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Could financial education be a universal social policy? A simulation of potential influences on inequality levels☆

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ABSTRACT

Financial vulnerability is a concern of policymakers around the world. Based on previous literature, providing financial education may reduce financial vulnerabilities with reasonable positive effects on income and wealth. However, how these potential effects on income and wealth may affect inequality is unknown a priori. This paper looks at Italy in examining how a marginal change in a household's financial literacy level might affect household income (wealth) inequality levels, both at the mean value and along with the distribution. Using data from the 2016 wave of the Bank of Italy Survey of Households Income and Wealth (SHIW), which includes the Big Three questions that are widely used as a measure of financial literacy, we show a noteworthy shift if financial literacy were improved among as few as 10 % of the survey respondents. If one of every 10 Italians who had no correct answers on the financial literacy questions in the survey were replaced with respondents reporting two correct answers out of three, the mean value of the household equivalized disposable income would rise by 0.8 %, or €160 per year. If one of every 10 respondents reporting no correct answers were replaced by respondents who could answer all three questions correctly, it would jump by +1.5 %, or €285 per year. To achieve the same results through lump sum payments to households would cost Italy as much as €7.3 billion annually. Our preliminary cost analysis supports mandatory financial education in schools. Heterogeneous analysis reveals that an increase in financial literacy levels can also be associated with a reduction of inequality levels among the most vulnerable groups.

1. Introduction

Decreasing inequality has been a long-standing challenge for policymakers, both in high-income countries and developing economies (Chancel and Piketty, 2021). Recent global shocks from the COVID-19 pandemic and the resurgence of inflation have exacerbated the problem and sparked demands for more urgent action to support vulnerable households and reduce income and wealth

inequality. Previous literature offers several options for reducing inequality, including changes in taxes and social policies (e.g., Caminada and Goudswaard, 2001; Rillaers, 2001; Poterba, 2007; Lemieux, 2008; Joumard et al., 2012; Atkinson, 2015; Iosifidi and Mulonidis, 2017; Blundell et al. 2018, Sabelhaus and Henriques Volz, 2022). A growing body of literature has also shown financial literacy to be a powerful tool against financial fragility, contributing to better civic and financial choices, greater asset accumulation, and financial wellbeing (Berg and Zia, 2017; Lusardi and Mitchell, 2014; van Rooij et al., 2011, 2012; Bucciol et al., 2022; Almenberg et al., 2021; Bucciol et al., 2021; Clark et al., 2021; Collins and Urban, 2020; Deuflhard et al., 2019; Kaiser et al., 2022; Klapper and Lusardi, 2020; Oggero et al., 2023; Sansone et al., 2019; Sconti et al., 2024). However, most of this literature focuses on a specific financial education program or a specific segment of the population. That means policymakers still lack a comprehensive model for assessing financial literacy's macro impact on inequality. To conduct a cost-benefit analysis of large-scale financial education initiatives, a tool is needed that takes into account the heterogeneity of the population.

In this paper, we provide a framework for conducting such analysis via the creation of hypothetical scenarios with minimal data requirements. This framework can be applied to an extended range of countries. Specifically, we propose a replicable framework to compute the influence of financial literacy on income and wealth across a country's full population, quantifying both its average and distributional effects. While causality cannot be fully established, this methodology presents several advantages. First, the data requirements are minimal. All that is needed is a micro-level survey of household income and assets and the Big Three questions[1] that are commonly used to gauge financial literacy. Such data is readily available in many countries for all income levels. If not already present, the Big Three questions can easily be included in future waves of any household-level survey, as shown by Lusardi and Mitchell (2014). Second, the method provides both aggregate-level results—needed for budgeting purposes—as well as a detailed picture of heterogeneity across demographics. The latter is important in targeting at-risk populations/vulnerable groups. Third, the rigorous statistical technique adopted in this work, the Recentered Influence Functions (RIF) regressions proposed by Firpo et al. (2009), is well established and easily implementable through standard econometric packages.

To the best of our knowledge, this is the first paper to apply this method to exploit the relationship between financial literacy and equivalized disposable income and wealth inequality. We apply this method to Italy using the 2016 Bank of Italy Survey on Household Income and Wealth (SHIW).[2] Italy is an interesting case study because it maintains the lowest levels of financial literacy among OECD countries and shows a statistically significant gender gap at an early stage of life (OECD, 2014).[3] Moreover, our work is timely in supporting mandatory financial education in Italian schools. A national law in April 2023 called for compulsory financial education; its implementation should unfold over the next three years (*DDL Capitali*).[4]

Based on previous literature, the reasonable expectation related to an increase in financial literacy would be a growth in the mean values of household income/wealth. However, the potential "direction" of the influence of an increase in financial literacy levels on income/wealth inequality is unknown a priori. Indeed, an increase in inequality levels would be expected if the increase in financial literacy levels favors more households with high levels of income/wealth, whereas an inequality decrease would be expected if the increase of financial literacy goes more in favor of households with low levels of income/wealth.

Our main results suggest that financial literacy significantly influences values and inequality levels of household income and wealth. In particular, if 10 % of the survey respondents who answered none of the three financial literacy questions correctly were replaced with respondents reporting two correct answers out of three, keeping constant all the observed characteristics, the mean value of the household equivalized disposable income seems to increase by 0.8 %. The increase in the mean value seems to be even higher if we replace respondents reporting no correct answers with those reporting three correct answers (+1.5 %). These results are not insignificant. Heterogeneous analysis shows that an increase in financial literacy levels may change outcomes across the population, often associated with a greater reduction of inequality among the most vulnerable groups. We calculate that if this same income increase were made possible through a lump sum transfer, it would be extremely expensive, annually costing as much as €7 billion. Given that the expected annual costs linked to the introduction of mandatory financial education in Italian schools are about €32 million, the potential financial benefits of using education policy as a tool seem to be huge.

Lo Prete (2013) finds a preliminary link between income inequality and basic knowledge of economics. Her findings show that income inequality grows at a lesser rate in countries where economic literacy is higher. In addition, Lusardi et al. (2017) suggest that a lack of financial knowledge accounts for 30 % to 40 % of wealth inequality in retirement. Financial literacy seems to be the skill people need to improve their financial decisions, particularly among the most vulnerable groups (OECD, 2017, 2020; Lusardi, 2015, Nieddu and Pandolfi, 2021). A recent *meta*-analysis suggests that financial education is effective in improving both financial knowledge and

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[1] To measure financial literacy, Lusardi and Mitchell in the early 2000s created three simple and basic questions to capture the fundamentals of personal finance (see Appendix B). These questions are known worldwide as the Big Three and investigate how people deal with inflation, compound interest, and risk diversification concepts necessary for financial decisions. These questions revealed that knowledge is poor throughout the world (with only 2.1 per cent of countries qualifying as top performers), particularly among the young, women and the older adults (OECD, 2014). The Big Three questions are mainly used to assess financial literacy among adults. Due to higher comparability with several national and international surveys and our target group's age, we follow Lusardi and Mitchell's (2011) approach.

[2] SHIW data are available at the following link: https://www.bancaditalia.it/statistiche/tematiche/indagini-famiglie-imprese/bilanci-famiglie/distribuzione-microdati/index.html (last visited on September 24, 2022).

[3] The OECD countries' financial literacy ranking is available at the following link: https://www.oecd.org/financial/education/oecd-infe-2020-international-survey-of-adult-financial-literacy.pdf (last visited on September 24, 2022).

[4] https://www.ansa.it/sito/notizie/economia/2023/04/11/ddl-capitali-leducazione-finanziaria-entra-nelle-scuole_7b26f856-bc6d-41f4-8a9c-38a9e5ce9617.html.

behavior (Kaiser et al., 2022). However, wealth inequality may influence schooling supply and the private demand for education (Mariella, 2022). Our results suggest that by providing mandatory financial education in schools potential sources of inequality can be reduced at an early stage of life.

We contribute to the literature in many ways. By analyzing the hypothetical scenarios in which part of the population becomes, *ceteris paribus*, financially literate, we can suggest the expected quantitative importance of financial knowledge and perform informative policy experiments. Our work also helps to estimate the economic worthiness of a universal financial education policy at the national level in a 'bias-free' context. For instance, the self-selection bias makes it impossible to evaluate the impact of several financial education initiatives. When a rigorous impact evaluation is possible, other studies find a positive effect of financial education on economic outcomes. However, evidence is mainly available in the short run (Kaiser et al., 2022).

Exploiting the relationship between financial literacy and income and wealth distribution is crucial for three main reasons. First of all, inequality levels are currently reaching their highest levels worldwide, carrying with them an additional widening of the gender gap (Fonseca et al., 2012; Driva et al., 2016). A second reason involves the most vulnerable groups: women, minorities, the young, and older adults. They are more likely to lack an understanding of the ABCs of finance, and they face greater challenges in managing their money. Third, too many householders are financially fragile, being unable to come up with US$2,000 in response to an exogenous financial shock (Lusardi et al., 2021). These cited concerns have all been exacerbated since 2022, when inflation hit its highest level in four decades.

Inequality, as well as deficit living conditions among the poorest, carries policy implications. Financial distress prevents people from participating in economic and social life. The lowest participation levels are found among vulnerable groups in both developing and developed countries. For instance, only 47 % of women, versus 55 % of men, have access to an account at a traditional financial institution, and their ability to obtain formal credit is also lower (World Bank, 2020). It is important to note that those experiencing prolonged financial distress are more likely to resist new technologies, avoid investment in education and health, and feel low levels of life satisfaction and personal control (Farkas et al., 2000; Kraus et al., 2009; Haushofer and Fehr, 2014; Carvalho et al., 2016; Poluektova et al., 2022).

The remainder of the paper is organized as follows. Section 2 describes our subsample of SHIW data and the financial literacy measure we use. Section 3 explains our empirical strategy using the RIF method to address our hypotheses. Section 4 shows the critical potential influences that financial literacy may have on household income and wealth and summarizes the main findings. Section 5 presents a discussion on the economic worthiness of a universal financial education policy. Finally, Section 6 offers a conclusion. Robustness checks and additional analyses are included in the Appendix.

2. Data and definition of financial literacy

To investigate the link between financial literacy and inequality we use data from the Bank of Italy Household Income and Wealth Survey (SHIW). For each household, SHIW asks one person, generally the person in charge of the household's wealth management, questions about financial habits and knowledge. It is worth noting that in the 2016 wave, contrary to the 2020 wave, for instance, householders are allowed to ask other family members to answer financial literacy questions. Although the Bank of Italy's historical data collection started in the 1960s, financial knowledge questions are included in only five waves and those questions have changed in number and content over time. The SHIW survey included six financial knowledge questions in 2006, nine in 2008, and three in both 2010, 2016, and 2020. Any financial literacy specifications measured on this data confirm a positive relationship between financial knowledge and behavior (D'Alessio et al., 2021; Di Salvatore et al., 2018; Sconti, 2022a).

Mainstream literature identifies financially literate respondents as those who correctly answer all of the Big Three, the three questions proposed by Lusardi and Mitchell (2011) to gauge basic knowledge. In other words, those who correctly answer one, two, or none out of the Big Three questions are considered financially illiterate. The Big Three cover three simple but essential topics: inflation, compounded interest, and risk diversification. Although there is evidence that a standardized indicator including questions from previous waves is performing well, we restricted our sample to participants in the 2016 wave, which relies on the Big Three, the most rigorous measure of financial literacy. This enables us to generalize our findings to make them comparable to analog data collection from other countries. The 2016 wave is the last one prior to the Covid-19 pandemic. Dramatic negative shocks on incomes have been reported in several studies using post-Covid results, such as Gallo and Raitano, 2023. Some recent studies also warn of potential discontinuities in the survey designs to deal with pandemic-related restrictions (Rothbaum et al., 2021; Ward and Edwards, 2021; Meyer et al., 2022). Also, the Bank of Italy provides evidence of critical data issues in their methodological notes[5] about the 2020 SHIW

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[5] For further information please consider reviewing the methodological notes provided by Bank of Italy (2022) and available at the following link: https://www.bancaditalia.it/pubblicazioni/metodi-e-fonti-note/metodi-note-2022/MOP_IBF_en.pdf?language_id=1 (Last retrieved: April 10, 2024). Bank of Italy (2022) reports that, starting from the 2020 survey, secondary sampling units are stratified based on household income and indebtedness. On top of that, Bank of Italy (2022:4) reports that participation in the 2020 survey has been strongly impacted by the COVID-19 pandemic: "*The 2020 sample includes about 6,240 households, with a participation rate of 30 per cent (60 per cent for panel households and 20 per cent for non-panel households)*". We believe that this very low participation rate during the pandemic period supports our empirical strategy, thus performing our main analysis on 2016 data. Also, further elaborations of the authors on the 2020 SHIW data show that both households' equivalized disposable income and wealth mean values are much higher than those in 2016, highlighting our concerns about the oversampling of high-income households. For all the reasons above, we just keep a selection of 2020 wave results in the Appendix (see Table A9). More details are available upon request to the authors.

wave. For this reason, even if it includes the Big Three questions, we keep the 2016 wave as the main analysis (results based on the 2020 wave are reported in the Appendix, see Table A9).

Our sample analysis counts 7,421 respondents who are mainly householders. Specifically, the sample is composed of 94 % householders (of which 75 % are "breadwinners," meaning they earn the highest individual income in the family), 5 % spouses, and 1 % other family members. Even though the percentage of the other family members as respondents is small, we consider it a more comprehensive approach to generalize our results. Table 1 reports summary statistics on the variables used in our analysis.

We ended up with a total sample composed, on average, of 57-year-old respondents. The sample was gender-balanced (49.6 % women) and highly educated (half of the respondents have at least upper secondary education and 15 % had parents who were college graduates). Average household equivalized disposable income is €19,420, while wealth is €133,472.

2.1. Some sample statistics on financial literacy

Fig. 1, which is based on the Big Three questions, shows respondents' average financial literacy across Italian regions. The lighter the blue color, the lower the respondents' financial literacy. As is clear from the map, financial illiteracy is more widespread in areas with lower economic development, such as in Italy's southern region.

Financially literate respondents make up only 28 % of our sample. We find a financial literacy gender gap emerging, with women performing worse than men, even when the woman is the breadwinner. This is consistent with previous literature (Hsu, 2016). We also confirm the positive relationship between higher education and financial literacy: 48.9 % of higher-educated respondents (i.e., those with tertiary education) meet the criteria for financial literacy, compared to only 34.4 % of those with upper secondary education, 21 % of those with lower secondary education, and 10 % of those with primary education or lower. These characteristics are crucial in the interpretation of our results.

Figs. 2 and 3 show the breakdown of financially literate/illiterate respondents by the number of correct answers, along with family income or wealth distribution. The figures look at the number of correct answers by respondents within each decile of income/wealth. (The values add up to 1 vertically.) Respondents who answer all Big Three questions incorrectly account for 40 % of households in the first decile of household equivalent income. Those who answer all Big Three questions correctly represent half of the households in the top decile of equivalent household income. The latter also represent about half when we look at the household wealth distribution.

Nowadays, to safeguard the whole economic cycle, policymakers focus on preventing additional financial inequalities. However, investment in financial literacy to improve financial wellbeing could be also beneficial in reducing inequalities. The strong graphic correlations in Figs. 1-3 support our hypothesis that financial education interventions could be associated with lower income and wealth inequalities.

3. Empirical strategy

Let F be the distribution function of household incomes and $v(F)$ denote a distributional statistic, such as the mean or a quantile. Since we can identify four different types of respondents in Italy according to the number of correct answers to the Big Three questions (i.e., 0 correct answers out of 3, 1 out of 3, 2 out of 3, and 3 out of 3), F can be expressed as

$$F(y) = \sum_{x=1}^{4} s_x F_x(y) \tag{1}$$

where y is the household equivalized disposable income (i.e., the outcome variable),[6] F_x is the household income distribution among respondents belonging to the type x group, and s_x is the proportion of the total population of respondents reporting that number of correct answers.

The method proposed by Firpo et al. (2009) aims to assess the impact of a marginal change in the distribution of the explanatory variables on the distributional statistic $v(F)$. We can formally define this change on the statistic v as

$$\Delta v = \lim_{t \downarrow 0} \frac{v(G_1^{F,t,4}) - v(F)}{t} \tag{2}$$

where $G_1^{F,t,4}$ is the household income distribution after substituting a proportion t of respondents belonging to the type 1 group (i.e., no correct answers to the Big Three questions) with others belonging to the type 4 group (i.e., three correct answers out of three), that is

$$G_1^{F,t,4} = (s_4 + t)F_4(y) + (s_1 - t)F_1(y) + \sum_{x=2}^{3} s_x F_x(y). \tag{3}$$

Specifically, Firpo et al. (2009) propose to assess the rate of change of the distributional statistic v caused by an infinitesimally small change in the income distribution (from F to G) by means of the influence function (IF) introduced by Hampel (1974). As explained by Rios-Avila (2020), the IF is a directional derivative that can also be interpreted as the influence that observation y_i has on the estimation of the distributional statistic v. The IF can be formally defined as follows:

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[6] Values of household income and wealth have been equalized using the OECD-modified equivalence scale.

Table 1
Sample statistics.

	Total sample		Financially illiterate		Financially literate	
	Mean	Std. dev	Mean	Std. dev	Mean	Std. dev
Household equivalised disposable income (€)	19.420	12.992	17.560	11.066	24.268	16.036
Household equivalised disposable wealth (€)	133.472	216.471	112.819	185.959	187.307	273.659
Correct answers = 0	0.226	0.419	0.313	0.464	0.000	0.000
Correct answers = 1	0.193	0.395	0.267	0.442	0.000	0.000
Correct answers = 2	0.303	0.460	0.420	0.494	0.000	0.000
Correct answers = 3	0.277	0.448	0.000	0.000	1.000	0.000
Female	0.496	0.500	0.526	0.499	0.418	0.493
Foreign	0.064	0.244	0.077	0.267	0.028	0.164
Aged 40 or lower	0.177	0.381	0.171	0.377	0.191	0.393
Aged 41–50	0.212	0.409	0.200	0.400	0.242	0.428
Aged 51–60	0.194	0.395	0.183	0.387	0.221	0.415
Aged 61–70	0.178	0.383	0.173	0.378	0.193	0.394
Aged 71 or more	0.239	0.427	0.272	0.445	0.153	0.360
Primary education or lower	0.214	0.410	0.265	0.442	0.082	0.275
Lower secondary education	0.284	0.451	0.308	0.462	0.221	0.415
Upper secondary education	0.366	0.482	0.330	0.470	0.459	0.498
Tertiary education	0.136	0.342	0.096	0.295	0.239	0.426
Graduated parents	0.150	0.357	0.116	0.321	0.237	0.425
Single	0.195	0.397	0.200	0.400	0.183	0.386
Married	0.535	0.499	0.507	0.500	0.607	0.488
Divorced/separated/widowed	0.270	0.444	0.293	0.455	0.210	0.407
Blue-collar worker	0.183	0.387	0.194	0.395	0.156	0.363
White-collar worker	0.151	0.358	0.130	0.336	0.204	0.403
Teacher/manager/director	0.059	0.236	0.041	0.197	0.109	0.311
Self-employed	0.095	0.293	0.085	0.279	0.121	0.326
Unemployed	0.061	0.239	0.068	0.253	0.041	0.199
Retired from work	0.278	0.448	0.281	0.449	0.272	0.445
Other retired	0.082	0.275	0.103	0.304	0.029	0.167
Other inactivity status	0.090	0.286	0.099	0.298	0.067	0.250
Household size = 1	0.337	0.473	0.368	0.482	0.256	0.436
Household size = 2	0.267	0.442	0.262	0.440	0.281	0.450
Household size = 3	0.176	0.381	0.165	0.371	0.205	0.404
Household size = 4	0.160	0.367	0.144	0.351	0.202	0.402
Household size = 5 or more	0.060	0.238	0.062	0.241	0.056	0.229
Presence of minors	0.238	0.426	0.214	0.410	0.302	0.459
Work intensity < 0.5	0.071	0.257	0.076	0.266	0.058	0.233
Work intensity = 0.5	0.173	0.378	0.177	0.381	0.164	0.370
0.5 < Work intensity < 1	0.102	0.302	0.097	0.296	0.114	0.318
Work intensity = 1	0.654	0.476	0.650	0.477	0.664	0.472
North-East	0.279	0.448	0.274	0.446	0.290	0.454
North-West	0.196	0.397	0.181	0.385	0.235	0.424
Middle	0.205	0.404	0.185	0.388	0.258	0.438
South	0.244	0.430	0.284	0.451	0.141	0.348
Islands	0.076	0.265	0.076	0.266	0.076	0.264
Observations	7,421		5,444		1,977	

Notes: Descriptive statistics are computed with household sample weights. The variable description is provided in Appendix (Table A1). Correct answers equal to 0, 1 or 2 out of the Big Three identify financially illiterate respondents, while Correct answers equal to 3 identifies financially literate ones. Source: Elaborations by the authors on SHIW 2016 data.

$$\text{IF}(y; \nu, F) = \lim_{t \downarrow 0} \frac{\nu\big((1-t)F + t\Delta_y\big) - \nu(F)}{t} \tag{4}$$

However, instead of using the IF directly, Firpo et al. (2009) propose using its recentered version, thus the RIF, which can be defined as follows:

$$\text{RIF}(y; \nu, F) = \nu(F) + \text{IF}(y; \nu, F) \tag{5}$$

Moving from the IF to the RIF has no relevant impact in terms of regression analysis, but it changes the outcome interpretation: the RIF reports the relative contribution that observation y_i has on the estimation of the distributional statistic ν (Rios-Avila, 2020).

Once the values of $\text{RIF}(y; \nu, F)$ are computed for all the observations of the distributional statistic $\nu(F)$, Firpo et al. (2009) estimate the effects of small changes in the distribution of the explanatory variables on the distributional statistic through the estimation of unconditional quantile regressions. Following the authors, we assume a simple linear relationship between the RIF and the vector of explanatory variables X, so that we can use linear (OLS) models for the estimation of RIF regressions. The resulting effect is generally
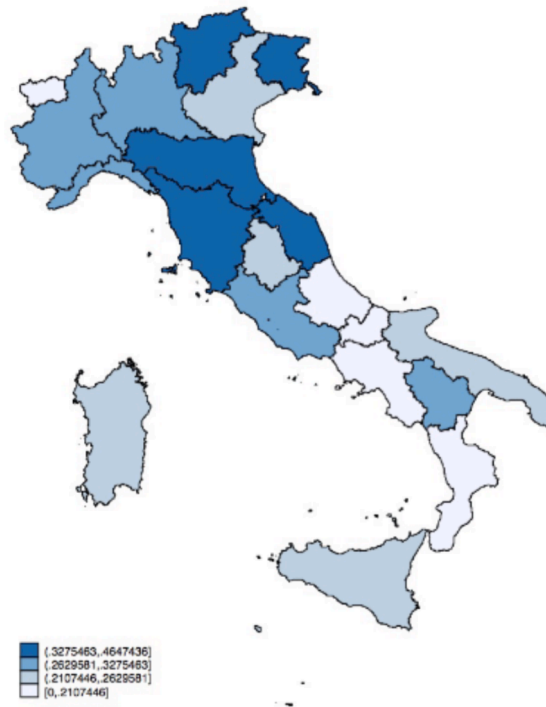
Fig. 1. Financial literacy distribution across Italian regions. .
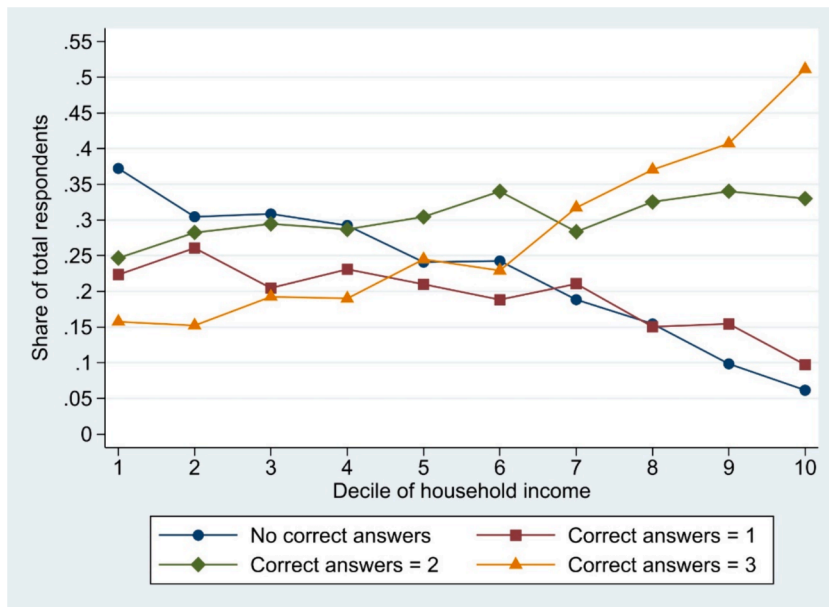Source: Elaborations by the authors on SHIW 2016 data

Fig. 2. Financial literacy and household income. Notes: The figure shows the composition of respondents by number of correct answers within each decile of income (the values add up to 1 vertically) .
Source: Elaborations by the authors on SHIW 2016 data

labeled as the 'unconditional partial effect' (UPE) (Firpo et al., 2009; Choe and Van Kerm, 2018; Rios-Avila, 2020) or 'policy effect' (Rothe, 2010; Gallo and Pagliacci, 2020).

With respect to the (conventional) quantile regression method developed by Koenker and Bassett (1978), the unconditional quantile regression method offers the ability to estimate the effects on an outcome variable distribution that is not conditioned by the
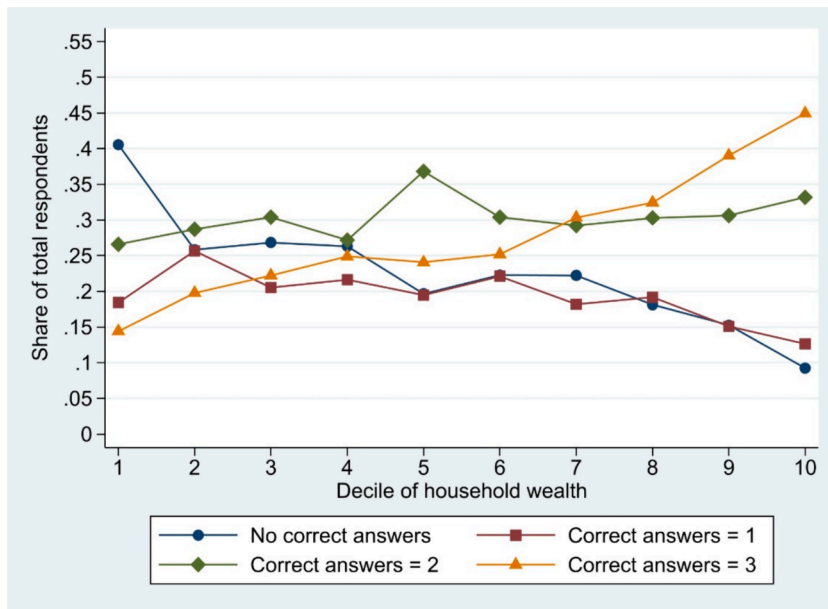
Fig. 3. Financial literacy and household wealth Notes: The figure shows the composition of respondents by number of correct answers within each decile of wealth (the values add up to 1 vertically) .
Source: Elaborations of the authors on SHIW 2016 data

set of covariates included in the model (Fortin et al. 2011). In other words, the unconditional quantile regression methodology allows for consideration of the socioeconomic characteristics that may diverge across groups of respondents and potentially lead to incorrect effects on the distributional statistics. To this end, the model specification of RIF regressions must include, beyond the vector X of interest, a vector Z of relevant covariates including demographic characteristics of the respondents (i.e., gender, citizenship, age group, education level, dummy for tertiary education of parents, marital status, and occupational status) and the household (i.e., household size, presence of minors, work intensity, and macro-region of residence). More details on variables included in the model are provided in Table A1.

Similarly to Choe and Van Kerm (2018) and Bonacini et al. (2021), we set the 'financial literacy shift' t, thus the marginal change illustrated in Equations 2–4, to equal 0.1 in order to estimate the UPEs. This means that in the analysis we assume as marginal change a 10 % swapping share of respondents from one group (i.e., no correct answers to the Big Three questions) to another group. In this 'shares swap' scenario, within-groups household income distributions remain constant. The core idea of this methodology is the following: if the described marginal change is associated with significant effects on distributional statistics, then the level of financial literacy in the population influences the household income distribution. In other words, the bigger the estimated coefficients and the greater their distance from zero, the more important the role that financial literacy (as measured by the number of correct Big Three answers and, thus, financial literacy in general) seems to play in the household income distribution of the analyzed country.

With the mechanism we have described, of course, it is very helpful to understand the econometric method adopted and, in particular, how the hypothetical scenarios emerging from the shares swapping and our results need to be interpreted. Nonetheless, the mechanism may reveal little as regards the actual channels through which an increase in financial literacy levels produces an increase in both household income and wealth levels.[7] Given the existing literature and the descriptive evidence illustrated in Section 2.1, we take three steps to explain the potential outcome of an increase in financial literacy. First, we assume the implementation of a universal policy, such as the introduction of mandatory financial education courses at secondary schools, may increase levels of financial literacy for many cohorts of students. The opportunity to implement such a policy in the Italian context is explored further in Section 5. Second, as financial literacy is positively correlated with income levels (Fig. 2), we expect that skills and behavior patterns linked to higher levels of financial literacy would allow a share of the population to be better remunerated in the labor and financial markets. Finally, cumulated income gains and a better understanding of financial and credit markets linked to the increase of financial literacy levels could be associated with an increase in household wealth values in the medium-long term. If, as expected, the extent of all these influences is greater among vulnerable population groups, then the financial literacy increase is likely to lessen existing inequality levels. These steps come all at once in our hypothetical scenarios, but in the real world, they unfold in tandem with changes in in-dividuals' attitudes and economic behaviors. Since the hypothetical scenarios generated by the method of Firpo et al. (2009) work in the absence of general equilibrium effects, these changes are not explored in this study. In addition, the results based on the meth-odology adopted do not imply changes in individuals' economic behaviors but are driven by the existing population characteristics.

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[7] A similar mechanism is theoretically supported by the model proposed by Lusardi et al. (2017).

The fact that the influence of an increase in financial literacy levels is different on inequality levels of household income and wealth or by swapping scenarios may be strictly related to the individual characteristics and, in particular, the positioning in the actual income/wealth distribution of respondents by the number of correct answers to the Big Three questions.

In our analysis, we estimate the unconditional effects of financial literacy on household income distribution by focusing on the following distributional statistics: the mean, the Gini index, and the nine deciles.[8] The formula to calculate the RIFs for the mean is the following:

$$\text{RIF}(y; \mu(F), F) = \mu(F) + (y - \mu(F)) \tag{6}$$

The formula to calculate the RIFs for the pth quantile is the following:

$$\text{RIF}\left(y; q_p, F\right) = q_p + \frac{p - 1\left\{y \le q_p\right\}}{f(q_p)} \tag{7}$$

where $f(q_p)$ is the density function at the quantile p (Firpo et al., 2009; Choe and Van Kerm, 2018; Rios-Avila, 2020). The formula to calculate the RIFs for the Gini index (v^G) is the following:

$$\text{RIF}(y; v^G, F) = v^G + 2\frac{y}{\mu(F)}\left[F(y) - \frac{(1 + v^G)}{2}\right] + 2\left[\frac{(1 - v^G)}{2} - GL(p; F)\right] \tag{8}$$

where $(1 + v^G)/2$ and $(1 - v^G)/2$ correspond, respectively, to the areas above and below the Lorenz curve, and $GL(p; F)$ is the generalized Lorenz ordinate of F (Firpo et al., 2018; Rios-Avila, 2020).

Together with the household income, we also explore the potential influence an increase in financial literacy levels may have on the household equivalized wealth—an additional measure of the wellbeing of Italian households.

All estimates are provided in relative terms in the main text and in absolute terms in the Appendix. Relative coefficients are calculated by dividing by the point estimation value for the distributional statistic (i.e., the mean value, Gini index, nine deciles) in the specific subgroup of respondents.

4. Results

Table 2 reports our main results and confirms that financial literacy seems to have a significant influence on values and inequality levels when it comes to household income and wealth at the population level. In particular, column I of Table 2 highlights how replacing 10 % of respondents reporting no correct answers with respondents reporting two correct answers (out of three) seems to increase the mean value of the household equivalized disposable income by 0.8 %, or about €160 per year (see column I of Table A2).[9]

Note that coefficients in Table 2 and Table A2 were scaled by 10 % in accordance with the methodological choices described in Section 3. The associated increase in the mean value seems to be even higher if we replace 10 % of respondents reporting no correct answers with those reporting three correct answers (+1.5 %, equivalent to €285 per year). No significant effect occurs through the replacement of those reporting only one correct answer.

Interestingly, a marginal increase in financial literacy levels seems to be associated with an effect almost three times greater on the mean values of household wealth (column III of Table 2). This is probably related to the fact that looking at wealth values implicitly assumes a long-term perspective where advantages on household incomes related to a higher financial literacy can accumulate one on the other.

As regards the potential influence of financial literacy on inequality levels, columns II and IV of Table 2 show that the effects on the Gini index of both household income and wealth are negative, although barely significant. In other words, in some cases, an increase in the level of financial literacy may overall be associated with a progressive effect on household income and wealth distributions at the national level. In the other possible cases, an increase in the level of financial literacy seems to be associated with a null effect on the inequality levels, while potential inequality growth is never highlighted.[10]

In Figs. 4 and 5 below, we provide graphical evidence of the estimated unconditional effects by decile of household income/wealth to understand why we observe a decrease or null effect on inequality levels in Table 2.

Specifically, Fig. 4 shows that the scenario where respondents with 0 correct answers are swapped with those reporting 2 correct answers is the one presenting the highest unconditional effects in the first decile and the greater magnitude decline along the household income distribution. This trend then likely explains why the reduction of the Gini index is strongly significant in this case.

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[8] Influences of an increase in financial literacy levels on further inequality indexes have been explored. Specifically, we replicated the analysis by looking at the mean log deviation index and the Atkinson index (with an epsilon parameter equal to 1). Results of this additional analysis, presented in the Appendix (Table A3).

[9] Just to give an idea of how the coefficients of our variables of interest change according to the share swap scenario adopted, Table A4 in the Appendix shows the variation of estimated influences on the mean value of household income.

[10] Adopting the respondents with 2 correct answers as base group (instead of those with 0 correct answers), the hypothetical scenario where they are swapped with respondents reporting 3 correct answers suggests a positive influence on inequality levels of household income (i.e. increase of Gini index), but the estimated coefficient is statistically insignificant. More details are available upon request to the authors.

Table 2

Unconditional effects of an increase in the financial literacy levels on the mean and Gini index of household income and wealth.

	Household income		Household wealth	
	(I) Mean value	(II) Gini index	(III) Mean value	(IV) Gini index
Correct answers = 1	0.001	−0.007*	0.008	−0.004**
Correct answers = 2	0.008**	−0.009***	0.025***	−0.002
Correct answers = 3	0.015***	−0.001	0.039***	−0.002
Female	−0.006**	−0.011***	−0.015*	−0.006***
Foreign	−0.025***	0.035***	−0.043***	0.040***
Aged 41–50	0.014***	0.016***	0.043***	−0.006***
Aged 51–60	0.024***	0.007	0.072***	−0.014**
Aged 61–70	0.031***	0.010	0.095***	−0.010
Aged 71 or more	0.040***	0.010	0.140***	−0.003
Lower secondary education	0.017***	0.000	0.038***	0.000
Upper secondary education	0.033***	−0.005	0.069***	−0.002
Tertiary education	0.064***	0.040**	0.124***	0.015*
Graduated parents	0.020***	0.023**	0.056***	0.014**
Married	0.011***	0.004	0.012	−0.001
Divorced/separated/widowed	0.001	0.008**	−0.004	0.006
White-collar worker	0.009***	−0.021***	−0.003	−0.030***
Teacher/manager/director	0.040***	0.014	0.034	−0.025***
Self-employed	0.026***	0.031***	0.089***	−0.014*
Unemployed	−0.028***	0.080***	0.012*	−0.003
Retired from work	0.004	−0.005	0.020**	−0.024***
Other retired	−0.008**	0.013*	0.002	−0.014**
Other inactivity status	−0.004	0.027***	0.029***	−0.013***
Household size = 2	0.006**	0.002	−0.014*	−0.006*
Household size = 3	0.006	−0.013**	−0.032***	−0.015***
Household size = 4	0.005	−0.014	−0.041**	−0.015*
Household size = 5 or more	−0.001	0.006	−0.041**	−0.009
Presence of minors	−0.016***	0.003	−0.001	0.001
Work intensity = 0.5	0.019***	−0.023***	0.021***	−0.006*
0.5 < Work intensity < 1	0.023***	−0.042***	0.013*	−0.012***
Work intensity = 1	0.041***	−0.046***	0.007	−0.023***
North-West	−0.008**	−0.006	−0.001	0.000
Middle	−0.009*	−0.008	−0.010	−0.009***
South	−0.031***	0.009	−0.039***	0.000
Islands	−0.027***	0.009*	−0.034***	0.002
Constant	−0.082***	0.021	−0.145***	0.046***
Observations	7.421	7.421	7.421	7.421
R-squared	0.427	0.157	0.217	0.073

Notes: Standard errors are clustered by NUTS-2 region and estimates are computed with household sample weights; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Regression results reporting absolute variations of household income and wealth values at the national level related to a positive shift in financial literacy are provided in the Appendix (Table A2).

Conversely, although unconditional effects are always significant along the household income distribution, the scenario where respondents with 0 correct answers are swapped with those reporting 3 correct answers leads to stable effects along the distribution. This evidence suggests that the latter scenario would favor households with low and high levels of income in a similar way, therefore not being associated with any significant effect on existing inequality levels. Similar considerations can be made for the results looking at household wealth (Fig. 5).

In fact, Fig. 5, in the case of unconditional effects on household wealth, shows that the estimated coefficients are often significantly different from 0. Interestingly, increasing the number of correct answers to one, from zero, would significantly affect at least the first three deciles. There is a further difference from the results in Fig. 4. In all cases, swapping effects in the lower part of household wealth distribution are significantly greater than those estimated in the higher part of the distribution.

It is important to recall that the very close effects on household income/wealth distribution reported in Figs. 4 and 5 mean that an increase in financial literacy could affect the population similarly, under a relative perspective only. Figure A1 and Figure A2, for household income and wealth, respectively, highlight how an increase in financial literacy might indeed benefit (in absolute terms) most households with higher levels of wellbeing.

However, the Gini index is indeed known and commonly reported to be over-sensitive to changes in the middle of a distribution compared to changes in the distribution tails. For this reason, we replicated our RIF regressions using two alternative inequality indicators that are more sensitive to changes in the distribution tails: the Mean log deviation and the Atkinson index (with an epsilon parameter equal to 1). Table A3 confirms that an increase in financial literacy levels would not be associated with an increase in inequality levels but, rather, a reduction as gauged by income or wealth values. The unconditional effects on inequality levels of household income are insignificant though, while the negative effect on inequality levels of household wealth is significant at a 1 %
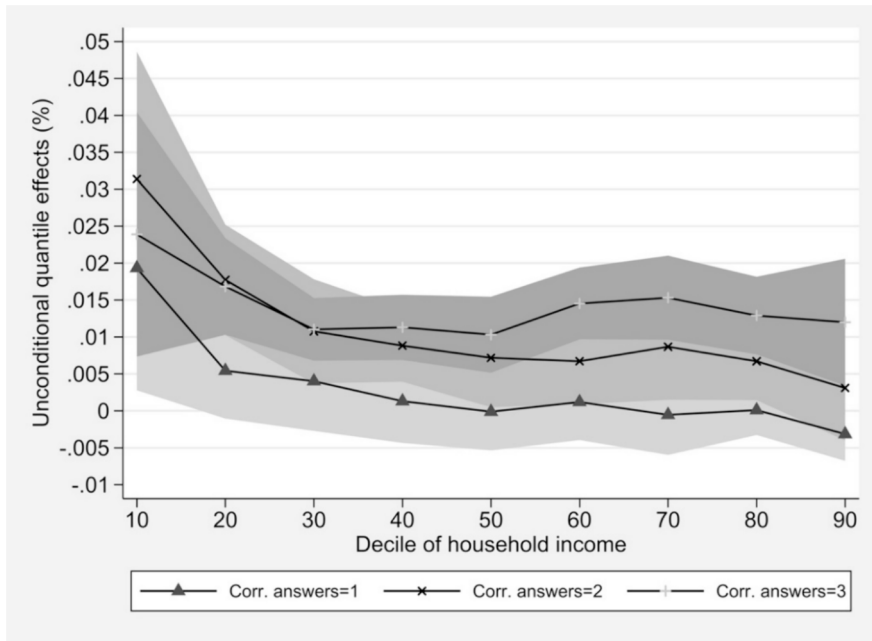
Fig. 4. Unconditional effects of an increase in the financial literacy levels along the household income distribution (coefficients scaled by 10%). *Notes: Standard errors are clustered by NUTS-2 region and estimates are computed with household sample weights. The shadowed area reports confidence intervals at a 90% level. The figures present coefficients of variables of interest only, but the estimation model includes all other covariates shown in* Table 2. *Regression results reporting absolute variations are provided in the Appendix (*Figure A1*).*
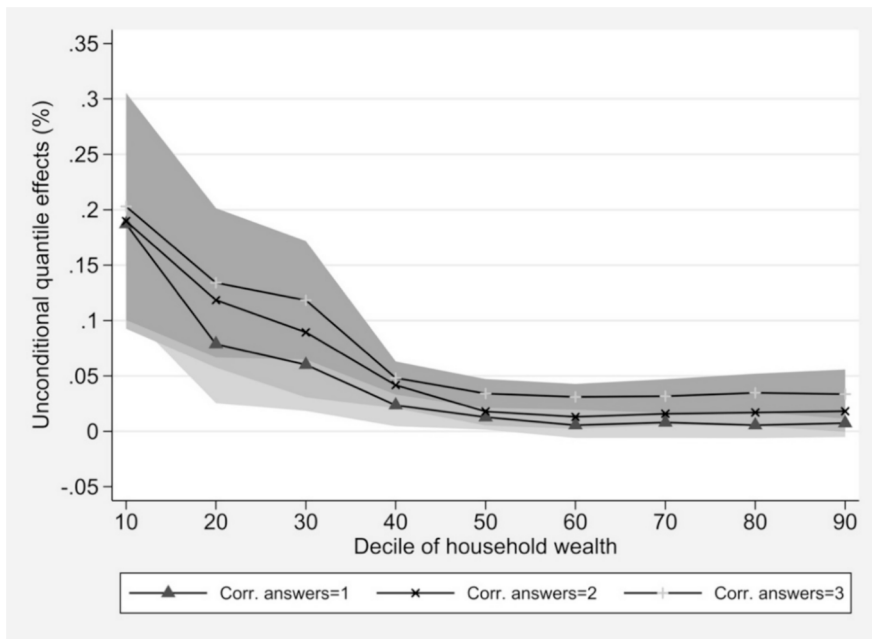

Fig. 5. Unconditional effects of an increase in the financial literacy levels along the household wealth distribution (coefficients scaled by 10%). *Notes: Standard errors are clustered by NUTS-2 region and estimates are computed with household sample weights. The shadowed area reports confidence intervals at a 90% level. The figures present coefficients of variables of interest only, but the estimation model includes all other covariates shown in* Table 2. *Regression results reporting absolute variations are provided in the Appendix (*Figure A2*).*

level for all swapping scenarios (with no relevant differences from one to another), better confirming what is illustrated in Fig. 5.

As further deepening on the reasons behind the influence of an increase in financial literacy levels on household wealth distribution, Table A5 in the Appendix replicates the main evidence of Table 2 disentangling between different subcomponents of the

household net wealth, thus financial assets, real assets, and financial liabilities (the latter expressed in positive terms). Table A5 shows that the positive and significant effect (with increasing magnitude by number of correct answers to the Big Three questions) on the mean value of household wealth is confirmed in all wealth subcomponents. The coefficient magnitudes are only slightly smaller when focusing on the real assets. This evidence suggests that an increase in financial literacy levels would then be beneficial for all kinds of household investments and for the probability of obtaining larger financial liabilities. For example, Lusardi and Tufano (2015) show that better debt literacy is positively correlated with better borrowing conditions, and then probably with easier access to credit. Moving to the unconditional effects on the inequality levels of household wealth, Table A5 shows that the evidence we collect in the main analysis (Table 2), thus that the Gini index significantly decreases only when replacing respondents with 0 correct answers with those reporting 1 correct answer, is mainly due to changes in the real assets distribution.

Conversely, the decrease of the Gini index is instead larger the more the financial literacy levels increase when focusing on financial assets and financial liabilities distributions, even if the coefficient related to the best scenario (i.e. respondents with 0 correct answers are replaced with those reporting 3 correct answers) is statistically significant only for financial liabilities. This trend overall disappears when looking at the total household net wealth. This can be partially explained by the huge fraction of homeownership in the Italian population (80 %) according to the Italian National Institute of Statistics.[11] In line with the aforementioned national statistics, further elaborations of the authors on 2016 SHIW data reveal that the total amount of real assets represents 92 % of the total amount of household net wealth (87 % of total household gross wealth).

4.1. Heterogeneity analysis

To better identify the potential effects and the implications of our analysis on different subgroups of the population, we conduct a heterogeneity analysis across gender, age groups, educational levels, and regions of residence. The influence of a marginal increase in financial literacy appears quite heterogeneous within the analyzed population of respondents (Tables 3 and 4). In particular, Table 3 reveals that both male and female respondents' disposable income would benefit from financial literacy (correctly answering all three questions). That said, the gain in financial knowledge does not lead to any significant change in the relative gender gap, although it slightly reduces the within-group inequality among men for income (Table 3) and among women for wealth (Table 4). When age groups are considered, those who would see the greatest income benefit are middle-aged respondents (aged 41–50). A partial gain in knowledge (two questions correctly answered out of three) seems to be associated with a reduction in inequality within that particular age group.

Interesting results arise for educational levels. Those with the highest level of education would benefit the most in terms of greater disposable income and wealth. In that case, the Gini index is positive and statistically significant, meaning that acquiring basic financial knowledge is associated with different disposable income levels among the most educated respondents. This result suggests that there could be hidden mechanisms that lead part of the population to differently allocate their additional human capital. Previous literature suggests that better-educated people are more likely to participate in the stock market and save more. Based on this theory, we can argue that some of those who gain financial knowledge may start investing their savings more wisely or spend differently to avoid wasting their money. Our results are in line with Lo Prete (2013), who suggests that the ability to benefit from investment opportunities depends on economic literacy, which is not captured by more generic measures of school attainment.

One noteworthy result is that inequality decreases among the most vulnerable groups, such as respondents with lower secondary education. Interestingly, within low-educated groups, a small gain in knowledge (one correct answer out of three) is enough to identify a correlation with a reduction in inequality intra-group.

Finally, the geographical analysis suggests that being able to correctly answer three questions out of three is associated with a statistically significant decrease in inequality in the South of Italy, which nationally has the highest levels of poverty and income inequality (Gallo and Pagliacci, 2020). This is a powerful result that speaks about the critical importance of financial literacy, not only as a necessary skill for overall financial wellbeing but also as a tool that may contribute to reducing inequality where most needed.

Heterogeneous analysis, therefore, reveals that an increase in financial literacy levels is expected to bring different outcomes across the population, often producing a greater reduction in inequality levels among the most vulnerable groups.

4.2. Additional analysis on single questions

In using the Big Three to determine financial literacy, it can be useful to look at each question separately. For instance, numeracy knowledge—the understanding of compound interest—is crucial in making financial decisions that involve return assessment. In this subsection, we examine how correct (or incorrect) answers to any single question are unconditionally tied to income or wealth levels and compare that to the results when questions are unanswered or receive "do not know" responses.

To do this, we use respondents who replied "Do not know" to one of the Big Three questions as a base group.[12] In this paper, we want to further investigate any source of information offered by the Big Three questions to exploit unconditional effects on

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[11] Data refers to the 2016 wave, but is almost equal to the most recent wave available for 2022. For further information on homeownership in Italy please visit the official website at the following link: https://dati.istat.it/Index.aspx?DataSetCode=DCCV_TITGODABIT# (Last retrieved: April 10, 2024).
[12] Since very few respondents choose "Refuse-to-answer" to each one of the Big Three questions, we included them in the base group of the "Do-not-know" respondents.

Table 3

Unconditional effects on the mean and Gini index of household income by type of respondent.

Type of respondent	Mean value			Gini index		
	Correct answers = 1	Correct answers = 2	Correct answers = 3	Correct answers = 1	Correct answers = 2	Correct answers = 3
Total sample	0.001	0.008**	0.015***	−0.007*	−0.009***	−0.001
Male	0.003	0.010**	0.018***	−0.009*	−0.010*	−0.002
Female	−0.000	0.009***	0.011**	−0.006	−0.005	−0.001
Aged 40 or lower	0.012***	0.016***	0.017***	−0.022	−0.018	−0.015
Aged 41–50	0.001	0.008	0.024***	−0.004	−0.019***	0.005
Aged 51–60	0.001	0.005	0.001	−0.003	−0.008	−0.008
Aged 61–70	0.007**	0.010***	0.010***	−0.007	−0.001	−0.005
Aged 71 or more	−0.003	0.007	0.018***	−0.005	−0.005	0.009
Primary education or lower	−0.001	0.004	0.015*	0.001	−0.001	0.004
Lower secondary education	0.003	0.005*	0.009***	−0.010**	−0.018***	−0.010***
Upper secondary education	0.003	0.015**	0.020***	−0.006	−0.004	−0.004
Tertiary education	0.032**	0.047***	0.052***	−0.005	0.022	0.046**
North-East	0.002	0.012	0.020*	−0.008	−0.010**	0.005
North-West	0.003	0.008	0.024**	−0.003*	−0.007	0.011
Middle	0.005	0.015*	0.012**	−0.009	−0.001	−0.004
South	0.000	0.008*	0.007***	−0.004	−0.014**	−0.018**
Islands	−0.005	0.001	0.009	−0.004	−0.006	−0.005

Notes: Standard errors are clustered by NUTS-2 region and estimates are computed with household sample weights; *** p < 0.01, ** p < 0.05, * p < 0.1. The table presents coefficients of variables of interest only, but the estimation models include all other covariates shown in Table 2. Full estimation results are available upon request.

respondents' financial outcomes of interest. Table A6 in the Appendix shows the distribution of sample observations by correct answer to each Big Three question, while Table 5 reports the unconditional effects on income (columns I and II) and wealth (columns III and IV) from a gain in (or a lack of) knowledge related to each of the Big Three questions.

The overall results in Table 5 confirm what is shown in Table 2. But this analysis also reveals interesting new evidence. In particular, respondents who chose the "Do-not-know" option are those who show, *ceteris paribus*, the lowest levels of disposable income and wealth. This is true for two questions: numeracy and risk diversification. The difference between the base group and those who wrongly answered the inflation question is insignificant. As expected, an understanding of risk diversification correlates with higher levels of household income and wealth (Figs. A3-A5). Indeed, risk diversification appears to be the most useful knowledge when it comes to producing greater increases in the mean values of income and (especially) wealth at the national level. However, it is also the only knowledge area reporting no statistically significant effects on the Gini index. This is probably due to the fact that we do not observe any significant difference in the financial literacy influence along the distribution across groups (Figs. A10 and A11). Table 5 sheds light on the fact that the narrowing of income inequality through an increase in financial literacy comes mainly when numeracy or inflation knowledge is improved. A better understanding of this evidence is provided by Figs. A6 and A7 in the Appendix. Figs. A8 and A9 clearly illustrate why the effect on the Gini index is insignificant when we focus on household wealth values.

Considering that answers to the Big Three questions tend to intersect with each other (see Table A6 in the Appendix for details), Table A7 makes more explicit which of the Big Three questions drive the results illustrated by Table 2 distinguishing five different combinations of correct answers. Specifically, Table A7 highlights that the inequality decrease in household income/wealth associated with an overall increase of correct answers from 0 to 1 is mainly due to a better performance in the Inflation or Risk diversification questions, while the increase of correct answers from 0 to 2 reduces the Gini index of the household income only when it refers to the combination of Inflation and Risk diversification correct answers. As an important conclusion, therefore, the reduction of inequality levels seems to be mainly associated with an increase in the levels of knowledge regarding inflation and risk diversification.

Previous literature on the "Do-not-know" respondents suggests that one-third of the financial literacy gender gap may be due to a lack of confidence (Bucher-Koenen et al., 2021). Table A8 in the Appendix, which reports the sample composition by gender and kind of answer to each Big Three question, indeed shows that "Do-not-know" respondents are most often female. For this reason, we propose here an interesting deepening of the potential gender differences on the unconditional effects of the Big Three questions on respondents' household income and wealth distributions. Table 6, which presents a replication of Table 5 by gender, highlights that moving from the 'Do-not-know' answer to the correct answer does not bring particularly different results by gender (but the fact that an increase in the inflation knowledge is associated with a decrease in the Gini index of household income for men only). Conversely, when moving from the 'Do-not-know' answer to the wrong answer, we observe a significant increase in the mean values of household

Table 4

Unconditional effects on the mean and Gini index of household wealth by type of respondent.

Type of respondent	Mean value			Gini index		
	Correct answers = 1	Correct answers = 2	Correct answers = 3	Correct answers = 1	Correct answers = 2	Correct answers = 3
Total sample	0.008	0.025***	0.039***	−0.004**	−0.002	−0.002
Male	0.014	0.027***	0.051***	−0.005*	−0.002	0.002
Female	0.004	0.026***	0.024**	−0.005**	−0.001	−0.001**
Aged 40 or lower	0.007	0.018**	0.017	−0.007	−0.003	−0.002
Aged 41–50	−0.000	0.021	0.026**	0.003	0.002	−0.001*
Aged 51–60	0.005	0.014	0.027**	−0.003	−0.001	−0.006
Aged 61–70	0.015	0.021***	0.037**	−0.013**	−0.007	−0.011
Aged 71 or more	0.008	0.033*	0.081***	−0.004	−0.004	0.014*
Primary education or lower	0.008	0.026**	0.052**	−0.003	0.001	−0.002
Lower secondary education	0.012*	0.010	0.028***	−0.004	−0.008*	−0.004
Upper secondary education	0.003	0.030**	0.031***	−0.008*	−0.002	−0.007
Tertiary education	0.081***	0.120***	0.145***	−0.001	0.018	0.026**
North-East	0.001	0.024	0.048	−0.003	−0.007	0.003
North-West	0.023	0.042	0.069*	0.001	0.008	−0.003
Middle	0.022***	0.036**	0.041*	−0.002	0.002	0.002
South	0.009	0.021*	0.015*	−0.007*	−0.000	−0.007
Islands	−0.022	−0.011	−0.010	0.003	0.001	0.004

Notes: Standard errors are clustered by NUTS-2 region and estimates are computed with household sample weights; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. The table presents coefficients of variables of interest only, but the estimation models include all other covariates shown in Table 2. Full estimation results are available upon request.

Table 5

The Big Three questions' unconditional effects on household income and wealth (base group: Do-not-know option).

	Household income			Household wealth	
	(I) Mean value	(II) Gini index		(III) Mean value	(IV) Gini index
Numeracy					
Wrong answer	0.005*	−0.001**		0.015*	−0.003
Correct answer	0.011***	−0.005**		0.023**	−0.004
R-squared	0.424	0.157		0.213	0.073
Inflation					
Wrong answer	0.003	−0.006		−0.001	−0.003
Correct answer	0.006**	−0.006**		0.018**	−0.001
R-squared	0.422	0.157		0.213	0.073
Risk Diversification					
Wrong answer	0.007***	−0.006		0.015**	−0.003
Correct answer	0.013***	−0.001		0.033***	−0.000
R-squared	0.427	0.156		0.218	0.073

Notes: Standard errors are clustered by NUTS-2 region and estimates are computed with household sample weights; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. The table presents coefficients of variables of interest only, but the estimation models include all other covariates shown in Table 2. Full estimation results are available upon request.

income and wealth for women only (except for the risk diversification question where it is significant for both men and women). This evidence suggests that the "underconfidence condition" may represent an even worse status than reporting limited/missing financial education for women.

5. Discussion of costs, benefits, and policy implications in Italy

This discussion on financial literacy's potential to influence income and wealth inequality is incomplete without a cost analysis. Our approach is twofold. First of all, we describe a hypothetical scenario based on population-register statistics to simulate a 10 % swap in Italy. Then we discuss the estimated cost analyses conducted in previous studies in Italy. Finally, we provide a list of the costs to be considered in implementing mandatory financial education in Italy, taking into account the requirements introduced by the *DDL Capitali* law.

In our dataset, 23 % of respondents fail to provide any correct answers to the Big Three. That means about 5.8 million Italian householders are financially illiterate. If 10 % of them become financially literate, the mean value of their households' equivalized disposable income each year would, on average, increase by €285. Considering there are 25.5 million Italian households (ISTAT, 2022), a policy intervention mirroring the same income increase through a lump sum transfer would be extremely expensive, as much as €7.3 billion. Based on the ISTAT 2023 data, approximately 400,000 children are born in Italy every year. To make our 10 % swap hypothesis realistic, assuming that financial education has long-lasting effects on an individual's life, compulsory financial education should be introduced in school for at least two consecutive years. Both public and private schools in Italy are managed by the state and, therefore, are similar in their organization. Italian law provides that all children aged 6 to 16, at least, have the right to study and are subject to compulsory schooling. Education is defined as an 'essential service' by the national law, and the Italian Ministry of Education guarantees the same qualitative standard for schools across the country. This leads to a straightforward policy implication: Scalable financial education initiatives might be a reasonable and cost-effective tool for reducing inequality. The magnitude of our results should be considered only in the Italian context. The same analysis conducted in other countries may lead to effects of different magnitude and economic importance.

Although there is limited cost analysis in previous literature, there is still evidence—both in Italy and other countries—suggesting that financial education works and that it is cost-effective (Kaiser et al., 2022; Sconti, 2022b, Frisancho, 2020). In addition, the true impact of mandatory financial education in schools may be underestimated due to its spillover effects (Lieber and Skimmyhorn, 2018; Frisancho, 2020).

In the Italian context, Sconti (2022b) tested the effectiveness of an eight-hour traditional financial literacy course against that of an eight-hour digitized financial education course. She concludes that each euro spent in the traditional program translates into a 2 % probability that students answer all Big Three questions correctly. The cost-effectiveness ratio for the traditional treatment was reported as 0.02 (0.28/11.04) if the financial advisors were paid for their time.

In other countries, Frisancho (2020) reports a per-pupil cost of $4.80. As noted by Kaiser et al. (2022), this applies to a year-long financial education class for which average and median interventions in the sample are only 12 and 7 h, respectively, which means that the average effect across studies may correspond to lower costs. In addition, Frisancho (2020) provides estimates of limiting opportunity costs and translates that into performance gain: a $1 increase in spending on the program yields a 3.3-point improvement in the OECD-PISA financial literacy assessment.[13] Both Frisancho (2020) and Bruhn et al. (2016) document positive effects and positive externalities beyond the target group (such as teachers' and parents' outcomes).

To calculate the potential cost related to the introduction of mandatory financial education in Italian schools since 2023, let's assume for Italy a €5 cost per pupil annually, which is similar to that reported by Frisancho (2020). The mandatory financial education course should involve all grade levels, meaning 13 different cohorts covering children aged from 6 to 18 years old. Based on the ISTAT 2023 data, about 480,000 children aged 6 years old and about 585,000 individuals aged 18 years old live in Italy. Assuming a linear progression in the decrease of births across these cohorts, there would be about 532,500 children in each cohort, for a total of 6,390,000 children affected by the new policy. With a per-pupil cost of €5, mandatory financial education should then cost about €32 million per year. To achieve the same effect on household income and wealth levels as estimated in Section 4, it would be enough that the expected increase in financial literacy is long-lasting for at least one-eleventh of the large number of children covered by mandatory financial education every year.

Although this assumption could be strong, previous research shows that receiving financial education at an early stage of life can positively affect labor outcomes and financial behavior which supports our hypothesis. On the one hand, among the scant evidence on the long-run effects of financial education, Bruhn et al. (2022) investigate the long-term effects of a comprehensive financial education program through a randomized controlled trial with 892 high schools in Brazil. Using administrative data, in a follow-up of the study on 16,000 students for nine years after the intervention, they find that treated students are less likely to borrow from expensive sources and to have loans with late payments than control students. On top of that, those students exposed to the financial education program are also more likely to own microenterprises and less likely to be formally employed than students in the control group.

On the other hand, Bucciol and Veronesi (2014) investigate how various parental teaching methods during childhood and adolescence influence adults' propensity to save and the amount they save. Analyzing a comprehensive dataset from the Dutch DNB Household Survey on more than 1300 individuals across different age groups tracked for up to 13 years, the authors find that parental instruction on saving enhances the likelihood of adults saving by 16 % and increases the amount saved by roughly 30 %. Optimal results are achieved through a multifaceted approach, combining methods such as providing pocket money, monitoring spending, and offering guidance on budgeting and saving. Notably, the most effective strategy involves giving pocket money to children aged 8–12, coupled with parental oversight on expenditure and advice on saving during ages 12–16. Moreover, solely providing pocket money

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[13] For more details see: https://www.oecd.org/pisa/.

Table 6

The Big Three questions' unconditional effects on household income and wealth by gender (base group: Do-not-know option).

Male respondents				
	Household income		Household wealth	
	(I)	(II)	(III)	(IV)
	Mean value	Gini index	Mean value	Gini index
Numeracy				
Wrong answer	0.003	−0.008*	0.011	−0.001
Correct answer	0.011**	−0.003	0.027*	0.001
R-squared	0.433	0.178	0.242	0.088
Inflation				
Wrong answer	0.000	−0.007	−0.005	−0.004
Correct answer	0.006	−0.007**	0.017	0.000
R-squared	0.431	0.178	0.242	0.088
Risk Diversification				
Wrong answer	0.007***	−0.009	0.012	−0.004
Correct answer	0.014***	−0.003	0.039***	0.000
R-squared	0.436	0.178	0.248	0.088
Female respondents				
	Household income		Household wealth	
	(I)	(II)	(III)	(IV)
	Mean value	Gini index	Mean value	Gini index
Numeracy				
Wrong answer	0.007**	−0.010**	0.019**	−0.004
Correct answer	0.011***	−0.006*	0.019**	−0.008***
R-squared	0.433	0.197	0.182	0.086
Inflation				
Wrong answer	0.009*	−0.005	0.006	−0.002
Correct answer	0.006**	−0.004	0.018**	−0.003
R-squared	0.431	0.195	0.182	0.085
Risk Diversification				
Wrong answer	0.006**	−0.006	0.017**	−0.003
Correct answer	0.011***	−0.000	0.025**	−0.001
R-squared	0.436	0.195	0.185	0.085

Notes: Standard errors are clustered by NUTS-2 region and estimates are computed with household sample weights; *** p < 0.01, ** p < 0.05, * p < 0.1. The table presents coefficients of variables of interest only, but the estimation models include all other covariates shown in Table 2. *Full estimation results are available upon request.*

proves ineffective, while the pivotal factor lies in offering advice, which acts as an informal financial education intervention. Conversely, individuals who did not receive parental teaching tend to delay their savings efforts. The influence of parental financial guidance persists over time, although its impact on the propensity to save diminishes with age, particularly among older adults. Sansone et al. (2019) provided similar findings on the long-lasting effect of pocket money to help children learn about financial topics and develop savvy financial behaviors.

Since already some informal financial education effects are proven to be long-lasting, we reasonably expect that financial education at an early stage of life can positively influence several future financial outcomes.

In other words, there is evidence to believe that the €32 million cost linked to the introduction of mandatory financial education in Italy is much lower than the €7 billion in potential benefits, making this kind of policy worth implementing. Our discussion on the costs and benefits of mandatory financial education is still preliminary and should also take into account, beyond the actual cost of learning materials and teaching training hours, the opportunity cost of introducing financial education in another subject, such as in a civics course, as the Italian law is aiming to do.

6. Conclusions

Financial literacy has been recognized as the essential basic knowledge that can help prevent financial fragility and advance wellbeing of individuals and their households. We contribute to the literature by showing hypothetical scenarios that look at financial literacy's potential to narrow inequality levels when it comes to household income and wealth. To the best of our knowledge, this is the

first paper that examines this using the rigorous unconditional quantile regression method proposed by Firpo et al. (2009).

Our findings indicate that a marginal increment in financial literacy within the population is associated with a significant reduction in both household income inequality and wealth inequality. Our results are robust for different wealth measures, both in relative and absolute terms. If 10 % of households become financially literate, on average the mean value of each of those households' equivalized disposable income would increase by €285 annually. A lump sum payment to Italy's 25.5 million households (ISTAT (2022) to achieve the same benefit would cost an estimated €7.3 billion per year. Financial education seems to offer a much more economical investment.

We use the SHIW to look at financial literacy as measured by the correct answers to the Big Three questions focused on inflation, compounded interest, and risk diversification. To make our 10 %-swap hypothesis realistic, compulsory financial education should be introduced in schools for at least two consecutive years. Our preliminary cost analysis indicates that the expected €32 million investment linked to mandatory financial education in schools in Italy would generate €7 billion in potential benefits, making this kind of policy worth implementing. Our results from a heterogeneity analysis further suggest that the most vulnerable populations are the ones that could most benefit from higher levels of financial literacy.

To sum up, our results demonstrate that financially literate people are positioned to reach higher wealth and income levels. This is a crucial point in supporting empirical evidence in favor of financial literacy effects. The presented evidence carries particular importance because it is based on a national context where levels of financial literacy are extremely low. Italy maintains the lowest levels of financial literacy among OECD countries. One-quarter of the analyzed sample of respondents failed to provide any correct answers to the Big Three questions, meaning that about 5.8 million Italian householders out of 25.5 million are financially illiterate. Since our sample of respondents is mainly composed of householders and breadwinners, strongly assuming they have the highest level of financial literacy within the household, we believe our results may represent an actual lower boundary of the potential effect of a financial literacy increase on household income and wealth values.

The results presented in this paper carry three straightforward policy implications. First, scalable financial education initiatives might be a reasonable cost-effective tool in a greater strategy to reduce inequality. Second, financial education in schools not only provides a pathway for reaching the most vulnerable groups but it provides them with knowledge starting on the same opportunity levels. Third, financial education may have positive externalities, such as reducing financial anxiety and financial fragility. Our findings should be of interest to researchers, academics, and policymakers who seek to design financial education programs and more deeply understand their potential impact on inequality.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

Appendix A. Additional analyses and robustness checks

Table A1
Variable description.

Variable	Description
Household equivalized disposable income	Continuous variable representing the annual household equivalized disposable income. OECD modified equivalence scale was applied. All RIFs on income distributional statistics are based on this variable.
Household equivalized disposable wealth	Continuous variable representing the annual household equivalized disposable wealth. OECD modified equivalence scale was applied. All RIFs on wealth distributional statistics are based on this variable.

Correct answers = 1
    Correct answers = 2
    Correct answers = 3
	Binary variables representing the number of correct answers made replying to the Big Three questions (i.e., those to assess the financial literacy level). The reference category is composed of those reporting 0 correct answers.

Female	Binary variable taking value 1 for female, 0 for male.
Foreign	Binary variable taking value 1 for foreign citizens, 0 for Italian ones.

Aged 41–50
    Aged 51–60
    Aged 61–70
    Aged 71 or more
	Binary variables representing the age group of respondents. The reference category is Aged 40 or lower.

Lower secondary education
    Upper secondary education
    Tertiary education
	Binary variables representing the highest education level achieved by respondent. The reference category is composed of Primary education or lower (i.e., no education).

Graduated parents	Binary variable taking value 1 for those reporting at least one parent with a University degree, and 0 otherwise.
Married Divorced/separated/widowed	Binary variables representing the respondent's marital status. The reference category is composed of Single.

Table A1 (*continued*)

Variable	Description
White-collar worker	Binary variables representing the respondent's occupational status. The reference category is composed of Blue-collar
Teacher/manager/director	worker.
Self-employed	
Unemployed	
Retired from work	
Other retired	
Other inactivity status	
Household size = 2	Binary variables representing the household size. The reference category is Single person (or Household size = 1).
Household size = 3	
Household size = 4	
Household size = 5 or more	
Presence of minors	Binary variable taking value 1 for people living in households with at least one minor child, and 0 otherwise.
Work intensity = 0.5	Binary variables representing the household work intensity status. The work intensity is calculated as the ratio between the
0.5 < Work intensity < 1	number of earners and the number of employable (aged 16 or more) household members. The reference category is Work
Work intensity = 1	intensity < 0.5.
North-West	Binary variables representing the macro-region of residence. The reference category is North-East.
Middle	
South	
Islands	

Table A2
Unconditional effects of an increase in the financial literacy levels on the mean and Gini index of household income and wealth (absolute terms).

	Household income		Household wealth	
	(I) Mean value	(II) Gini index	(III) Mean value	(IV) Gini index
Correct answers = 1	19,5	−0,002*	1081,7	−0,003**
Correct answers = 2	160,7**	−0,003***	3323,7***	−0,001
Correct answers = 3	285,3***	0.000	5205,4***	−0,001
Female	−120,1**	−0,004***	−1963,5*	−0,004***
Foreign	−484,5***	0,011***	−5738,5***	0,025***
Aged 41–50	274,2***	0,005***	5702,9***	−0,003***
Aged 51–60	461,4***	0,002	9550.0***	−0,009**
Aged 61–70	594,4***	0,003	12723,7***	−0,006
Aged 71 or more	780,8***	0,003	18676,4***	−0,002
Lower secondary education	327,4***	0.000	5118.0***	0.000
Upper secondary education	645,5***	−0,002	9168,5***	−0,001
Tertiary education	1238.0***	0,013**	16567,6***	0,009*
Graduated parents	378,7***	0,007**	7474,7***	0,009**
Married	209,5***	0,001	1605	−0,001
Divorced/separated/widowed	11,8	0,003**	−508,7	0,003
White-collar worker	168,2***	−0,007***	−423,3	−0,019***
Teacher/manager/director	775,7***	0,005	4511,5	−0,015***
Self-employed	505,7***	0.010***	11845,5***	−0,008*
Unemployed	−550,7***	0,026***	1535,8*	−0,002
Retired from work	71,3	−0,002	2609,1**	−0,015***
Other retired	−155,2**	0,004*	260,3	−0,008**
Other inactivity status	−78,4	0,009***	3864,8***	−0,008***
Household size = 2	116.0**	0,001	−1860,5*	−0,004*
Household size = 3	121,1	−0,004**	−4326,7***	−0,009***
Household size = 4	98,4	−0,004	−5502,9**	−0,009*
Household size = 5 or more	−22,4	0,002	−5501.0**	−0,005
Presence of minors	−309,5***	0,001	−166,4	0,001
Work intensity = 0.5	365,6***	−0,007***	2747,8***	−0,004*
0.5 < Work intensity < 1	439,5***	−0,013***	1725.0*	−0,007***
Work intensity = 1	788,7***	−0,015***	905,6	−0,014***
North-West	−158,8**	−0,002	−191,7	0.000
Middle	−172.0*	−0,003	−1392,2	−0,005***
South	−606,9***	0,003	−5132,1***	0.000
Islands	−517,6***	0,003*	−4483,9***	0,001
Constant	342,8***	0,039***	−5998,3***	0.090***
Observations	7.421	7.421	7.421	7.421
R-squared	0,427	0,157	0,217	0,073

Notes: Standard errors are clustered by NUTS-2 region and estimates are computed with household sample weights; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table A3

Unconditional effects of an increase in the financial literacy levels on the mean log deviation and the Atkinson index of household income and wealth.

	Household income			Household wealth		
	Gini index	Mean log deviation	Atkinson index (e = 1)	Gini index	Mean log deviation	Atkinson index (e = 1)
Effects in absolute terms						
Correct answers = 1	−0.023*	−0.093	−0.071	−0.027**	−0.584***	−0.117***
Correct answers = 2	−0.028***	−0.116	−0.088	−0.010	−0.514***	−0.103***
Correct answers = 3	−0.003	−0.056	−0.043	−0.014	−0.515***	−0.103***
Effects in relative terms						
Correct answers = 1	−0.071*	−0.338	−0.293	−0.044**	−0.362***	−0.146***
Correct answers = 2	−0.087***	−0.418	−0.363	−0.016	−0.319***	−0.128***
Correct answers = 3	−0.011	−0.204	−0.177	−0.022	−0.320***	−0.129***
Observations	7421	7421	7421	7421	7421	7421
R-squared	0.157	0.157	0.157	0.073	0.152	0.152
Sample distributional statistic	0.320	0.277	0.242	0.616	1.610	0.800

Notes: Standard errors are clustered by NUTS-2 region and estimates are computed with household sample weights; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. The table presents coefficients of variables of interest only, but the estimation models include all other covariates showed in Table 2. Full estimation results are available upon request.

Table A4

Unconditional effects of an increase in the financial literacy levels on the mean value of household income by respondents share swap.

Share swap	Correct answers = 1	Correct answers = 2	Correct answers = 3
10 %	0.001	0.008**	0.015***
20 %	0.002	0.016**	0.030***
30 %	0.003	0.024**	0.045***
40 %	0.004	0.032**	0.060***
50 %	0.005	0.040**	0.075***
60 %	0.006	0.048**	0.090***
70 %	0.007	0.056**	0.105***
80 %	0.008	0.064**	0.120***
90 %	0.009	0.072**	0.135***
100 %	0.010	0.080**	0.150***

Notes: Standard errors are clustered by NUTS-2 region and estimates are computed with household sample weights; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. The table presents coefficients of variables of interest only, but the estimation models include all other covariates showed in Table 2. Full estimation results are available upon request.

Table A5

Unconditional effects of an increase in the financial literacy levels on the mean and Gini index of household wealth and its subcomponents.

Component of total wealth	Mean value			Gini index		
	Correct answers = 1	Correct answers = 2	Correct answers = 3	Correct answers = 1	Correct answers = 2	Correct answers = 3
Total wealth	0.008	0.025***	0.039***	−0.004**	−0.002	−0.002
Financial assets	0.006	0.022**	0.054***	−0.002	−0.003	−0.005
Real assets	0.008	0.026**	0.038***	−0.005**	−0.002	−0.003
Financial liabilities	−0.007	0.036*	0.053*	−0.001	−0.002	−0.004***

*Notes: Standard errors are clustered by NUTS-2 region and estimates are computed with household sample weights; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. The table presents coefficients of variables of interest only, but the estimation models include all other covariates showed in Table 2. Full estimation results are available upon request.*

Table A6

Sample composition by correct answer to each Big Three question.

Numeracy	Inflation	Risk diversification	Observations	Percentage
No	No	No	1,680	22.6 %

Table A6 (*continued*)

Numeracy	Inflation	Risk diversification	Observations	Percentage
Yes	No	No	438	5.9 %
No	Yes	No	644	8.7 %
No	No	Yes	350	4.7 %
Yes	Yes	No	829	11.2 %
Yes	No	Yes	396	5.3 %
No	Yes	Yes	1,027	13.8 %
Yes	Yes	Yes	2,058	27.7 %
Total			7,421	100.0 %

Notes: Descriptive statistics are computed with household sample weights. Source: Elaborations by the authors on SHIW 2016 data.

Table A7

The Big Three questions' unconditional effects on household income and wealth (base group: Do-not-know option). Combinations of correct answers.

	Household income		Household wealth	
	Mean value	Gini index	Mean value	Gini index
Numeracy	−0.002	−0.006	0.004	−0.005
Inflation or Risk diversification	0.003	−0.008*	0.010	−0.004*
Numeracy & (Inflation or Risk div.)	0.010**	−0.008	0.018**	−0.004
Inflation & Risk diversification	0.007**	−0.010**	0.033***	0.001
Numeracy & Inflation & Risk div.	0.015***	−0.001	0.039***	−0.002
Observations	7,421	7,421	7,421	7,421
R-squared	0.427	0.157	0.218	0.073

Notes: Standard errors are clustered by NUTS-2 region and estimates are computed with household sample weights; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. The table presents coefficients of variables of interest only, but the estimation models include all other covariates shown in Table 2. Full estimation results are available upon request.

Table A8

Sample composition by gender and answer to each Big Three question.

Question	Answer	Men	Women	Total
Numeracy	Do not know option	37.9 %	62.2 %	100.0 %
		16.3 %	*27.2 %*	*21.7 %*
	Wrong answer	50.1 %	49.9 %	100.0 %
		28.0 %	*28.4 %*	*28.2 %*
	Correct answer	56.0 %	44.0 %	100.0 %
		55.7 %	*44.5 %*	*50.1 %*
	Total	50.4 %	49.6 %	100.0 %
		100.0 %	*100.0 %*	*100.0 %*
Inflation	Do not know option	38.4 %	61.6 %	100.0 %
		19.5 %	*31.7 %*	*25.5 %*
	Wrong answer	54.5 %	45.5 %	100.0 %
		14.1 %	*12.0 %*	*13.0 %*
	Correct answer	54.5 %	45.5 %	100.0 %
		66.4 %	*56.3 %*	*61.4 %*
	Total	50.4 %	49.6 %	100.0 %
		100.0 %	*100.0 %*	*100.0 %*
Risk diversification	Do not know option	43.0 %	57.0 %	100.0 %
		32.4 %	*43.6 %*	*38.0 %*
	Wrong answer	55.3 %	44.7 %	100.0 %
		11.4 %	*9.4 %*	*10.4 %*
	Correct answer	54.9 %	45.1 %	100.0 %
		56.2 %	*47.0 %*	*51.6 %*
	Total	50.4 %	49.6 %	100.0 %
		100.0 %	*100.0 %*	*100.0 %*

Notes: Descriptive statistics are computed with household sample weights. Percentages in italic represent the column relative frequencies. Source: Elaborations by the authors on SHIW 2016 data.

Table A9

Unconditional effects of an increase in the financial literacy levels on the mean and Gini index of household income and wealth (2020 SHIW wave).

VARIABLES	Household income		Household wealth	
	(I) Mean value	(II) Gini index	(III) Mean value	(IV) Gini index
Correct answers = 1	0.001	−0.006	−0.008	−0.008**
Correct answers = 2	0.005	−0.007**	−0.002	−0.001***
Correct answers = 3	0.017***	0.002	0.031***	−0.005
Observations	6,239	6,239	6,239	6,239
R-squared	0.299	0.125	0.138	0.032

Notes: Standard errors are clustered by NUTS-2 region and estimates are computed with household sample weights; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. The table presents coefficients of variables of interest only, but the estimation models include all other covariates shown in Table 2. Full estimation results are available upon request.
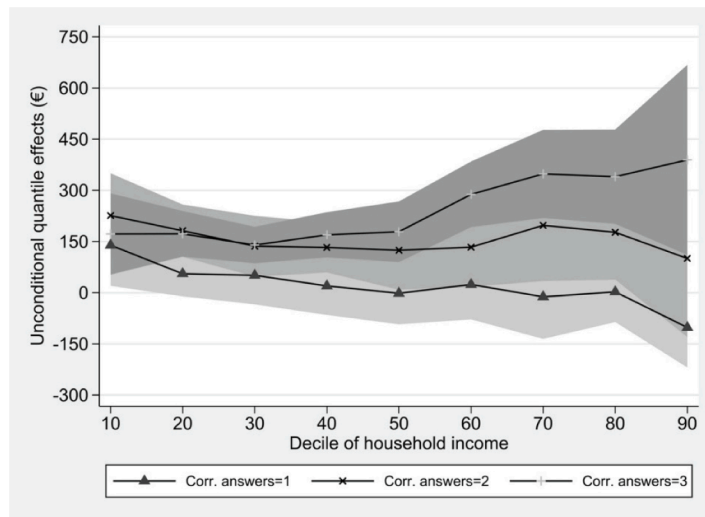
Fig. A1. Unconditional effects of an increase in the financial literacy levels along the household income distribution (absolute terms − coefficients scaled by 10 %). *Notes: Standard errors are clustered by NUTS-2 region and estimates are computed with household sample weights. The shadowed area reports confidence intervals at a 90 % level. The figures present coefficients of variables of interest only, but the estimation model includes all other covariates showed in* Table 2.
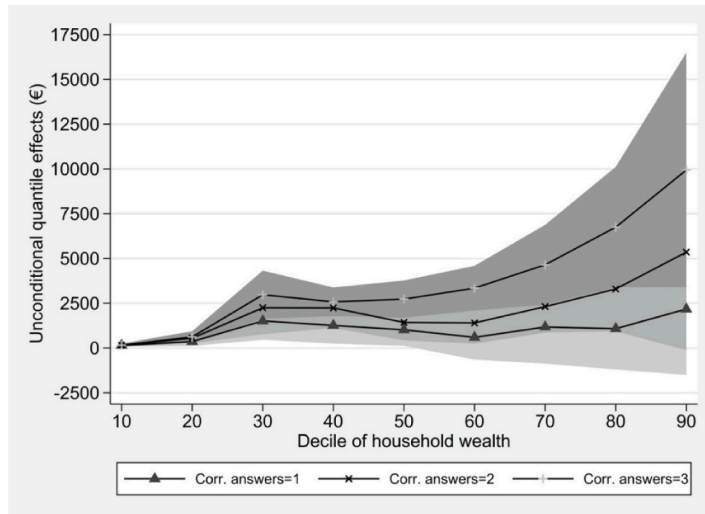
Fig. A2. *Unconditional effects of an increase in the financial literacy levels along the household wealth distribution (absolute terms − coefficients scaled by 10 %). Notes: Standard errors are clustered by NUTS-2 region and estimates are computed with household sample weights. The shadowed area reports confidence intervals at a 90 % level. The figures present coefficients of variables of interest only, but the estimation model includes all other covariates showed in* Table 2.
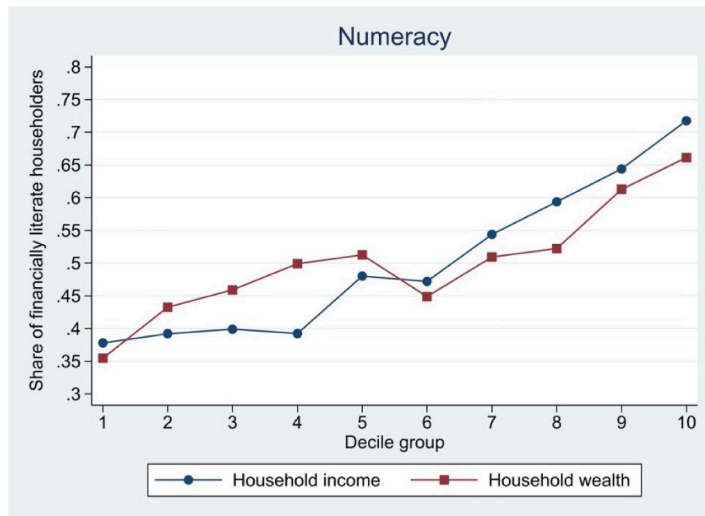
Fig. A3. Numeracy knowledge and income (and wealth) distribution. Notes: The figure shows the composition of respondents by numeracy knowledge within each decile of income or wealth (the values add up to 1 vertically) Source: Elaborations of the authors on SHIW 2016 data.
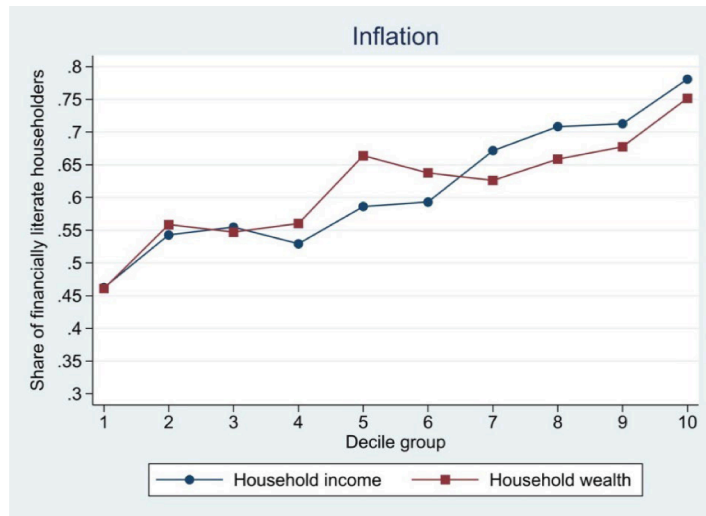
Fig. A4. Inflation knowledge and income (and wealth) distribution. Notes: The figure shows the composition of respondents by inflation knowledge within each decile of *income or wealth (the values add up to 1 vertically) Source: Elaborations of the authors on SHIW 2016 data.*
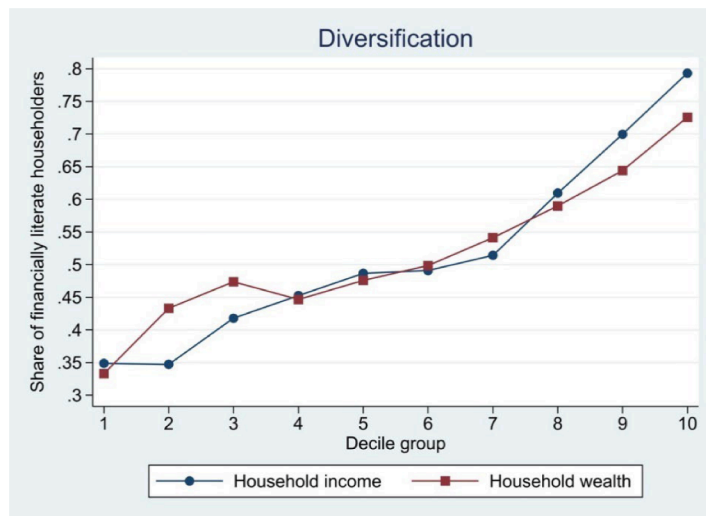
Fig. A5. Inflation knowledge and income (and wealth) distribution. *Notes: The figure shows the composition of respondents by diversification knowledge within each decile of income or wealth (the values add up to 1 vertically) Source: Elaborations of the authors on SHIW 2016 data.*
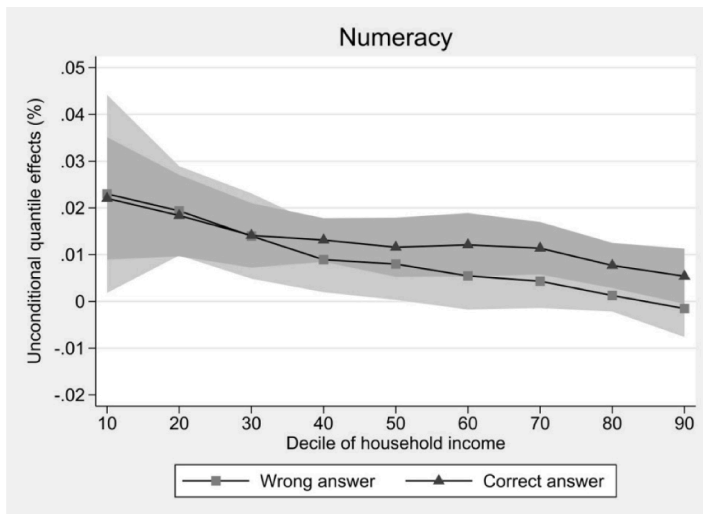
Fig. A6. Unconditional effects of an increase in numeracy knowledge along the household income distribution (absolute terms − coefficients scaled by 10 %). *Notes: Standard errors are clustered by NUTS-2 region and estimates are computed with household sample weights. The shadowed area reports confidence intervals at a 90 % level. The figures present coefficients of variables of interest only, but the estimation model includes all other covariates showed in* Table 2.
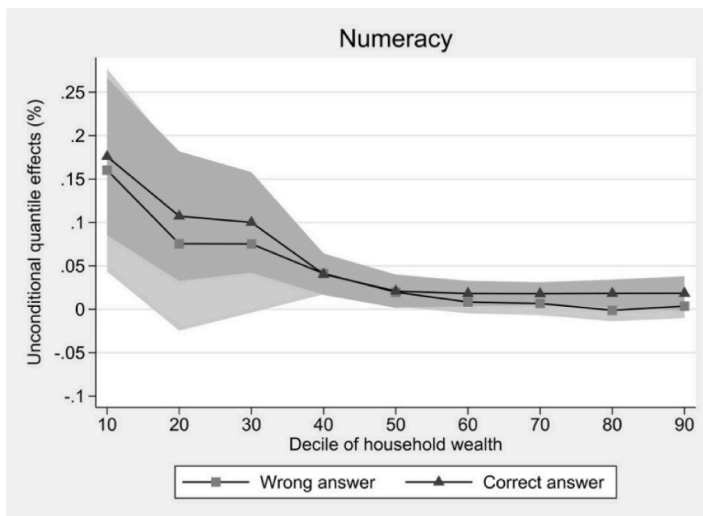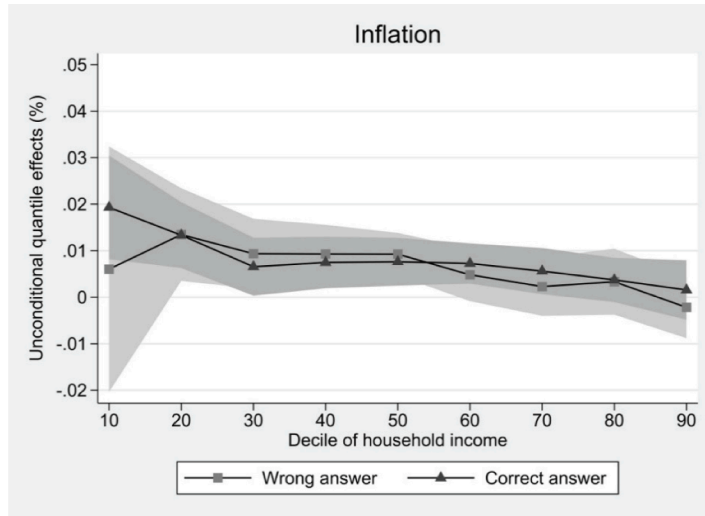

Fig. A7. Unconditional effects of an increase in numeracy knowledge along the household wealth distribution (absolute terms − coefficients scaled by 10 %). Notes: Standard errors are clustered by NUTS-2 region and estimates are computed with household sample weights. The shadowed area reports confidence intervals at a 90 % level. The figures present coefficients of variables of interest only, but the estimation model includes all other covariates showed in Table 2.
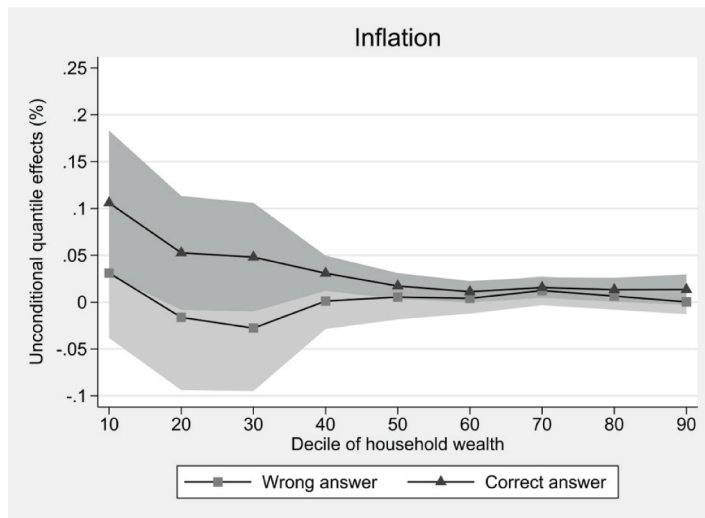
Fig. A8. Unconditional effects of an increase in inflation knowledge along the household income distribution (absolute terms − coefficients scaled by 10 %). *Notes: Standard errors are clustered by NUTS-2 region and estimates are computed with household sample weights. The shadowed area reports confidence intervals at a 90 % level. The figures present coefficients of variables of interest only, but the estimation model includes all other covariates showed in* Table 2.
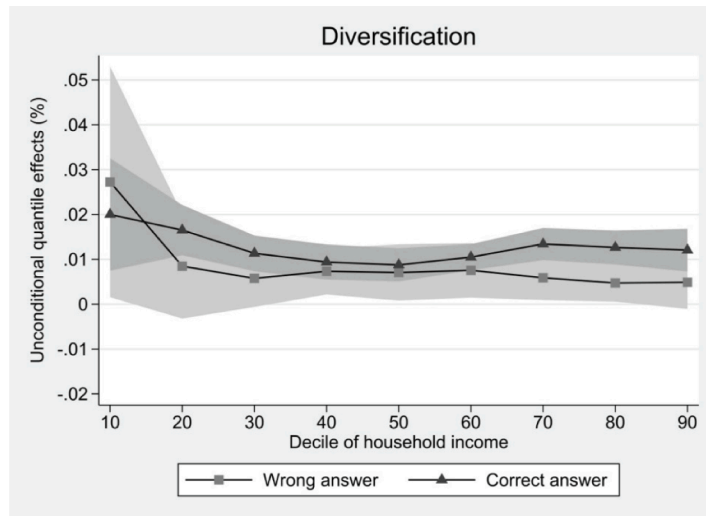

Fig. A9. *Unconditional effects of an increase in inflation knowledge along the household wealth distribution (absolute terms − coefficients scaled by 10 %). Notes: Standard errors are clustered by NUTS-2 region and estimates are computed with household sample weights. The shadowed area reports confidence intervals at a 90 % level. The figures present coefficients of variables of interest only, but the estimation model includes all other covariates showed in* Table 2.
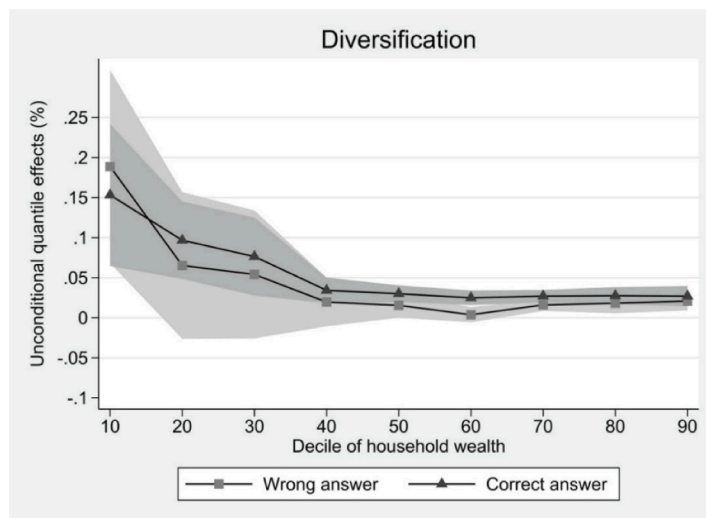
Fig. A10. *Unconditional effects of an increase in the risk diversification knowledge along the household income distribution (absolute terms − coefficients scaled by 10 %). Notes: Standard errors are clustered by NUTS-2 region and estimates are computed with household sample weights. The shadowed area reports confidence intervals at a 90 % level. The figures present coefficients of variables of interest only, but the estimation model includes all other covariates showed in* Table 2.

Fig. A11. Unconditional effects of an increase in the risk diversification knowledge along the household wealth distribution (absolute terms − coefficients scaled by 10 %). *Notes: Standard errors are clustered by NUTS-2 region and estimates are computed with household sample weights. The shadowed area reports confidence intervals at a 90 % level. The figures present coefficients of variables of interest only, but the estimation model includes all other covariates showed in* Table 2.

Appendix B. Details on the Big Three questions

To measure financial literacy, Lusardi and Mitchell (2011) created in the early twenties three simple and basic questions to capture the fundamentals of personal finance. These questions are known worldwide as the Big Three and investigate how people deal with inflation, compound interest, and risk diversification concepts necessary for financial decisions.

The Big 3 questions:

1. "Suppose you had $100 in a savings account and the interest rate was 2 % per year. After 5 years, how much do you think you would have in the account if you left the money to grow?"
   (a) More than $102
   (b) Exactly $102
   (c) Less than $102
   (d) Don't know

    (e) Refuse to answer

2. "Imagine that the interest rate on your savings account was 1 % per year and inflation was 2 % per year. After 1 year, with the money in this account, would you be able to buy…"

    (a) More than today

    (b) Exactly the same as today

    (c) Less than today

    (d) Don't know

    (e) Refuse to answer

3. "Do you think the following statement is true or false? Buying a single company stock usually provides a safer return than a stock mutual fund."

    (a) True

    (b) False

    (c) Don't know

    (d) Refuse to answer

The Big Three questions are characterized by four main characteristics such as brevity, clarity, relevance and importance. In fact, these questions are concise, consisting of only a few words or sentences. This brevity ensures that the questions are easy to understand and quick to answer. The questions are formulated in a straightforward manner, using plain language accessible to a wide range of individuals. Clear wording helps ensure that respondents interpret the questions correctly and provide accurate responses. Also, the questions address fundamental financial concepts that are relevant to individuals' daily lives and financial decision-making. They focus on topics such as budgeting, saving, and investing, which are essential for financial well-being. Finally, the questions assess concepts that are considered crucial for financial literacy. Understanding these concepts is essential for making informed financial decisions, managing money effectively, and achieving financial goals.

These four characteristics together make the Big Three questions effective tools for measuring financial literacy and predict very well individuals' level of understanding and competence in managing their finances.

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