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Temi di Discussione
(Working Papers)

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WHAT DETERMINES ANNUITY DEMAND AT RETIREMENT?

di Giuseppe Cappelletti*, Giovanni Guazzarotti* e Pietro Tommasino*

Abstract

In most advanced countries, future retirees will have to rely less on social security schemes and more on private pension plans, which mostly leave to the worker the choice between cashing-in or annuitizing pension wealth at retirement. Therefore, a better understanding of the determinants of the demand for annuities will soon become a priority. Research in this field has been hampered by lack of data (due to current market thinness) and by difficulties in disentagling demand from supply-side effects. In this paper, we avoid these problems resorting to ad hoc survey data from Italy. Our results highlight the importance of wealth, impatience, education and (to a lesser extent) financial literacy in shaping annuity demand.

Indice

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1. Introduction[1]

An annuity is an insurance contract in which, in exchange for a premium up-front, the insurer promises a stream of payments to the client which stops only if the person insured dies. Therefore, the client who buys an annuity is able to transform pension wealth at retirement into a regular life-long stream of benefits.

It is a well-established result in economic theory that risk-averse individuals should annuitize a significant part of their wealth.[2] The intuition behind this result is straightforward, and rooted in the life cycle model (Modigliani, 1986). Consider a worker on the verge of retirement who has to choose the level of consumption for the coming years, given their level of wealth. Without annuities, workers would be exposed to both sides of longevity risk: if they live longer than expected, they could outlive their resources; if on the contrary their lifespan turns out to be shorter than expected, some resources are wasted. Buying an annuity, longevity risk is shifted onto the insurance company. As companies have a wide pool of clients, they can diversify away the idiosyncratic component of the longevity risk,[3] so they can offer annuities at a price which is reasonably priced for the individual client.

As is well known, social security wealth, which typically constitutes the biggest share of a retiree's wealth, comes in an annuitized form. However, in most advanced countries, future retirees will have to rely less on social security schemes and more on funded pension plans (see Feldstein and Siebert, 2002, Diamond and Orszag, 2004), which mostly leave to the worker the choice between cashing-out or annuitizing pension wealth at retirement. Within employer-sponsored pension plans, the shift from defined benefit (DB) schemes (which mostly require annuitization at retirement) to defined contribution (DC) schemes (which often do not even have annuitization as an option) raises similar concerns. Therefore, a better understanding of the demand for annuities will soon become a priority for policy-makers and regulators.

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[2] Yaari (1965). More recently, see Davidoff et al. (2005) and Sheshinski (2007).

[3] They only have to bear the aggregate component, i.e. the risk of unpredicted changes in the *average* lifespan (Visco, 2006).

In this paper, we propose a way to estimate the annuity demand schedule. We use data from the Survey of Household Income and Wealth (SHIW), a large representative survey of the Italian population conducted by the Bank of Italy every two years. In the 2008 wave, all heads of household were asked the following question:[4]

"Imagine you are 65 years old and receive a total pension income of 1,000 euros a month (adjusted for inflation). Would you be willing to give up half that pension for the whole of your old age in exchange for a lump sum of 60,000 euros to be paid immediately?"

Respondents who preferred the annuity to the lump-sum were then asked the same question with the lump-sum increased to 80,000 euros; those who still preferred the annuity to the 80,000 euros lump-sum were asked again the same question with the lump-sum increased to 100,000 euros. The 80,000 euros payment corresponds to the price which would leave a risk-neutral 65 year-old married male indifferent between buying and not buying the annuity, considering the most up-to-date official mortality rates[5] and a 3 per cent real interest rate. Answers to this battery of questions represent our dependent variable.

To date, it has proved very difficult to assess annuity demand and its determinants, mainly due to the fact that annuity markets are very thin (in most countries individual demand is basically non existent).[6] To the best of our knowledge, there are only two other papers which study annuitization choices at retirement. Brown (2001) considers a subgroup of respondents in the 1992 wave of the US Health and Retirement Survey (HRS) which covers people aged 51-61, namely those with a significant amount of wealth invested in a DC pension plan, and exploits answers to a prospective question, namely: "In what form do you expect to receive benefits?". He then estimates a probit model in which the binary dependent variable is the intention to annuitize. He finds that the basic tenets of the theory are confirmed, as married people with higher risk aversion, longer life expectancy and a smaller fraction of pre-annuitized retirement wealth tend to prefer annuitization. Butler and Teppa (2007)

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[4] The questions of the module are similar to those included in the 2004 wave of the US Health and Retirement Survey (HRS).

[5] We used the official life tables provided by the Italian National Institute of Statistics (ISTAT), which computes cohort-specific mortality rates.

[6] Surveys of annuity market development around the world can be found in James and Song (2002), Mackenzie, (2006), and Cannon and Tonks (2008).

perform the same exercise as Brown (2001), but using actual choices instead of intentions: in particular they consider administrative data about annuitization choices at retirement of Swiss workers enrolled in 10 employer-sponsored pension plans. With respect to survey questions, administrative data have their pros and cons: on one side, they are certainly more reliable; on the other side, they usually provide much less information about the worker. Their results are also in line with Brown (2001).

The paper by Hurd and Panis (2006) is also relevant; its methodology and results are analogous to Brown (2001) and Butler and Teppa (2007). However, it does not distinguish between annuitization choices at the moment of retirement and those made when the worker changes job but stays in the labour force (which is the case for about 40% of the observations in their sample). Hurd and Panis use HRS data from the five waves between 1992-2000.[7]

These contributions share some limitations: (1) they do not study a representative sample of the underlying population; (2) they observe annuitization choices but cannot disentangle the demand from the supply of annuities, as they do not control for annuity prices; and (3) they either do not observe the fraction of annuitized wealth held outside private pension plans (Butler and Teppa, 2007, Hurd and Panis, 2006) or they measure it very imperfectly (Brown, 2001).[8]

The empirical approach adopted in this paper largely avoids these drawbacks. First, we use a sample which is representative of a large subgroup of the Italian population (namely, Italian heads of household), which constitutes an important component of the Italian labour force. Second, experimenting with different annuity prices enables us to elicit the shape of the annuity demand schedule. Third, making the total amount of annuity benefits explicit solves the problem of controlling for differences in annuitized wealth.

Our paper also contributes to the very small literature which explores the role of financial literacy and more generally behavioural factors on the decision to annuitize. This research avenue has been strongly advocated by Brown (2007, 2008). While in his survey (Brown,

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[7] Respondents were asked if they had done anything with a pension right since the previous wave.

[8] Brown (2001) reconstructs social security wealth using social security data on earnings and benefits histories included in the HRS. However, these data are missing for about 1/3 of the sample. Moreover, he has to assume that the fraction of wealth annuitized at retirement is equal to that observed at the moment of the survey. He also assumes that all retirement wealth in DB plans will be annuitized.

2007) he asserts that "the literature applying behavioural economics to the annuitization decision has still to emerge", a couple of important contributions have been published since then (Brown et al. 2008, Agnew et al. 2008). Both papers show the importance of "framing" effects in shaping annuity demand. In the present paper, we focus instead on the effects of education and of financial literacy.[9]

The rest of the paper is organized as follows: Section 2 describes our data; in Section 3 we perform a more formal multivariate analysis; Section 4 discusses some implications of our results and offers some tentative conclusions.

2. Data, variables and descriptive statistics

The Survey of Household Income and Wealth (SHIW), is a representative survey of the Italian population conducted by the Bank of Italy every two years. It includes information on the socio-demographic characteristics, income and wealth of about 20,000 participants. For the 2008 wave of the survey we included a module on the demand for annuities which was completed by all heads of household at least 15 years old. Total respondents were 7,124 out of 7,977 heads of household. Overall, the non-response rate is quite low, and there seem to be no systematic differences between respondents and non-respondents. Table 1 provides a description of our sample. We should stress that, while it is representative of Italian heads of household, it is not representative of the Italian labour force. In particular, among heads of household there are relatively few women and young people (and by consequence relatively few singles and people without children). On the other hand, there seem to be no differences between the heads of household and the labour force when it comes to health and education (see Table 2 for a description of the Italian labour force as it emerges from the SHIW data).

We use the survey data to construct an indicator of the preference for annuities, which is a discrete variable taking the value of 1 for respondents who say no to the annuity even at the lowest price (60,000); 2 for those who prefer the annuity at the lowest price but reject it at a higher price; 3 for those who prefer the annuity at the middle price (80,000) but will not buy it at the highest price; and 4 for those who opt for the annuity even at the highest price (100,000).

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[9] Among others, Lusardi (2008a, b) and Lusardi and Mitchell (2006) convincingly argue that poor financial knowledge is the rule, rather than the exception, and that it has a significant impact on households' financial choices and outcomes.

Answers to the annuity module are summarized in Table 3, which focuses on individuals less than 65 years old (this makes sense given the structure of the question, however we checked that results do not change qualitatively if all respondents are included). The percentage who preferred the annuity against a lump sum of 80,000 euros is 69%. This percentage rises to 82% when the price of the annuity is reduced to 60,000 and falls to 40% when the price increases to 100,000.

As a first step, we look at simple unconditional correlations between our measure of annuity preference and some individual and household characteristics which economic theory singles out as potentially relevant.

Some of the results of the univariate analysis are at odds with the standard version of the life-cycle theory. First, women and younger cohorts do not seem to prefer annuities more than men and older cohorts (in the case of young people, quite the contrary is true), as should be the case since both groups enjoy a higher life expectancy at retirement, which in turn implies that the expected present value of a given stream of life-long payments is higher. Second, marital status and the presence of children does not influence annuity demand.[10] This result holds even if attention is restricted to senior people (aged between 50 and 65), for whom actual family status is likely to be equal to the one expected at 65. According to the theory, however, married people and people with children should have a reduced annuity demand, as they can at least in part obtain insurance against longevity risk within the family, either for altruistic of for self-interested reasons (e.g. through implicit contracts across generations, as in Kotlikoff and Spivak, 1981). Third, our measure of annuity preference does not increase with risk aversion,[11] even if the insurance against longevity risk provided by annuity contracts should be particularly valued by risk-averse individuals.

Other results are instead in line with the theory. First, health status has a strong positive impact on annuity demand (for example, against an 80,000 euro lump sum, 72% of people who report they are in "very good health" choose to annuitize; this figure goes down to

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[10]   These results confirm similar findings by Butler and Teppa (2007) and Johnson et al (2004).

[11]   Our proxy for risk adversion comes from a survey question included in the SHIW: *In managing your financial investments, would you say you have a preference for investments that offer: a) Very high returns, but with a high risk of losing part of the capital; b) A good return, but also a fair degree of protection for the invested capital; c) A fair return, with a good degree of protection for the invested capital; d) Low returns, with a low risk of losing the invested capital."*

63% for those with a health status self-reportedly worse than "good"). Indeed the life-cycle model predicts that people in good shape should value annuities relatively more, as they expect to receive a higher number of annuity payments. Second, higher income and higher wealth come with an increased propensity to annuitize, with a stronger effect at the bottom of the distribution. From a theoretical point of view, this finding has two complementary explanations: (i) to reach a given desired fraction of annuitized wealth, wealthier people need to buy a greater amount of annuities; (ii) poorer people should optimally annuitize a lower fraction of their wealth, because they have a higher probability of incurring a binding liquidity constraint sometime during retirement. In general it is not possible to borrow against future annuity payments. Therefire, people who fear becoming liquidity-constrained at a certain point during retirement (for example due to out-of-pocket medical expenditures) should prefer not to annuitize their pension wealth (Turra and Mitchell, 2005). Of course our interpretation of the data carries through to the extent that today's health and wealth are correlated to the expectations of the respondents concerning their own health and wealth at 65. Therefore, as we did for family status, we checked that the results for health and wealth are not affected if we focus on the 51-65 age class. Third, we find that people who discount future consumption at a higher rate tend to prefer a lump sum over the annuity, where we use as a proxy for the time discount rate the participants' answer to the following question:[12]

> "You have won the lottery and will receive a sum equal to your household's net yearly revenue. You will receive the money in a year's time. However, if you give up part of the sum you can collect the rest of your win immediately. To obtain the money immediately would you give up 20 per cent of your win?" What about 10 per cent?" "And 5 per cent?" "Just 2 per cent?".

How can one make sense of the mixed support that the data seem to provide for the life cycle model? Actually, the model is based on the assumption that households are able to make the annuitization decision based on a full evaluation of the effects and likelihood of all relevant future events, maximizing the expected discounted value of present and future utility. However, there is a lot of evidence showing that many individuals are not able to do even simple economic computations, and lack knowledge of even the most basic economic concepts (Lusardi 2008a, 2008b). This could explain some of the above-mentioned correlations: for

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[12]   The question was put to a randomized subset of our sample (about 1,000 people). See also Warner and Pleeter (2001) for a similar result.

example, older people might have a higher propensity to annuitize because they have already spent more time planning for retirement, so they are better equipped to understand annuities and their advantages. The negative correlation between risk aversion and annuity demand can also be due to behavioural biases. In particular, Brown et al. (2008) find the same relationship as we do looking at US survey data, and argue that some people might incorrectly interpret (or "frame") an annuity as a bet on one's life span, instead of a hedge against longevity risk.

One of the first signs of the importance of cognitive factors is that higher education comes with a greater propensity to annuitize: 64% of participants with primary education say they would prefer the annuity to a lump sum of 80,000 euros; this figure rises to 77% for those with a bachelor's or higher degree. To better assess the role of financial literacy in explaining annuity demand, we included some ad hoc questions in the Bank of Italy's Survey. In particular, we build a first dummy variable which equals 1 if the respondent answers the following question correctly:

"Imagine leaving 1,000 euros in a current account that pays 1% interest and has no charges. Imagine that inflation is running at 2%. Do you think that if you withdraw the money in a year's time you will be able to buy the same amount of goods as if you spent the 1,000 euros today?

a) Yes;

b) No, I will be able to buy less;

c) No, I will be able to buy more;

d) Don't know."

The second dummy is equal to one if the respondent answers correctly to the following question:

"Which of the following investment strategies do you think entails the greatest risk of losing your capital?

a) Investing in the shares of a single company;

b) Investing in the shares of more than one company;

c) Don't know."

These two questions were first used in the 2004 HRS survey (Lusardi and Mitchell, 2006). They assess the knowledge of very basic economic concepts (interest rates, inflation, risk diversification) which are crucial to evaluate correctly if an annuity is better value than a

lump sum. Indeed, people who respond incorrectly to the first question may not understand that the real returns of some asset classes (like a simple bank deposit) are dented by inflation: this might induce them to underestimate the value of a real annuity (like the one offered to our respondents). People responding incorrectly to the second question may not be able to understand the principle of portfolio diversification, so they are unlikely to profit from investing in financial markets: for them, the value of a lump sum (which depends on how it is invested during the post-retirement period) might be low relative to the value of the annuity. In line with these theoretical predictions, annuity demand is higher for people answering correctly to the first question and lower for those answering correctly to the second.[13]

We also consider a further dimension of financial literacy, measuring to what extent respondents understand the basic features of the Italian private pension system. This is likely to be relevant to the decision to annuitize, as private pension plans are the main financial instruments offering a pay-out in an annuity form. In particular, we consider the number of correct answers that the respondent gives to the following question:

"Which of the following statements concerning supplementary pension schemes do you believe to be true? 1) Investing in a supplementary pension plan has tax advantages compared with investment funds in general. 2) Part of the capital can be withdrawn at the time of retirement. 3) Some pension funds guarantee restitution of the capital paid in. 4) Pension funds guarantee a fixed percentage of the last salary."

Those who perform badly in this test of pension literacy are less likely to choose the annuity.

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[13] The point that the relationship between annuity demand and financial literacy can go in either direction has been stressed by Brown (2007, 2008) and by Agnew et al. (2008).

3. Multivariate analysis

3.1 *From theory to data*

In this section, we assess to what extent the simple correlation results highlighted above are robust to a more formal multivariate analysis. To motivate our empirical strategy, let us recap very briefly how an individual who behaves according to the prescriptions of the simplest version of the life cycle model should answer our survey question about the annuity/lump sum choice. For simplicity, let us consider an unmarried individual for whom longevity is the only source of uncertainty (the framework could easily be enriched to take into account bequest motives, uncertain rates of return, and the possibility of out-of-pocket expenses).

If agent i does not accept our deal to swap half of their pension with a lump sum LS, they have to solve the following problem:

$$\max_{\{C_{it}\}} \sum_{t=65}^{\infty} \left(\frac{1}{1+\delta_i} \right)^t \mu_{it} U_i(C_{it})$$

subject to:

(1)
$$\begin{aligned} W_{it+1} &= (1+r_i)W_{it} + 1,000 - C_{it} \text{ for } t \geq 65 \\ W_{i65} &= \text{ accumulated wealth at 65 for } i, \end{aligned}$$

where δ_i, μ_{it}, r_i, σ_i are the rate of time discount, the probability to survive up to time t, the rate of return on invested wealth and a parameter (or set of parameters) which characterize the period utility function of individual i (e.g., its elasticity of substitution), while W_{it} and C_{it} stand for its wealth and consumption in period t. If on the contrary agent i accepts our deal, they have to solve the following problem:

$$\max_{\{C_{it}\}} \sum_{t=65}^{\infty} \left(\frac{1}{1+\delta_i} \right)^t \mu_{it} U(C_{it}; \sigma_i)$$

subject to

(2)
$$\begin{aligned} W_{it+1} &= (1+r_i)W_{it} + 500 - C_{it} \text{ for } t \geq 65 \\ W_{i65} &= \text{ accumulated wealth at 65 for } i + LS. \end{aligned}$$

define

$$V^{NO}(X_i) \equiv \max_{\{C_{it}\}} \left\{ \sum_{t=65}^{\infty} \left(\frac{1}{1+\delta_i} \right)^t \mu_{it} U(C_{it}; \sigma_i) \text{ sub to (1)} \right\}$$

$$V^{YES}(X_i, LS) \equiv \max_{\{C_{it}\}} \left\{ \sum_{t=65}^{\infty} \left(\frac{1}{1+\delta_i} \right)^t \mu_{it} U(C_{it}; \sigma_i) \text{ sub to (2)} \right\}.$$

where

$$X_i \equiv \left\langle \delta_i, (\mu_{it})_{t>65}, r_i, \sigma_i, W_{i65} \right\rangle$$

is the vector of relevant individual-specific parameters. As $V^{YES}(X_i, LS)$ is obviously increasing in LS, there is a threshold amount $LS^*(X_i)$ below which the individual refuses the lump sum:

$$V^{NO}(X_i) \gtreqqless V^{YES}(X_i, LS) \text{ if and only if } LS \lesseqqgtr LS^*(X_i).$$

While this is basically the end of the story from a fully rational point of view, one can enrich the framework to take behavioural factors into account. We assume in particular that individual i refuses the lump sum if and only if

$$LS > LS^*(X_i) + \gamma' Z_i,$$

where Z_i represents a vector of variables capturing the role of financial literacy and education.

To move from the theoretical model to the data, we make two further assumptions: (1) the choice also involves a stochastic element: in particular, the agent chooses the lump sum if it is greater than or equal to $LS^*(X_i) + \gamma' Z_i + \varepsilon_i$, ε_i being a normal random variable; (2) the function $LS^*(X_i)$ can be approximated by a linear function: $LS^*(X_i) = \beta' X_i$.

Let us now indicate Y_i our dependent variable (the degree of annuity preference of individual i). As we remarked above, $Y_i=1$ if i always chooses the lump sum, $Y_i=2$ if i prefers a 80,000 euro lump sum to the annuity, but prefers the annuity to the 60,000 euro lump sum, $Y_i=3$ if i prefers a 100,000 euro lump sum to the annuity, but prefers the annuity to the

80,000 lump sum, and Y_i=4 if i always chooses the annuity. Then, one has:

$$
\begin{aligned}
\Pr(Y_i = 1 |\, X_i, Z_i) &= \Pr(\beta' X_i + \gamma' Z_i + \varepsilon_i < 60,000) \\
&= \Pr(\varepsilon_i < 60,000 - \beta' X_i - \gamma' Z_i) \\
&= \Phi(60,000 - \beta' X_i - \gamma' Z_i)
\end{aligned}
$$

where Φ is the cumulative density function of the normal distribution. In the same way, one has:

$$
\begin{aligned}
\Pr(Y_i = 2 |\, X_i, Z_i) &= \Phi(80,000 - \beta' X_i - \gamma' Z_i) - \Phi(60,000 - \beta' X_i - \gamma' Z_i) \\
\Pr(Y_i = 3 |\, X_i, Z_i) &= \Phi(100,000 - \beta' X_i - \gamma' Z_i) - \Phi(80,000 - \beta' X_i - \gamma' Z_i) \\
\Pr(Y_i = 4 |\, X_i, Z_i) &= 1 - \Phi(100,000 - \beta' X_i - \gamma' Z_i).
\end{aligned}
$$

This is an ordered probit model which we can estimate using standard maximum-likelihood techniques (see Wooldridge, 2002).

3.2 *Main results*

Our estimates mostly confirm the findings of the univariate analysis (Table 4).[14] Contrary to what the theory predicts, gender, marital status, the presence of children and risk aversion do not influence annuity demand. Instead, bad health and a low level of income and financial wealth reduce annuity preferences in a statistically significant way, as predicted by the theory.[15] Formal education and all our proxies for financial literacy are significant. In particular, as we expected, understanding the asset diversification principle reduces the propensity to annuitize. The contrary is true for schooling and for the other literacy variables (i.e. understanding the effects of inflation and understanding how private pension schemes work).

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[14]   In all the reported estimations, we use survey weights to ensure that the results are valid for the underlying population. The use of weights in order to correct for unequal probabilities of selection among sampling units is discussed, among others, in Deaton (1997). The weighting scheme adopted in the Bank of Italy Survey is explained in detail in Faiella and Gambacorta (2007).

[15]   In an early version of the regressions we added real estate wealth among the regressors but, contrary to financial wealth - which is more liquid - it is never significant, so we dropped it from our preferred specification.

To assess the economic/quantitative importance of the independent variables, in Table 4 we also look at how they affect the probability of not being a $Y_i = 1$ individual (symmetrically, in the table we also provide the effect on the probability of being a $Y_i = 4$ individual). The effect is particularly sizeable in the case of wealth and schooling. The probability of rejecting the annuity even against the lowest lump sum is 6.7 percentage points lower for an individual in the second income quartile than for an individual in the first quartile; it is 6.0 percentage points lower for an individual with a high school diploma than for an individual who only completed the lower secondary school. Concerning financial literacy, the effect on the probability of accepting the annuity in exchange for the lowest lump sum is also sizeable.

To further illustrate the economic significance of the effects, we can compute and confront the estimated demand schedule for individuals with different characteristics. For example, let us consider an individual holding a bachelor's degree, who is in the highest wealth quartile, and has the highest possible scores in all dimensions of financial literacy.[16] This individual is the one who, according to the estimated model, displays the highest propensity to annuitize.[17] Indeed, they display a very strong annuity demand at all prices (their estimated probability of buying an annuity even at the highest price is 54.7%, increasing to 82.1% against a lump sum of 80,000 and to 91.0% against a lump sum of 60,000 euros). We can then compare our benchmark with other individuals who are similar in all respects except that: (1) they belong to the lowest wealth quartile: this implies that the probability of going for the annuity at the mid price goes down from 82.1% to 75.8%; or (2) have only a lower secondary school diploma (the probability of choosing the annuity at the mid price is equal to 72.7%); or (3) get the worst possible scores in all the dimensions of financial literacy (in this case, the probability of choosing the annuity at the mid price is 79.9%). An individual who differs from the benchmark for all three aspects has a probability of choosing the annuity at the mid price equal to only 62.8% (Figure 1).

The annuity demand appears to be quite elastic with respect to prices. It is particularly so at high prices and for the most vulnerable people: it is 33% for our benchmark, 39% for a person belonging to the lowest wealth quartile, 41% for one having only a primary school

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[16] This individual is male, married with children, in good health, with an average degree of risk aversion, and is over 60 years old.

[17] Of course, the choice of the benchmark is quite arbitrary, and it only matters as a way to clarify and show the results of the multivariate analysis.

diploma, 35% for a person with low pension literacy, and arrives at almost 50% for a person which has all these three characteristics at the same time (i.e. in the lowest wealth quartile, no high school diploma, and very poor financial literacy).[18]

3.3 *Robustness checks and the role of the intertemporal discount rate*

The results of the previous section do not change if we enlarge the sample to consider all the respondents (therefore including those above 65).

As a further exercise, we restrict the sample to respondents in the 51-65 age bracket. This is potentially interesting because for these individuals the values of most variables should be very close to the (subjectively) expected values at retirement.

In this regression, some differences emerge with respect to the baseline (Table 5). On the one hand, the role of children now appears to be significantly negative, lending some support to the argument that informal within-family arrangements can be seen as a substitute for market-provided insurance against longevity risk. This mechanism might be attenuated when using our baseline sample simply because many younger respondents included in the larger sample plan or expect to increase their number of children (therefore, for these respondents the actual number of children is a poor proxy of the expected number of children at retirement). On the other hand, health loses significance, and education, while still significant, seems to play a lesser role.

We also estimate a richer specification (see Table 6), in which we add our proxy for the discount rate to the independent variables. This comes at the cost of a much lower number of observations, as the question concerning the discount rate was posed only to a (randomized) subset of respondents. It turns out that, as expected, a higher discount rate implies lower annuity demand. Instead, health and two out of three financial literacy variables (the exception being the one about risk diversification) lose their significance. This suggests that the correlation between financial literacy and annuity demand is partly due to the fact that a low discount rate has a positive impact not only on the latter (as predicted by the standard life cycle theory) but also on the former, as those who do not care about future well-being are unlikely to invest time and effort in acquiring financial knowledge.[19]

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[18] As in the previous exercise, all these individuals are, in all other respects, similar to the benchmark.

[19] As an aside, let us remark that the fact that the coefficient on health also loses significance is consistent

Quantitatively, the effect of a higher discount rate is paramount: with respect to an individual with a "very low" or "low" discount rate, the probability of choosing the annuity rather than the 60,000 euro lump sum is increased by 7.1 percentage points if the discount rate is "medium", by 16.0 percentage points if it is "high", and by 25.8 percentage points if it is "very high".

To summarize, across all the samples and specifications that we used, the importance of wealth, schooling and (to a lesser extent) financial literacy is confirmed.

4. Conclusions and policy implications

In this paper, we measured the strength of annuity demand at retirement using a sample representative of the Italian heads of household, adopting an empirical strategy able to control for differences in annuitized wealth, prices and other product characteristics.

On average, we find that there is a strong demand for annuity products (at least with respect to the one that we observe today, at current market prices).[20]

However, our empirical analysis highlights that this statement requires important qualifications. Indeed we have also shown that for poorer, less educated individuals annuity demand is significantly lower than average, and the price elasticity of annuity demand is significantly higher. These individuals are also those that, without an annuity, are more likely to end up with insufficient resources if they happen to live longer than they expected. This would in turn increase old-age poverty and/or welfare spending. It is quite likely that the annuity demand of these vulnerable subgroups is sub-optimal, either because they cannot understand the importance of insurance against longevity risk, or because they are prevented from taking advantage of longevity insurance due to stringent liquidity constraints.[21] It seems

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with the view that one's health is determined by one's investments in "health capital", which in turn negatively depend on the personal discount rate (see Grossman, 2000).

[20]   At the moment, the Italian annuity market is very small (Guazzarotti and Tommasino, 2008). The amount of annuity purchases, either by individuals or by pension funds, is small. While exact figures concerning single-premium immediate annuities (i.e., the plain vanilla annuity product that we study in the present paper) are not available, the number of deferred annuities (which bundle together an investment product and an option to convert the final wealth into an annuity) which are in the pay-out phase was only about 15,000 in 2006. Even if this number is increasing (almost a third of outstanding contracts were signed in 2005), in the 2003-05 period, out of 1,940,000 deferred annuities contracts which became due, only 11,000 investors preferred the annuity to the lump sum.

[21]   Under-annuitization can be socially inefficient even if it is efficient from an individual point of view:

therefore that a case can be made for public policies that help these groups to increase the annuitized fraction of their retirement wealth.

How can this be done? Policies which prevent annuity prices from increasing too much above their actuarially fair benchmark are the obvious first step. Indeed, there is by now ample evidence, coming from different national markets, that this is not so.[22] To curb excessively high prices, governments should foster competition among insurance companies and at the same time should help them manage the aggregate component of the longevity risk.[23] Public provision of annuities could also be efficiency-enhancing, as the State could sell annuities at a price nearer to the actuarially fair one (with respect to private insurance companies, it would be in a better position to manage the aggregate longevity risk, and would probably have lower administrative and marketing costs).[24] Increasing the reach of adequate financial education represents a second potentially fruitful policy. In particular, governments should promote not only programs aimed at providing basic financial skills, but also specific programs concerning pension-related topics, in order to raise awareness of retirement needs and longevity risk. As a policy of last resort, the minimum fraction of pension wealth which has to be annuitized at retirement could be mandatorily increased.[25]

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for example it might be rational for the individual to cash-out pension wealth and spend it immediately after retirement, thereafter relying on social assistance.

[22] See Brown et al. (1999, 2001) for the USA, Cannon and Tonks (2004, 2008) and Finkelstein and Poterba (2004) for the UK, Guazzarotti and Tommasino (2008) for Italy. James and Song (2002) provide data for a large group of countries.

[23] For example by promoting the timely release of accurate life tables or by providing adequate amounts of very-long-term bonds and longevity bonds, as suggested by Visco (2006).

[24] A similar arrangement has been adopted in Sweden, where the State has a monopoly over annuity provision.

[25] This policy would probably improve the welfare of investors with behavioural biases. On the other hand, it also entails costs, as some individuals could turn out to be over-annuitized.

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Table 1: Summary statistics.

(Heads of household 65 or younger)

	Number of respondents	Percentage		Number of respondents	Percentage
Sex			**Literacy 2 (risk diversification)**		
Male	3,346	*70.4*	Incorrect answer	2,359	*49.7*
Female	1,404	*29.6*	Correct answer	2,391	*50.3*
Age			**Literacy 3 (private pensions)**		
<= 30	231	*4.9*	Very poor	1,707	*35.9*
31-40	866	*18.2*	Poor	882	*18.6*
41-50	1,466	*30.9*	Fair	1,027	*21.6*
51-65	2,187	*46.0*	Good	948	*20.0*
			Very good	186	*3.9*
Marital status			**Discount rate**		
Married	3,419	*72.0*	Very low	755	*30.7*
Single	659	*13.9*	Low	504	*20.5*
Divorced	472	*9.9*	Medium	517	*21.0*
Widowed	200	*4.2*	High	291	*11.8*
			Very high	390	*15.9*
Number of children			Excluded from the module	2,293	*48.3*
0	1,833	*38.6*			
1	1,297	*27.3*	**Risk aversion**		
2	1,248	*26.3*	Low	816	*17.2*
3+	372	*7.8*	Medium	1,773	*37.3*
			High	2,161	*45.5*
Health					
Less than good	664	*14.0*	**Labour income**		
Good	2,673	*56.3*	First quartile	669	*14.1*
Very good	1,411	*29.7*	Second quartile	1,302	*27.4*
			Third quartile	1,433	*30.2*
Education			Last quartile	1,346	*28.3*
Primary	579	*12.2*			
Lower Secondary	1,642	*34.6*	**Financial wealth**		
Secondary	1,944	*40.9*	First quartile	1,107	*23.3*
Bachelor's or higher degree	585	*12.3*	Second quartile	1,193	*25.1*
			Third quartile	1,198	*25.2*
Literacy 1 (real interest rate)			Last quartile	1,252	*26.4*
Incorrect answer	954	*20.1*			
Correct answer	3,796	*79.9*	**Total**	4,750	*100.0*

Source: SHIW 2008.

Table 2: Summary statistics.

(Individuals belonging to the labor force)

	Number of respondents	Percentage		Number of respondents	Percentage
Sex			**Education**		
Male	4,699	*57.6*	Primary	479	*5.9*
Female	3,453	*42.4*	Lower Secondary	2,628	*32.2*
			Higher Secondary	3,780	*46.4*
			Bachelor's or higher degree	1,264	*15.5*
Age					
<= 30	1,693	*20.8*			
31-40	2,450	*30.1*			
41-50	2,448	*30.0*	**Risk aversion**		
51-65	1,561	*19.2*	Low	1,300	*15.95*
			Medium	2,932	*35.97*
Marital status			High	3,919	*48.08*
Married	4,862	*59.6*			
Single	2,671	*32.8*	**Labour income**		
Divorced	512	*6.3*	First quartile	319	*3.92*
Widower	107	*1.3*	Second quartile	2,235	*27.42*
			Third quartile	2,606	*31.97*
Number of children			Last quartile	2,991	*36.70*
0	2,149	*26.4*			
1	2,496	*30.6*	**Financial wealth**		
2	2,635	*32.3*	First quartile	1,949	*23.91*
3+	873	*10.7*	Second quartile	2,171	*26.64*
			Third quartile	2,038	*25.00*
Health			Last quartile	1,994	*24.46*
Less than good	635	*7.8*			
Good	4,489	*55.1*			
Very good	3,024	*37.1*	**Total**	8,152	*100.0*

Source: SHIW 2008.

Table 3: Demand for annuities - Participants who prefer the annuity to the lump sum.

(Heads of household 65 or younger)

	Lump sum			Lump sum		
	60,000	80,000	100,000	60,000	80,000	100,000
	percentage of respondents			*number of respondents*		
All respondents	*81.9*	*69.4*	*39.9*	3,891	3,296	1,897
Sex						
Male	*82.1*	*70.1*	*40.8*	2,738	2,339	1,362
Female	*81.5*	*67.6*	*37.8*	1,154	956	535
Age						
<= 30	*77.8*	*63.5*	*30.3*	180	147	70
31-40	*77.4*	*64.3*	*33.4*	671	557	289
41-50	*81.9*	*69.9*	*39.1*	1,201	1,025	574
51-65	*85.5*	*73.3*	*46.6*	1,870	1,602	1,019
Marital status						
Married	*82.1*	*69.6*	*40.8*	2,806	2,381	1,394
Single	*82.8*	*68.7*	*36.3*	545	453	239
Divorced	*81.2*	*70.8*	*40.2*	383	334	190
Widowed	*77.6*	*64.0*	*40.4*	155	128	81
Number of children						
0	*82.3*	*68.9*	*38.8*	1,508	1,262	711
1	*83.1*	*72.0*	*42.4*	1,078	934	550
2	*81.3*	*68.9*	*39.6*	1,015	860	495
3+	*78.1*	*65.0*	*39.0*	290	242	145
Health						
Less than good	*78.7*	*62.7*	*35.5*	523	416	235
Good	*82.3*	*69.8*	*38.6*	2,199	1,867	1,030
Very good	*82.7*	*71.5*	*44.6*	1,167	1,009	629
Education						
Primary	*77.9*	*63.5*	*32.0*	411	335	169
Lower Secondary	*79.8*	*64.2*	*33.4*	1,278	1,029	535
Higher Secondary	*83.9*	*72.9*	*43.8*	1,607	1,396	838
Bachelor's or higher degree	*83.4*	*76.5*	*50.0*	480	441	288

Source: SHIW 2008. (cont.)

Table 3: Demand for annuities - Participants who prefer the annuity to the lump sum (cont.).

	Lump sum			Lump sum		
	60,000	80,000	100,000	60,000	80,000	100,000
	percentage of respondents			*number of respondents*		
Literacy 1 (real interest rate)						
Incorrect answer	*78.1*	*62.0*	*32.1*	745	592	306
Correct answer	*82.9*	*71.3*	*42.0*	3,148	2,707	1,595
Literacy 2 (risk diversification)						
Incorrect answer	*81.5*	*68.5*	*42.7*	1,923	1,616	1,008
Correct answer	*82.3*	*70.2*	*37.3*	1,968	1,679	892
Literacy 3 (private pensions)						
Very poor	*76.7*	*61.7*	*34.0*	1,309	1,054	581
Poor	*84.0*	*72.0*	*43.8*	741	635	386
Fair	*84.6*	*74.4*	*39.5*	869	764	406
Good	*86.0*	*75.1*	*46.6*	816	712	442
Very good	*89.7*	*77.6*	*50.1*	167	144	93
Discount rate						
Very low	*86.8*	*76.3*	*54.9*	656	576	415
Low	*91.0*	*85.9*	*49.5*	459	433	250
Medium	*85.7*	*72.8*	*31.0*	443	376	160
High	*77.0*	*57.4*	*23.3*	224	167	68
Very high	*57.6*	*44.2*	*20.9*	225	172	81
Excluded from the module	*82.2*	*68.5*	*40.3*	1,885	1,571	924
Risk aversion						
Low	*82.6*	*72.2*	*45.0*	674	589	367
Medium	*83.6*	*71.7*	*38.7*	1,482	1,271	687
High	*80.4*	*66.7*	*39.2*	1,738	1,442	847
Labour income						
First quartile	*77.0*	*62.6*	*37.3*	915	743	443
Second quartile	*82.6*	*66.4*	*35.5*	1,009	811	433
Third quartile	*82.7*	*72.7*	*38.5*	957	841	446
Last quartile	*85.1*	*75.9*	*49.1*	1,008	899	581
Financial wealth						
First quartile	*72.2*	*56.3*	*29.8*	858	669	354
Second quartile	*84.5*	*70.7*	*41.3*	1,003	839	491
Third quartile	*85.6*	*73.8*	*42.7*	1,046	902	521
Last quartile	*85.9*	*78.0*	*47.0*	991	899	542

Source: SHIW 2008.

Table 4: Demand for annuities: ordered probit model.

(Heads of Household 65 or younger)

	Parameters estimates	Marginal effects on the probability of rejecting the annuity even at the lowest lump sum	Marginal effects on the probability of choosing the annuity even at the highest lump sum
Sex			
Female	-	-	-
Male	-0.0565	0.0143	-0.0208
Age (years)			
<= 30	-	-	-
31-40	0.0048	-0.0014	0.0017
41-50	0.1855*	-0.0509*	0.0667*
51-65	0.3777***	-0.0957***	0.1392***
Marital status			
Unmarried	-	-	-
Married	-0.0697	0.0172	-0.0258
Children			
No children	-	-	-
One or more children	0.0055	-0.0014	0.002
Health			
Less than good	-	-	-
Good	0.0918	-0.0243	0.0333
Very good	0.1966***	-0.0498***	0.0723***
Risk aversion			
Low	-	-	-
Medium	0.0625	-0.0165	0.0227
High	0.0996	-0.0258	0.0363
Financial wealth			
First quartile	-	-	-
Second quartile	0.2634***	-0.0692***	0.0966***
Third quartile	0.2572***	-0.0677***	0.0943***
Last quartile	0.2141***	-0.0574***	0.078***
Labour income			
First quartile	-	-	-
Second quartile	0.1697***	-0.0442***	0.0624***
Third quartile	0.1494**	-0.0393**	0.0548**
Last quartile	0.2122***	-0.0543***	0.0784***
Education			
Primary	-	-	-
Lower Secondary	0.0512	-0.0143	0.0183
Higher Secondary	0.2344***	-0.0607***	0.0861***
Bachelor's or higher degree	0.3082***	-0.0773***	0.1141***
Literacy 1 (real interest rate)			
Incorrect answer	-	-	-
Correct answer	0.1458**	-0.0379**	0.0533***
Literacy 2 (risk diversification)			
Incorrect answer	-	-	-
Correct answer	-0.2296***	0.0572***	-0.0844***
Literacy 3 (private pension)			
1 correct answer	0.1775***	-0.0449***	0.0657***
2 correct answers	0.0944	-0.0248	0.0346
3 correct answers	0.1951***	-0.049***	0.0724***
4 correct answers	0.2752**	-0.0667***	0.1029**
Number of observations	4,748	4,748	4,748
Pseudo R2	0.030	0.030	0.030

Significance levels: 1% (***); 5% (**), 10% (*).

Table 5: Demand for annuities: ordered probit model.

(Heads of household, between 51 and 65)

	Parameters estimates	Marginal effects on the probability of rejecting the annuity even at the lowest lump sum	Marginal effects on the probability of choosing the annuity even at the highest lump sum
Sex			
Female	-	-	-
Male	-0.1212	0.0263	-0.0459
Age (years)			
<= 30	-	-	-
31-40	-	-	-
41-50	-	-	-
51-65	-	-	-
Marital status			
Unmarried	-	-	-
Married	-0.0068	0.0015	-0.0026
Children			
No children	-	-	-
One or more children	-0.1537**	0.0334**	-0.0582**
Health			
Less than good	-	-	-
Good	0.063	-0.0137	0.0239
Very good	0.1627	-0.0353	0.0617
Risk aversion			
Low	-	-	-
Medium	-0.0842	0.0183	-0.0319
High	-0.0287	0.0062	-0.0109
Financial wealth			
First quartile	-	-	-
Second quartile	0.2059**	-0.0447**	0.078**
Third quartile	0.3287***	-0.0713***	0.1245***
Last quartile	0.3374***	-0.0732***	0.1278***
Labour income			
First quartile	-	-	-
Second quartile	0.2426***	-0.0527***	0.0919***
Third quartile	0.2368**	-0.0514**	0.0897**
Last quartile	0.4167***	-0.0905***	0.1579***
Education			
Primary	-	-	-
Lower Secondary	0.058	-0.0126	0.022
Higher Secondary	0.1552*	-0.0337*	0.0588*
Bachelor's or higher degree	0.1493	-0.0324	0.0566
Literacy 1 (real interest rate)			
Incorrect answer	-	-	-
Correct answer	0.062	-0.0135	0.0235
Literacy 2 (risk diversification)			
Incorrect answer	-	-	-
Correct answer	-0.2883***	0.0626***	-0.1092***
Literacy 3 (private pension)			
1 correct answer	0.2674***	-0.058***	0.1013***
2 correct answers	-0.0687	0.0149	-0.026
3 correct answers	-0.0117	0.0025	-0.0044
4 correct answers	0.4122**	-0.0895**	0.1562**
Number of observations	2,186	2,186	2,186
Pseudo R2	0.031	0.031	0.031

Significance levels: 1% (***); 5% (**), 10% (*).

Table 6: Demand for annuities: ordered probit model controlling for the discount rate.

(Heads of household 65 or younger)

	Parameters estimates	Marginal effects on the probability of rejecting the annuity even at the lowest lump sum	Marginal effects on the probability of choosing the annuity even at the highest lump sum
Sex			
Female	-	-	-
Male	-0.0449	0.0106	-0.0156
Age (years)			
<= 30	-	-	-
31-40	-0.1751	0.0489	-0.0576
41-50	0.1144	-0.0288	0.0396
51-65	0.4072***	-0.0908**	0.1451***
Marital status			
Unmarried	-	-	-
Married	-0.0016	0.0004	-0.0006
Children			
No children	-	-	-
One or more children	-0.0401	0.0094	-0.014
Health			
Less than good	-	-	-
Good	0.0381	-0.0091	0.0132
Very good	0.0885	-0.0208	0.0307
Risk aversion			
Low	-	-	-
Medium	-0.3695	0.0757	-0.131
High	-0.3625	0.074	-0.1286
Financial wealth			
First quartile	-	-	-
Second quartile	0.2748***	-0.0662***	0.0955***
Third quartile	0.2585***	-0.0627***	0.0896***
Last quartile	0.1177	-0.0301	0.0401
Labour income			
First quartile	-	-	-
Second quartile	0.1029	-0.0239	0.0359
Third quartile	-0.0088	0.0021	-0.003
Last quartile	0.0719	-0.0169	0.025
Education			
Primary	-	-	-
Lower Secondary	0.225**	-0.0583**	0.0755**
Higher Secondary	0.3547***	-0.0875***	0.1211***
Bachelor's or higher degree	0.1251	-0.0336	0.0413
Literacy 1 (real interest rate)			
Incorrect answer	-	-	-
Correct answer	0.1191	-0.0287	0.0412
Literacy 2 (risk diversification)			
Incorrect answer	-	-	-
Correct answer	-0.186***	0.0433***	-0.0645***
Literacy 3 (private pension)			
1 correct answer	0.0524	-0.0124	0.0182
2 correct answers	-0.0056	0.0014	-0.0019
3 correct answers	0.1329	-0.0305	0.0465
4 correct answers	0.1976	-0.0442	0.0695
Discount rate			
Very low	-	-	-
Low	0.0141	-0.0025	0.0054
Medium	-0.3348***	0.0713***	-0.1256***
High	-0.6472***	0.1596***	-0.2321***
Very high	-0.9365***	0.2575***	-0.3149***
Number of observations	2,455	2,455	2,455
Pseudo R2	0.070	0.070	0.070

Figure 1: Probability of choosing the annuity as a function of price.

(The benchmark individual is male, married, with children, in good health, with an average degree of risk aversion, age 60, with the highest score in all literacy measures, and in the highest wealth and education quartiles.)
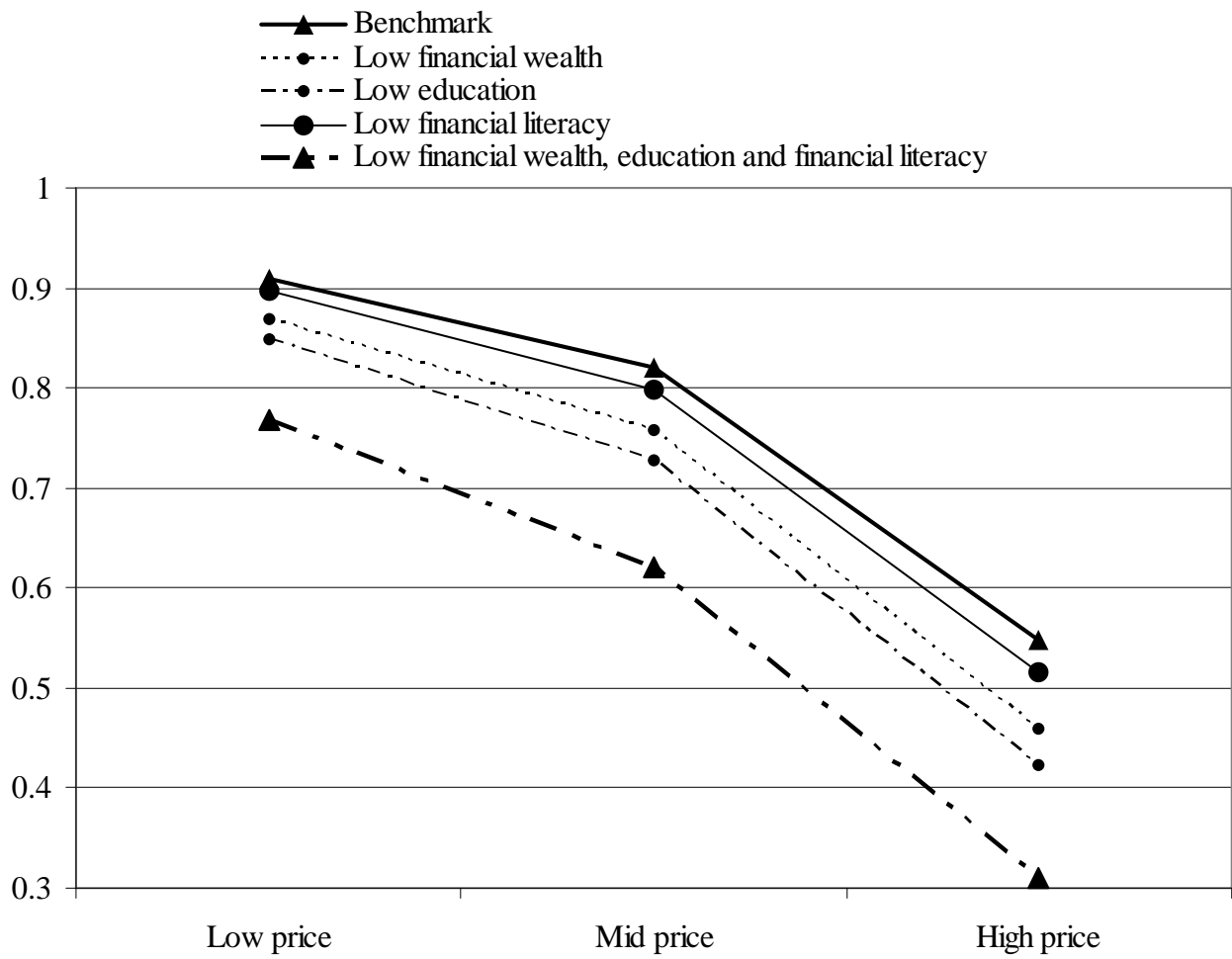
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