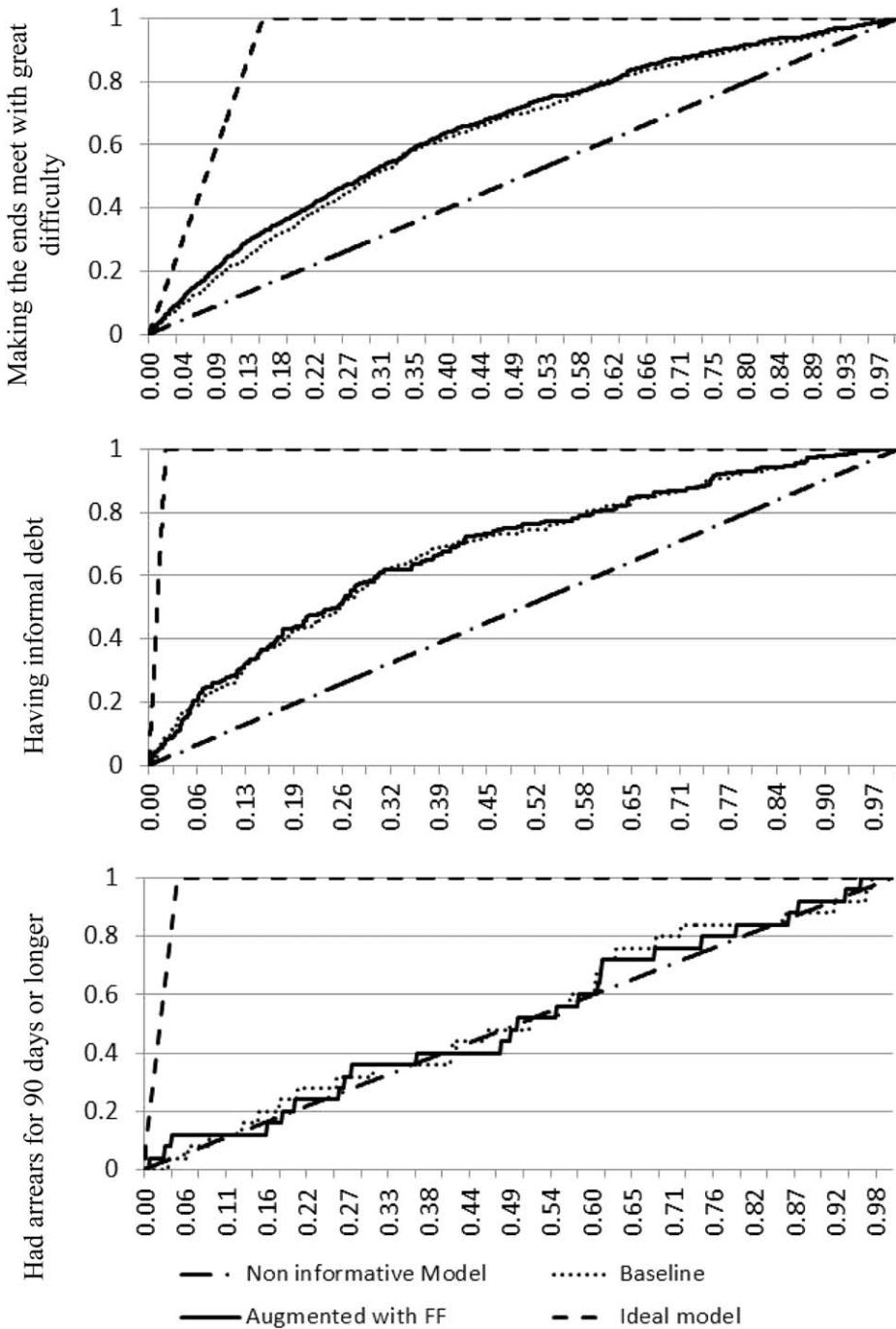
Figure 2. Out-of-Sample Cumulative Accuracy Profile (CAP) Curves

CAP curves depict the percentage of distress events captured by the model (vertical axis) versus the model score (horizontal axis).

TABLE 7

<span style="font-variant: small-caps;">Measures of Forecasting Performance: Accuracy Ratio (AR) and Log Probability Score (LPS)</span>

| | | Making the Ends Meet With Great Difficulty | | Having Informal Debt | | Had Arrears for 90 Days or Oonger | |
|---|---|---|---|---|---|---|---|
| | | Baseline Model | Augmented by FF Model | Baseline Model | Augmented by FF Model | Baseline Model | Augmented by FF Model |
| In-sample forecasts | AR | 0.6900 | 0.6958 | 0.6356 | 0.6485 | 0.5463 | 0.5947 |
| | LPS | 0.3197 | 0.3191 | 0.1029 | 0.0965 | 0.2121 | 0.1910 |
| | No. of obs. | 20,314 | | 23,259 | | 1,660 | |
| Out-of-sample forecasts | AR | 0.3305 | 0.3648 | 0.3704 | 0.3783 | 0.0502 | 0.0362 |
| | LPS | 0.4952 | 0.4745 | 0.1454 | 0.1435 | 0.1992 | 0.1950 |
| | No. of obs. | 6,771 | | 7,753 | | 553 | |

Estimations are performed on the longitudinal component of the SHIW.
FF is Financial Fragility; AR is the Accuracy Ratio, which ranges between 0 and 1 (the closer to 1, the better the forecast performance); LPS is the Log Probability Score, a non-negative loss function (the lower it is, the better the forecast performance).

other words, the presence of our lagged indicator leads to a marginally better performance at forecasting future conditions of distress, and its contribution is more valuable when distinguishing households at risk is more difficult. This conclusion is slightly enhanced when the actual distress is defined using the "having informal debts" indicator. Finally, when the distress event is identified as "in arrears for 90 days or longer," the additional contribution of our indicator for anticipating future distress is definitely more evident, since the solid line outperforms the dotted line, and does so at almost every point in the distribution. Although the evidence is not as clear-cut as in the in-sample case, the same conclusions hold for the out-of-sample forecasts (Figure 2).

The top panel in Table 7 reports the in-sample forecast evaluation measures, LPS and AR, for the three indicators of distress. Recall that the LPS is a loss function, while AR is higher for better forecast performances: the "augmented by FF" model performs better in all the cases considered, providing evidence in favor of anticipatory predictive power of our indicator. The findings are generally confirmed for the out-of-sample forecasts (bottom panel in Table 7), with the exception of the "arrears" indicator.

To sum up, for the three conditions of distress analyzed, we provide evidence that the use of our indicator improves the ability to forecast, both in-sample and out-of-sample, future conditions of distress.

## 7. Conclusions

This paper provides an analysis of financial fragility of Italian households, using data drawn from the Bank of Italy SHIW, for the period 1998–2012. The contents of this study are distinctive in three ways.

First, we propose a novel characterization of financially fragile households that overcomes some of the limitations in existing definitions. In fact, our definition is less exposed to perception bias, is related to household portfolio composition, separates the role of expected and unexpected expenses, and also does not refer to a specific household group in terms of indebtedness position or age. Specifically, we define as "financially fragile" all households that are able to afford expected expenses (planned yearly expenditures, i.e., yearly non-durable consumption, payments for rent and/or mortgages, maintenance payments, and insurances), but do not have enough liquidity to cope with unexpected expenses (i.e., restoration of their capital stocks, such as cars, housing and other household durables, unexpected medical expenses, or temporary income losses). Thus, we capture households not currently in economic and financial trouble, but which might succumb to this condition in the near future. This approach is appropriate for Italy, where homeownership is high, but indebtedness is low and the usual measures of financial fragility based on the debt position may fail to fully capture households' financial distress.

Second, we investigate the relationship between financial fragility and households' demographic characteristics, economic position, and portfolio composition, by means of a bivariate probit model where being able to face expected expenses and not being able to cope with unexpected ones are modeled jointly. The choice to introduce portfolio controls (the ratio between the value of the main property and total assets, and having a mortgage) allows us to evaluate the importance of the asset/liability choices of households alongside the more common economic and demographic controls. We control also for possible endogeneity problems due to the presence of portfolio variables in the set of explanatory variables, by performing our analysis on a subsample of households for which the simultaneity of portfolio decisions is ruled out. The results highlight that our characterization of financial fragility confirms the role played by most of the usual markers (income, wealth, education, gender, etc.), but emphasize the importance of portfolio controls: when the value of housing is high relative to total assets, the likelihood of financial distress increases sharply, while it is negatively associated with mortgages. In other words, housing purchases have a negative effect on the ability of a household to face unexpected financial needs, but this negative effect is partially offset if the house purchase is accompanied by a mortgage. We interpret this as suggesting that mortgages allow households to construct a better financial strategy to meet future unexpected outcomes.

Third, using measures for discriminatory power, such as cumulative accuracy profile curves, the accuracy ratio, and the log probability score, we provide evidence of the ability of our indicator to act as an early warning of future financial distress, thus confirming that our characterization of financial fragility captures households that are not necessarily poor, but rather have insufficient liquid assets, so that economic and financial troubles could arise in the near future.

Our approach to some extent is comparable with Lusardi *et al.* (2011), although they use the responses to specific survey questions, while we use a quantitative measure. While Lusardi *et al.* (2011) report that fragility is a condition mainly experienced by the U.S. "middle class" (however they stress that the June–September 2009 survey period might have exacerbated anxiety/

pessimism), our investigation shows that financial fragility in Italy seems to be related more to the fact that there is too much housing in household portfolios, and that households find themselves with excessive amounts of immobilized wealth. Overall, our analysis shows that, when making portfolio choices, households should consider the risk of incurring unexpected expenses or the possibility of income instability (resulting from a job change, wage reduction, employment layoff, or temporary cessation). Economic downturns and a move toward a weaker social safety net should make households increasingly more responsible to cope with the "unexpected."

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## SUPPORTING INFORMATION

Additional Supporting Information may be found in the online version of this article at the publisher's web-site:

**Appendix A:** Description of variables

**Appendix B:** Thresholds for the liquidity buffer

**Table B.1:** Marginal effects of portfolio controls ("Having a mortgage" and "Illiquidity due to housing") by liquidity buffer thresholds and with liquidity buffer as a function of income

**Appendix C:** Descriptive statistics and main results for the whole sample

**Table C.1:** Descriptive statistics of the full sample

**Table C.2:** Bivariate probit regression: marginal effects of being financially fragile (full sample)