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Risk and time preferences: Saver types

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RISK AND TIME PREFERENCES : SAVER TYPES

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Abstract

In an extended variant of the life-cycle hypothesis, saving behaviour is shown to depend crucially on the *interaction* between two preference parameters : β which represents *risk* attitudes (aversion, prudence...), and δ , the rate of *time* depreciation. Hence, the predictions of four specific accumulation regimes : the *Armchair investors* (high β , low δ) ; the *Entreprising* (low β low δ) ; the *Hotheads* (low β high δ) ; and the *Short-sighted prudent* (high β high δ).

The Insee "Patrimoine 1997" survey allows to obtain global relative measures of the two preference parameters. An econometric analysis of the amount and composition of wealth shows then that this savers' typology has sizeable explanatory power, with effects as predicted. *Ceteris paribus*, "armchair investors" accumulate more wealth than other households. "Hotheads" own less homes and Pep (insurance saving products), "short-sighted prudent" less (often) stocks, and these two types of savers invest less in long-term saving (whether for housing or retirement) than the other categories.

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1 □ INTRODUCTION

The consumer/saver of life-cycle microeconomic theory follows forward-looking rational behaviour. The future here takes on three different aspects:

- the optimal formation of expectations about the future as a function of both beliefs and information ;
- the amount of risk or uncertainty that the agent is ready to accept, according to his/her preferences towards risk ;
- the behavioural horizon, which covers "the theoretical set of periods over which the agent establishes his plans and forecasts" (T. Koopmans) □ here the length of his life □, and which is a function of the agent's *preference for the present*, i.e. the decreasing weights which he applies to future satisfaction as a simple function of their distance in time.

This paper focuses on the personal components of savers' choices, that is to say on their preferences regarding risk and time. It presents a somewhat new definition of these latter, in order to get more reliable empirical measures at the individual level. Then, the theoretical effects of these preferences on savings behaviour are both described and tested, using cross-section data from the INSEE survey "Patrimoine 1998".

Over and above its key elements (axiomatic modelling of behaviour, rationality, forward-looking behaviour), the microeconomics of saving include two specific elements which can be most clearly seen when compared to the approaches taken in other social sciences.

Psychologists and Sociologists emphasise the plurality of criteria of choice and the multidimensional nature of rationality, appealing to the multiple nature of time both at the individual and social level. Decisions will be heterogeneous as a function of the horizon over which they are made. For example, with respect to wealth accumulation, we have : [1] the management of current affairs (liquidities) ; [2] medium-term choices (durable goods, precautionary saving) ; [3] life plans (housing, retirement saving, life annuities); [4] the desire to "survive through ones family", through bequests to family members ; [5] the desire for power, prestige, or immortality, via non-family transfers (both Alfred Nobel and Howard Hughes had no direct descendants). The key question is thus to determine how a given individual carries out operations over these different horizons in a coherent manner, given that all choices operate over the same (limited) budget of financial resources and available time.

Moreover, both popular wisdom and most social sciences often suggest a close relationship between uncertainty and the time horizon, as well as between risk and time preferences. One popular discourse posits that increasing uncertainty shortens the time horizon over which decisions are made. Even in dictionaries, a certain haziness surrounds the distinction between prudence and foresight, as if they were somehow synonyms. The Sociology of risk, in particular, characterises modernity by a "risk culture" where "the

awareness of the risks encountered becomes a way to colonize the future" (Anthony Giddens) ; managing risks presupposes their anticipation, obliging the individual to unceasingly project herself into the future to control them and adapt herself to the changes that they imply.

Conventional economic theory is notably different. The difficulties posed by multiple time frames and horizons are by and large avoided (except for some models of self control, which describe the conflict between a long-term planner and short-term impulsive behaviour). Each individual is supposed to have a unique time horizon \square typically her lifetime \square tempered by his or her preference for the present.

Most notably, but only rarely emphasised, the conventional microeconomic approach relies on an inventive double-step procedure in its treatment of risk and time. On the one hand, individual preferences with respect to risk and uncertainty (risk-aversion or uncertainty-aversion, prudence, temperance, etc.), and time (preference for the present, intergenerational altruism), are treated *separately*, with independent parameters : the theory supposes that individuals act as if intertemporal choice can be abstracted from risk, even that relative to survival. On the other hand, the predictions of life-cycle models depend crucially on the *interaction* between the two types of parameters : knowing that an individual is risk-loving (or not very risk-averse), or that she is short-sighted (i.e. she has a strong preference for the present), only brings a limited amount of information regarding savings choices ; knowing that an individual is both at the same time \square risk-loving and short-sighted \square is far more useful regarding the individual's saving and investment decisions.

Section 2 presents the theoretical framework which leads us to distinguish two key preference parameters: the individual's general attitude (rather than aversion) to risk, \square and the discount rate, \square . Section 3 sums up the empirical approach of Arrondel *et al.* (2004), hitherto *AMV*, which yields ordinal measures of these two parameters, called *scores*, over a sub-sample of the "Patrimoine 98" survey. Section 4 recalls that life-cycle models predict different savings *regimes* according to the values of the \square and \square parameters. We thus define a typology of savers ; the tests concerning the different levels and composition of wealth over these five groups are consistent with the theoretical predictions (Section 5).

2 \square TWO KEY PREFERENCE PARAMETERS

Standard life cycle models posit exponential discounting of future additive utility ("DU model") over the lifetime T , homothetic preferences, and expected utility maximization in the face of risk ("EU model"), only need two preference parameters to explain savings behaviour and portfolio choices : risk-aversion and the discount rate. In simpler versions, there is even a clear division of labour : consumption/savings choices depend on the discount

rate, which therefore determines wealth over the life cycle ; risk-aversion comes into play only with respect to portfolio choice.

The manifest failure of the predictions of this theory led to the elaboration of *non-standard* models (non-expected utility, hyperbolic discounting, etc.), which are arguably more realistic. One problem is that these models greatly increase the number of preference parameters in order to obtain a better fit with experimental or survey data. In the empirical part of this paper, we side-step this proliferation by retaining two key preference parameters, one with respect to risk and the other with respect to time, but with non-standard definitions.

2.1. Standard theory : risk-aversion and the discount rate

The life-cycle hypothesis yields a number of savings predictions for a standard individual, who is supposed to be rational and to be concerned only with the level of consumption at each period. Accumulation motives are purely self-regarding : the individual considers only his own well-being over his own life ; there is no interdependence of preferences or demonstration effects ; equally, there is no habit formation. Preferences are homothetic, leading to a proportional relationship between consumption and resources (saving is not a luxury good, but simply postponed consumption). Last, the hypothesis of rationality imposes the dynamic consistency of choices.¹

These properties are \square with a few additional restrictions \square equivalent to a utility function, U^s at time s , which takes the following form \square additive and isoelastic \square in a world without uncertainty (see *AMV*):

$$U^s [C(s)...C(T)] = \int_{t=s}^T \beta(t) u[C(t)] dt = \int_{t=s}^T \beta(t) \frac{C(t)^{1-\beta}}{1-\beta} dt ; \quad \beta > 0, \quad \beta(t) \geq 0. \quad (1)$$

Here $C(t)$ represents overall consumption at time t , u is the instantaneous utility function at t (with constant "tastes"), and T is life expectancy. Individuals have a preference for the present : the weight accorded to future utility, $\beta(t)$, falls over time, and the discount factor, $\beta(t)$, which is weakly positive, is defined as:

$$\beta(t) = \beta \frac{d\beta(t)/dt}{\beta(t)} \geq 0, \quad \text{where: } \beta(t) = \exp(-\beta t) \text{ si } \beta(t) = \beta. \quad (2)$$

Equation (2) corresponds to exponential discounting. Under time consistency, β may be a function of age t but not of the distance from the present ($t-s$).

One sole preference parameter, β , governs choice over time : the higher is β , the shorter is the decision horizon (for given T). The homotheticity of the function U means that

¹ Time consistency implies, intuitively, that if everything happens as planned the agent will carry out his planned saving. This property corresponds to stable preferences over time. Time inconsistency results from a conflict between the desires of the present and future selves (see Jon Elster's *Ulysses and the Sirens*).

instantaneous utility u depends only on γ which represents both the concavity of u and the inverse of the intertemporal elasticity of substitution, denoted β (the elasticity of the growth rate of consumption with respect to the interest rate).

With an uncertain future, the individual maximises expected utility $U : \gamma$ is then equal to the degree of relative aversion to risk, β . More generally, *all* risky behaviours β precautionary saving generated by prudence (the third derivative of u), the reduction of portfolio risk in the presence of a background risk over labour income, which depends on temperance (the fourth derivative of u) and so on β will depend only on the parameter γ equal to :

$$\beta = \beta = 1/\gamma. \quad (3)$$

In standard theory, the diversity of wealth attributable to preference heterogeneity results from only two parameters : β the degree of relative risk-aversion, and γ , the time discount rate. Empirical tests then consist in estimating these parameters, $\hat{\beta}_i$ and $\hat{\gamma}_i$ for each individual i , and then measuring their effects on the level and composition of household wealth. The size of the estimated coefficients allows us to evaluate the explanatory power of taste heterogeneity on the distribution of wealth and the demand for financial assets.

2.2. Non-standard theory : realism at the expense of multiple parameters

The predictions of standard models do not match up with the behaviours observed in experiments or in survey data, both with respect to choice under uncertainty and choice over time. Standard theory cannot account, for example, for the limited demand for risky assets despite the observed excess return on stocks over fixed income securities, the so-called "equity premium puzzle".

- *Beyond expected utility*

If we keep homothetic preferences², the main problem is with equation (3). The models of non-expected utility which best explain the risk premium distinguish three parameters : β which now measures only decreasing marginal utility, $1/\beta$ which measures the aversion for movements in consumption over time, and γ , risk-aversion, i.e. the aversion regarding differences in consumption between different states of nature.

To account for a number of "anomalies" found in experiments (the Allais paradox) or in insurance demand, two more extensions seem necessary. The first introduces a non-linear transformation of probabilities, which accounts for experimental subjects' greater sensitivity to (extreme) low or high probabilities and classifies them as "optimists" or "pessimists".

² Homothetic preferences are not consistent with an inequality of wealth much greater than the inequality of income. However, the rejection of homotheticity would imply that risk attitudes, such as prudence or temperance, can no longer be summarised, in an expected utility model, by the sole parameter γ

Further, loss-aversion, as described by Kahneman and Tversky (1979), allows us to explain why some risky assets do not appear attractive.

The non-standard approach leads us to consider at least six key parameters : β ; δ ; γ ; λ ; the degree of optimism or pessimism ; and the degree of loss-aversion.

- *Beyond exponential discounting at a constant rate*

The abandon of the expected utility model, equations (1)-(2), for intertemporal choice leads to a substantial inflation of parameters, especially if we wish to account for the extreme dispersion of β (see Frederick *et al.*, 2002).

A more realistic model would posit current utility, u , in equation (1), as a function of both current consumption, but also leisure, needs, health, past consumption (habit-formation) and so on. These changes to the utility function will affect the measure of β , most leading to an *overestimate* of the true value : an individual may prefer "one today to two tomorrows" because of an intrinsic preference for the present (β), but also because she dislikes waiting, her time being limited (a high utility of leisure), or because tomorrow, when she is older, her ability to enjoy consumption will be smaller (falling needs), and so on. Other factors operate in the same direction \square i.e. overestimation of β : liquidity constraints (tomorrow the individual will be richer, but cannot borrow today against that future expected wealth) ; and especially uncertainty regarding the future ("A bird in the hand is worth two in the bush"). The difficulty of adequately controlling these factors explains in part the diversity of measures of β .³

As opposed to exponential discounting at a constant rate, experimental evidence suggests *hyperbolic* discounting, with a higher discount rate for the near future than for distant events. This can be presented in discrete time as follows (Laibson, 1997) :

$$U^t(C_t, C_{t+1}, \dots, C_T) = u_t(C_t) + (1 - \beta) \sum_{k=1}^{T-t} (1 + \beta)^{\beta k} u_{t+k}(C_{t+k}), \quad \text{avec: } 0 \leq \beta \leq 1. \quad (4)$$

In addition to the long-term discount rate, β , we have a second short-term discount rate, β , which leads to time-inconsistent choices, *i.e.* a conflict between the preferences of myself now and myself in the future : the future discount rate between periods $t+1$ and $t+2$ is equal to β for an individual at time t , but is equal to $(\beta + \beta)/(1 - \beta)$ for an individual at time $t+1$. The parameter β may be interpreted as reflecting bounded rationality, either by a lack of imagination (we always put unpleasant decisions off until tomorrow, such as stopping drinking or smoking), or by a lack of will-power or self-control in the short-term ; $\beta = 1$ hence corresponds to extreme short-sightedness or impatience.

An individual with such preferences may decide to side-step problems of time-inconsistency by a programme of pre-commitment, as for Ulysses facing the Sirens. Such

³ More anecdotally, the phenomena of anticipation, such as the pleasure of savouring a pleasant event in the future, or the dread of a future unpleasant experience, introduce a bias *in favour of the future*, which works in the opposite direction to the classic preference for the present.

strategies may explain the popularity of contractual savings plans, even with relatively low yields, especially for retirement saving (Laibson, 1997).

Even without taking into account a time horizon which transcends her own existence (intergenerational altruism), intertemporal trade-offs in a non-standard framework imply more than half a dozen additional preference parameters to be estimated, while taking into account any factors leading to an over-estimate of β . This is clearly an impossible task.

2.3. A middle, pragmatic approach

Parsimony leads us to reduce the number of parameters to estimate, and hence pushes us towards a partial rehabilitation of standard theory, while realising its insufficiencies. In this sense, instead of estimating quantitatively parameters which precisely describe certain concepts, such as relative risk-aversion, we use qualitative *ordinal* measures regarding risk attitudes which summarise a number of theoretical parameters.

We thus assume at first that wealth choices depend of one sole risk parameter β which we still denote β which is supposed to reflect general attitude towards risk, representing risk-aversion, prudence, temperance, and loss- and uncertainty-aversion. This parameter corresponds, moreover, to an average measure over a number of different *life-domains* with the exception of wealth (consumption and leisure, health, work, family, financial lotteries, retirement, etc.) and over different contexts (small or large risks, gains or losses, etc.). Of course, our data may argue against the existence of such a "risk-taking propensity as a generalized characteristic of individuals" (Barky *et al.*, 1997), and show, for instance, a high heterogeneity of reactions across domains β for instance, if risk exposure in one domain (whether desired or imposed) tempers risk behaviour in another. Our statistical analysis will show that our prior assumption is warranted, one indicator of risk preference "being enough".

The pure preference for the present, represented by the discount rate β determines the time horizon of the saver (for given survival probabilities). We have decided to augment it by other independent parameters describing preferences regarding time :

- On the one hand, a number of behavioural "anomalies" can be explained by *short-term impatience*, which includes both time inconsistency, β , but also the fact of being "in a rush";

- On the other hand, the size and inequality of wealth transfers, often the source of large fortunes, obliges us to take *intergenerational altruism* into account, in particular its familial component : over and above his or her own well-being, individuals are concerned about the well-being of their children, which should be introduced as an argument of the individual's own utility function. Individuals act as if their decision horizon were longer than the duration of their own life, T , implying that equation (1) should be summed over a period greater than T , with discount rate β .

Past experience has shown that it is difficult to obtain reliable measures of β without being explicit about what this rate represents⁴. Time preference seems to us to be a fundamental human disposition, expressing the existential relationship between the current me and future "selves", the greater weight given to the former coming from the primacy of today's me for the existence of all future incarnations : my future selves only "exist" in my eyes, today, if the current me cares about them, and sets up future projects involving them. The relative weight given to future satisfaction measures the degree of "altruism" of the current self for her future "successors", the strength and extent of the projects which regard them. These ground projects give substance and meaning to life, providing reasons to stay alive and the motive force which propels us into the future ; they must exhibit a sufficient degree of legitimacy with respect to current me, as well as for others (Masson, 1995 and 2000).

This existential conception of time preference corresponds to a personal, idiosyncratic disposition, characterising (the inverse of) his or her propensity to project themselves into the future. As such, this preference should not depend on the domain under consideration : someone who is far-sighted with respect to health should be also so with respect to her career or her retirement.

Finally, our approach retains two key parameters, β and δ , which should however be interpreted in a wider and richer sense than in standard theory. The "revelation" of these preferences is carried out by more direct (real-life) but multi-dimensional questions, which do not generally rely on, especially in the case of β the choice between lotteries.

3 – PREFERENCE SCORES AND THEIR EFFECTS ON WEALTH

To measure individual preferences with respect to risk and time, we conceived a methodological questionnaire entitled "Behaviour in the face of risk and the future" (85 questions) which was given, in a second interview, to 1135 volunteers, drawn from the sample of the INSEE survey "Patrimoine 1998" (see *AMV*).

3.1. Calculating summary "scores"

The questionnaire covers a wide variety of domains (consumption, leisure, health, financial lotteries, work, retirement, and family). For each of these domains, different types of questions are used (concerning behaviour, opinion, or choices over lotteries or fictitious scenarios). Finally, the respondent is asked to position herself on *scales* graduated from 0 to

⁴ The type of questions asked is largely behind the difficulties encountered in previous work : the choice between monetary gains and losses at different dates brings in another factor, the interest rate ; trade-offs between comparable amounts of "pleasure" or "pain", again at different dates, reveal an interpretation too naïve or literal of the discount rate, etc. (see *AMV*).

10, according to the perception that she has of her attitude with respect to risk (between "prudent" and "risk-loving"), preference for the present (between "live for today" and "take care of the future"), and short-term impatience (between "impatient" and "sedate").

For each preference that we wish to measure $\square \square \square$, short-term impatience (\square), family altruism (\square), and non-family altruism \square we have selected a certain number of questions on *a priori* grounds. Some have been assigned to two different indicators, notably \square and \square (the future is both far away and uncertain).

For example, considering risk-attitude, we find a number of anecdotal questions such as :

- "do you take an umbrella when the weather outlook is uncertain ?"
- "do you park your car where you would run the risk of a fine ?"

as well as lottery choices and consumption habits such as :

- "have you changed your consumption patterns as a result of the Mad Cow disease ?" (remember that the survey was carried out in 1997-8),

or opinions :

- "do you agree with the statement "marriage is a form of insurance ?"
- "do you feel concerned by current public health issues (such as AIDS or contaminated blood) ?".

A reference question to identify \square is :

- "as a result of an unexpected workload, your employer asks you to forego a week's holiday this year, in exchange for x extra days next year... : do you agree ?".

On the other hand, the questions :

- "do you think that it is worthwhile to gain a few extra years of life by depriving yourself of today's pleasures ?"
- "to avoid health problems, do you pay attention to your weight or your diet, do you practise a sport ?"
- "do you prefer an increased public pension before age 85, in exchange of a reduced one thereafter ?"

are considered to reflect both \square and \square

The interpretation of the replies to such direct questions raises the problem of framing effects and irrelevant factors (someone who is risk-loving may never park in a proscribed place, due to feelings of good citizenship). The underlying idea is that only the mean of the responses per individual will convey relevant information. The statistical approach is then to code each question using three levels (for $\square \square 1$ corresponds to short-sighted, 0 to neutral, and +1 to far-sighted) and then to sum these "marks" for each individual ; the score is then this summation concerning only the items which are shown to form a coherent whole, while eliminating the questions which negative or too small correlation with the sum of all the others (the score without the question) and using Cronbach's alpha to judge and maximise the

degree of internal coherence of the measure (Spector, 1991). The score is thus a summary measure, qualitative and ordinal, which is supposed to represent the individual's answers to a set of diverse questions (see *AMV*).⁵

How are preferences distributed across individuals ? Generally, the results conform to our priors. Men and the younger are less risk-averse than women and the older respectively. Individuals have a longer time horizon (weaker time preference) when they are older, more educated, in a couple, or with children, and individuals' time preference seems to be positively correlated with that of their mothers. The educated are more altruistic. However, there is no clear demographic distribution of impatience. The only surprise is that men are no more short-sighted or less altruistic (in the family sense) than women, and this holds even in the sample of couples with children.⁶

3.2. Preference scores and wealth

Preference scores have significant effects on wealth (financial, gross and net) in the predicted manner⁷. Being more prudent or more forward-looking increases wealth (financial or total). Family altruism is also associated with greater wealth. Wealth is thus a joint outcome of precautionary saving, retirement saving, and bequest motives. On the other hand, short-run impatience is not correlated with the level of wealth, and neither is non-family altruism (protection of the environment, saving the planet, etc.).

The gain in explanatory power from using preference scores may appear modest : due to the skewness in wealth, the contribution of unobserved heterogeneity is not substantially reduced. However, the quantitative effect of these variables is substantial, notably for time preference : the difference in wealth between the extreme individuals (*i.e.* between the most short-sighted and long-sighted in the sample) is of the order of 1 to 4. Further, the decomposition of wealth inequality using the Theil index shows that the relevant taste parameters (β and family altruism) have explanatory power (Theil contributions in the order of 15 %) greater than that of social origin, education, household type, town size, or liquidity

⁵ We judge the robustness of these scores by comparing them to the results from principal components analysis. These latter show that the questions retained have a common component, often bi-dimensional. The risk score can thus be decomposed along (the first) two axes, the first corresponding to current choices or those relating to early economic life (marital and professional), the second to longer-term risks (health and retirement). The risk scale response is only projected on the first axis, and much nearer to the origin.

⁶ There is indirect corroboration of estimated age and sex effects. One half of respondents consider themselves to have changed preferences, of which an overwhelming majority say that they have become more prudent and/or far-sighted. Both husbands and wives also agree that the wife is more prudent, but both consider their partner to be the more far-sighted, a contradiction suggesting that the sex effect on time preference is indeed ambiguous.

⁷ The scales (risk, time preference, impatience) explain wealth much less well : only that with respect to time preference is significantly correlated. Taken one at a time, each question has little explanatory power. This is the case notably for the lotteries which are supposed to reveal risk-aversion, and also for Barsky *et al.* (1997) measure of risk tolerance (see Kapteyn and Teppa, 2002, for similar results) For time-preference, only one question, the fact of having long-term projects (over 10, 20, or 30 years or more) is significantly correlated with wealth, but may suffer from endogeneity bias. These results justify our method of construction of summary scores.

constraints ; only age, income, social class, and inheritance \square the reference explanatory variables \square are more important.

A strong correlation does not imply causation, and our results would be less interesting if interpreted as richer individuals taking more risks (Arrow), or discounting less (see Becker and Mulligan, 1997). Endogeneity tests using instrumental variables (notably parents' characteristics) show that the three relevant scores in the wealth equations (β , γ and family altruism) can be simultaneously considered as exogenous. This result is not surprising. The scores are the sum of a number of items, a significant part of which (such as "take your umbrella when the weather outlook is uncertain" or "foregoing current pleasure to gain future years of life) can be considered as natural instruments.

We can now answer a key question : is prudent (a high value of β) a synonym for long foresight (a low value of γ) ? There is some evidence that this is the case, the correlation between the two scores being $\square 0.34$. This relation can be seen in Table 1. Amongst the least prudent individuals, 45 % have a strong preference for the present while only 4 % have a weak preference for the present (*i.e.* risk-loving and far-sighted). Symmetrically, amongst the most prudent individuals, 47 % are equally far-sighted while only 6 % have a strong preference for the present (*i.e.* risk-averse but live for today).

We also see that foresight is correlated with family altruism : the correlation between β and γ equals $\square 0.38$. Family altruism is indeed a sign of a long time horizon, even if it should be clearly distinguished from time preference (on the other hand, the correlation between the altruism scores, family and non-family, is under 0.20 : it is possible to be altruistic with respect to one's family without being altruist with respect to others).

The last message from the wealth regressions is that the introduction of interactions between risk and time preferences ($\beta * \gamma$) allows a better explanation of the distribution of wealth : an individual who is both prudent and far-sighted has greater wealth than someone who is risk-loving and short-sighted, with the difference in wealth being in the order of ten to one.⁸

4 \square THE INTERACTION OF KEY PREFERENCE PARAMETERS

The standard theory of saving limits preferences to two parameters $\square \beta$ (relative risk aversion) and γ \square but also implies that saving will depend on the interaction between these two parameters. While each parameter, on its own, is insufficient to explain agents' choices, the models define a number of different saving regimes according to the values taken by the

⁸ In order to not overly multiply the different types of savers as a function of their preferences over risk and time, we do not take the family altruism score into account in the empirical analysis. This score is correlated with time preference (0.38) but less so with risk preference (0.14 : altruists are somewhat more prudent).

risk and time preference parameters, β and β_i , which allow us to identify different types of savers.

Our approach is again based on these two key parameters defined appropriately, as above. But in addition to the pair (β, β_i) we should introduce, if necessary, short-term time impatience, β_i , or the degree of family altruism β_i . A mythological digression serves to illustrate.

4.1. An illustration : Ulysses and Achilles or the heterogeneity of risk-lovers

Homer's two most famous heroes supply a convincing illustration of the necessity of the triple $(\beta, \beta_i, \beta_i)$, where β refers to an absence of "self-control".

To account for Ulysses' actions faced with the sirens, we should underline his relatively risk-loving character (β weakly positive, or even negative), far-sighted (a low value of β), and "impatient" β a victim of passions which he does not control ($\beta > 0$). A prudent individual (a high value of β , who does not play with fire, would have avoided the Straits of Messina or would have, like his sailors, put wax in his ears ; someone in control of his passions ($\beta = 0$) would not need to have attached himself to the mast ; a third, more short-sighted (a high value of β), would have acted as a function of his instantaneous preferences and would have drowned himself. The "wise" Ulysses avoids this sad end precisely because he is far-sighted and recognises his time-inconsistency, which leads him to adopt a strategy of *pre-commitment*.⁹

The impetuous Achilles is also a risk-lover (a low or negative value of β) and impulsive ($\beta > 0$). However, he chooses a short and glorious life (rather than long and boring) because, contrary to Ulysses, he has a strong preference for the present (a high value of β).

The Stoics contrasted Achilles, a violent and impulsive man looking for bravado, with Ulysses, the prime example of a wise man, in control of his passions (*i.e.* "prudent", in the Greek sense). Time preference introduces another distinction, just as pertinent : Achilles died young (that was his destiny), while Ulysses lived to a ripe old age according to most versions.

In a somewhat different context, we call individuals like Achilles *hotheads* (low value of β high ones for β and β_i) : an unkind characterisation has them as thoughtless risk-takers, who are likely to end up as outsiders, rebels or criminals, although another β positive β reading has them as dashing or detached. Individuals like Ulysses are *enterprising* (low values of β and β_i , $\beta \geq 0$) : not particularly risk-averse but responsible and far-sighted, they are in control of their passions or able to hinder their negative effects.

This distinction between two heterogeneous categories of individuals relatively little risk-averse can also be applied to a recent controversy presented by Ewald and Kessler (2000) in the journal *Le Débat* : rather than being divided between rich and poor, is society rather

⁹ This strategy of pre-commitment has nonetheless two major drawbacks : it requires the intervention of a well-intentioned third party β the obedient sailors β and involves a cost in that the future self is put under the control of another person : Ulysses tied to the mast complains that he cannot go to see the Sirens (see Masson, 1995).

split between risk-lovers and the risk-averse, a divide which reflects to a large extent, according to the authors, that between entrepreneurs and rentiers (those with private means), or even between the brave and the timid ?

Critics have insisted on the heterogeneous nature of risk-lovers, which group includes explorers and entrepreneurs in the Schumpeterian sense, as well as individuals who are much more unstable or much less commendable (Castel, 2003). Without judging the foundation of these criticisms, the introduction of a second dimension, reflecting time preference, illuminates the debate : when they talk about risk-lovers, Ewald and Kessler have implicitly in mind "enterprising", responsible and far-sighted individuals, not "hotheads"; equally, the risk-averse that they call timid are, for them, irresponsible and with no plans for the future. However, a number of individuals are both prudent and far-sighted, that we call in French "bons pères de famille" and in English, tentatively, *armchair investors*.¹⁰

4.2. Types of wealth accumulation according to preferences

In the standard theory of saving, with CRRA utility functions, the interaction between risk-aversion (γ) and time preference (β) should allow us to distinguish four types or regimes of saving behaviour (we say *should*, since extensive microsimulation of life-cycle models is still needed to qualify this statement). The first frontier is Carroll's (2001) "impatience condition" separating prudent consumers ($\beta > 1$) into two groups : hump plus precautionary saving and buffer-stock behaviour. The second frontier should be $\beta = 1$: when there is no floor for income but a strictly positive probability of zero income, short-sighted individuals will never borrow (even if it were possible) when β is superior to one, since utility tends to minus infinity when consumption goes to zero and there is such a probability of zero consumption in future periods ; but individuals with $\beta < 1$ could do so. Finally, farsighted but less prudent individuals may follow atypical behaviours. This imprecision explains that, regarding the predictions of the models, we will have to innovate to a various extent.

The representative agent of the life-cycle hypothesis, who follows the hump-shaped age-wealth profile observed in surveys, corresponds to a high value of risk-aversion ($\gamma = 3$ or 4) and a low value of time preference β (1 to 3 %), less than the real interest rate. Saving is carried out for retirement and long-run precautionary purposes (Modigliani, 1986). The group of savers corresponding to this category will be called the *Armchair investors*.

With a higher value of the time discount rate ($\beta \gg r$) and β in the same range as before (3 to 4, say), we have a different type of saving, called *buffer-stock*. Agents would like to borrow against their future resources, were these latter to be certain (and more so as these rise with age), but their prudence prevents them from doing so as these latter are uncertain. They therefore reach a compromise between prudence, which incites them to accumulate

¹⁰ The French name is not intended to be pejorative : rather it refers to a legal term, which is used in the case of the administration of assets by a third party, which gives priority to long-term and prudent management.

reserves in the face of the unexpected, and their strong preference for the present which pushes them to consume straight away.

The relatively modest levels of wealth of these *Short-sighted prudent* only provides a medium-term buffer against unexpected falls in their income. Numerical simulations show that the buffer has a very irregular profile (a function of the stochastic properties of income) ; if the individual is liquidity-constrained (Deaton, 1992), wealth will occasionally drop to zero ; with a probability $p (> 0)$ that income drops to zero, the individual will plan upon (with $\beta > 1$) a positive level of wealth \bar{w} "self-imposed" constraint (Carroll, 2001). Whenever wealth itself is only small, consumption will drop sharply in the case of repeated bad luck in income, although the individual is fully aware of this danger (as her choices are intertemporally consistent) : in this sense, her behaviour can be termed auto-destructive.

This auto-destructive tendency will be more pronounced for those who are less risk-averse than the short-sighted prudent ($\beta \gg r ; \beta < 1$). These *hotheads*, weakly risk-averse and little concerned with the future, are the most likely candidates for careless risky behaviour with respect to investment and borrowing.¹¹

The last category consists of those who are far-sighted but who are not afraid of risk: the *Enterprising* ($\beta < r ; \beta < 1$). Their wealth behaviour is more difficult to describe, as they are the farthest removed from the standard life-cycle model, rather depending on entrepreneurial investments, with an interaction between business investments and domestic wealth (see Shorrocks, 1988, and Hurst and Lusardi, 2004). The typical entrepreneurial figure is that of a "temperant" individual ($u''' < 0$), who concentrates risky positions in the framework of professional activity, but who takes fewer chances in other domains of life. Wealth choices will then depend on the specific type of professional activity adopted.¹²

These cases derived from the standard theory can be refined by the introduction of two other preferences over time : β and β_i . It is possible that a number of hotheads are impatient ($\beta_i > 0$), a time inconsistency which could explain their typical lack of money and difficulties with repayments. Amongst the more far-sighted (the "armchair investors"), or even the more risk-averse (the "short-sighted prudent"), this same impatience might explain the attraction of contractual saving, which allows for pre-commitment.

Family altruism ($\beta_i > 0$) allows us first to explain certain levels of wealth through bequest motives, but has other implications. A generous "enterprising" will thus think to insure his family against the risk associated with his activity : he will purchase a *term-life*

¹¹ In another theoretical context, hotheads are those most susceptible to "rational addiction" (Becker and Murphy, 1988). This supposes not only a high discount rate, but also weak risk-aversion : uncertainty affects the "tolerance level before addiction", which differs from one individual to another, and is not known by the individual at the outset (see Orphanides and Zervos, 1995).

¹² According to circumstances, a professional mountain climber, for example, will undertake risky investments to finance his or her expeditions, or will manage his or her investments wisely if he or she can count on a devoted patron.

insurance, with a better rate of return if he plans to stop his current activity early, as in the case of a dangerous sport.

4.3. A provisional typology of five saver types

For the empirical application, we will consider saver types defined only by the pair (\square, \square) : 1) "armchair investors"; 2) "enterprising"; 3) "hotheads"; 4) "short-sighted prudent". Groups 2 and 4 contrast prudence and foresight (contrarily to popular wisdom): "enterprising" are forward-looking and little risk-averse, while "short-sighted prudent" clearly represent an oxymoron. A paternalistic view will oppose group 1 parents to group 3 children which they have to control; group 2 and group 4 individuals will give opposite answers to the opportunity of a risky operation in order to gain a few years of life.

We add a last category: 5) the *middle ground* ("average" values of \square and \square), in order to obtain a clear statistical distinction between saver types. As scores are ordinal measures, the groups are only defined in a *relative* manner: e.g., the "armchair investors" are more prudent and more forward-looking than others. The "middle ground" will serve as a reference point to judge the effects of belonging to different categories of savers on the amount or the composition of wealth.

The saving behaviour of each saver type, relative to the middle ground, can be broadly summarised as follows.

1) *Armchair investors* (a high value of \square but a low value of \square). Wealth, which is relatively high, is primarily constituted of a reserve of deferred consumption for old age, but also serves as precautionary saving against income and life expectancy uncertainties: the age-wealth profile is hump-shaped, with a maximum just before retirement and falling thereafter, which is however moderated by precautionary saving (against lifetime uncertainty). Buying property is a key phase in wealth accumulation, generally taking place before retirement saving in the form of annuities or pension funds. Contractual saving, even with a relatively low return, enforces savings discipline on the individual. Share-holding, where returns are risky in the short-run but higher and more certain in the long-run, is more difficult to predict.

2) *Enterprising* (low levels of both \square and \square). Their risk-taking activity is often concentrated in potentially high-return sectors: setting up firms, speculative investments, dangerous jobs, extreme sports and so on. For certain types of activity, we will see a preponderance of business assets and risky investments, but not for others. The age profile of wealth is less regular, perhaps always increasing throughout life. Significant risk exposure (whether in terms of income, health, or wealth) may lead the enterprising, if altruist, to subscribe to (term-) life insurance for her family's benefit.

3) *Hotheads* (a low value of \square but a high value of \square). There is little life-cycle or precautionary saving (some individuals are permanently zero-wealth holders). The little wealth is composed of shares and other risky assets (but not of financial instruments for

retirement, or contractual saving). These individuals may undertake substantial risks in a number of different domains (job, health, sport, family, etc.). The most impatient in the short-run ($\beta > 0$) will suffer from chronic lack of money, and will have difficulties with repayments and with excessive debt.

4) *The short-sighted prudent* (high values of both β and γ : buffer-stock behaviour). The goal of their saving is to establish a minimum amount of precautionary capital which will vary little if at all around its target level, given by a certain number of months or years or average or permanent income. This capital (other than housing) is most often limited to liquid or semi-liquid precautionary saving which is low-risk, available at short notice. There is little saving through retirement instruments, life insurance or stocks and shares. Failing anything better, French tax-exempt insurance saving products (PER-PEP), which operate over a limited time horizon, may be attractive to some individuals for their contractual nature, to counter short-sightedness and impatience.

Table 2 summarises the relative predicted effects, *ceteris paribus*, of belonging to different saver group types on the level of wealth and asset demands. Parentheses indicate that the effect is considered to be less strong, in absolute value, than that for other groups. Question marks show that there are a number of contradictory effects, or simply that theory does not provide unambiguous predictions. This table is a cross-section : it does not inform about any transitions between groups over the life-cycle, especially from "hothead" to "short-sighted prudent" or "armchair investors" \square indeed, a lot of respondents see themselves as more prudent and/or far-sighted than they were in the past.¹³

5 \square SAVER TYPES : EMPIRICAL TESTS

The empirical analysis is carried out in three stages : first we describe how the individuals are divided up into the five groups ; then the characteristics of each saver type ; and we finally test the predicted effects, as summarised in Table 2.

5.1. The determination of the five saver groups

Figure 1 represents visually the cutpoints between the different groups, obtained by cutting the two scores β (on the X-axis) and γ (on the Y-axis) into quartiles or thirds, taking into account the relative scarcity of "enterprising" and "short-sighted prudent" (see Table 1). This splitting up of groups is relative : we have thus redrawn the frontiers to maximise the statistical distance between the groups, and also to better identify the effect of group membership on wealth behaviour, which explains the somewhat uneven nature of the figure.

¹³ Carroll (2001) suggests another trajectory whereby savers change from "short-sighted prudent" (*buffer-stock savers*) to "armchair savers" preparing their retirement (*hump saving*) : we do not find this pattern in our data.

For the "enterprising", for example, we consider individuals with a time preference score \leq below the median (Me) and a risk-attitude score \leq below the first quartile (Q1) ; we add those belonging to the first quartile of \leq (Q1) and those between the first quartile (Q1') and the first third (P33') of \leq This covers 7% of the sample.

For the other categories, the division of the sample produces one third "armchair investors", 27 % "hotheads", and 15 % "short-sighted prudent". The "middle ground", the reference category, covers 18 % of individuals.

5.2. Who belongs to which group ?

The estimated probabilities of saver group membership, from a multinomial Logit, are presented in Table 3 (each line sums to one).

An individual under the age of 30 has a 42.3 % chance of being a "hothead", a 20.7 % of being in the "middle ground", 16.5 % of being an "armchair investor", 12.6 % of being "short-sighted prudent", and 7.8 % of being "enterprising". Were observable characteristics to be uncorrelated with saver type, the percentage figures within each column of Table 3 would be the same. We can thus interpret any differences as showing who is in each group (the variables are all significant at the five per cent level).

There are four times as many individuals under the age of 30 as individuals 65 or over in the category "hotheads", and twice as many in the category "enterprising" ; on the contrary the young are 3.5 times less numerous in the category "armchair investors". This suggests an evolution over time which corroborates respondents' self-reports (see footnote 6) : individuals change from "hotheads" to enterprising or "armchair investors" as they grow older. Other variables are also important, including gender : women are relatively less numerous amongst the "hotheads" (1.4 times less) and "enterprising" (almost two times less).

The "armchair investors" are typically women in couples, older rather than younger, with children, in the public sector ; "hotheads" are young single men, in management or self-employed, in the private sector; "enterprising" are also young single men, in management or self-employed in the private sector, but better-educated and more likely to have children ; "short-sighted prudent" are more likely to be women, less well-educated and single.

5.3. The effect of preferences on the level and composition of wealth

Table 4 summarises the estimated effects of saver type on the level of wealth, financial, gross and net. The values of the average respondent (with average sample characteristics) have been normalised to 100. The significance of the estimated effects is with respect to the "middle ground" group, the reference category.¹⁴

¹⁴ The explanatory variables in the wealth regressions include age, social class and education of the reference person ; total earnings, marital status, number of children, intergenerational transfers received, liquidity constraints, and region at the household level.

Two saver types possess less wealth (of all types) than the others : "hotheads" and "short-sighted prudent" ; and one category, "armchair investors", is significantly richer than the others. Compared to "armchair investors", "hotheads" have 40 % less financial wealth, and 50 % less gross wealth ; the same qualitative results apply for the "short-sighted prudent".

Table 5 summarises the results of Probit estimation of the effect of saver type on the probabilities of holding different types of assets.¹⁵ Within financial assets, we consider securities, life insurance and retirement saving, and housing saving ; for real assets, housing and business assets.¹⁶ Asset demand (except for life insurance and "RCV") was also analysed using Tobit techniques, which simultaneously estimate the probability of detention and the amount held : the results are qualitatively unchanged, and are somewhat more often significant.

These estimated effects match closely with the theoretical predictions in Table 2. The "short-sighted prudent" hold less shares, mutual funds and securities than the other types □ they are half as likely to hold shares.

Housing saving is less prevalent for "hotheads" and "short-sighted prudent" ; the same is true for holding life insurance and retirement instruments (the "short-sighted prudent" hold 13 % less of these than the "middle ground"). Decomposing this difference, we note that the gap can be explained by a lower prevalence of annuities and life insurance contracts in these two categories : life insurance is held by 3.4 % of the "short-sighted prudent" but 9.4 % of the "armchair investors". On the other hand, while "hotheads" are not tempted by insurance saving products PER-PEP (6.8 %), the "short-sighted prudent" are, as predicted, more likely than average to hold these assets (15.9 % against an average probability of 12.5 %). This is the only asset, real or financial, for which this is the case. Last, we note that complementary retirement saving (RCV) is particularly attractive for the "enterprising" ; however, these latter are no more likely to hold life insurance policies than other households.

With respect to real assets, "hotheads" exhibit the predicted atypical profile : they are far less likely to be homeowners than other types (43.4 % against 52.3 % for the "middle ground"), but more likely to hold business assets, to almost the same extent as the "enterprising" (4.3 % vs. 1.3 % for the "middle ground").¹⁷

¹⁵ The explanatory variables in these equations are wealth (financial or total), earned income, age, education, marital status, number of children, liquidity constraints and region. With respect to housing, household wealth was not included (for causality reasons) ; for financial assets, we control for financial information inherited from parents.

¹⁶ Including housing may be problematic in the sense that, more than other assets, it can be inherited or purchased using an inheritance.

¹⁷ Restricting the analysis to the hard core of each category does not change these relative effects. The "enterprising" become more likely to hold business assets, while "hotheads" possess still less wealth.

6 □ CONCLUSIONS

The econometric analysis of the level and composition of wealth in France in 1998 strongly supports, via a number of different theoretical effects which are found in the data, the typology of savers resulting from the interaction of the "attitude" towards risk and time preference.

"Hotheads" and "short-sighted prudent" possess less wealth than the other categories. Regarding wealth composition, the "short-sighted prudent" behave as expected, owning fewer risky assets and less annuities than other households, but are tempted by insurance saving products (PER-PEP) ; "hotheads" have a short time horizon (less housing, annuities and retirement saving) but take greater risks in their saving (financial assets) as in their work life. This holds equally for the "enterprising", who do however have a longer time horizon (housing and, especially, retirement saving greater than average). Last, "armchair investors", prudent and far-sighted, have fairly average portfolio choices : they are only distinguished by a greater demand for annuities, life insurance and retirement saving.

This typology can be applied to other fields of research. We might ask whether the low level of saving of a significant proportion of the population before retirement might be explained by their preferences : the "short-sighted prudent" and the "hotheads" are twice as likely to be "non-savers" (wealth/permanent income < 2 at retirement eve), the "armchair investors" are 50 % more likely to be amongst the "savers". This provisional typology could also be refined by considering the role of altruism : there are two to three times more altruists (the top quartile of the score) amongst the "armchair investors" (30.2 %) and the "enterprising" than amongst the "hotheads" and the "short-sighted prudent" (9.9 %).

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Table 1: Population Distribution according to Time Preference and Risk-Attitude (%) :
Correlation = -0.34

<i>Risk Aversion</i>	<i>Weak</i>	<i>Average</i>	<i>Strong</i>	Total
<i>Time Preference</i>				
<i>Weak</i>	1,6	13,2	9,1	23,9
<i>Average</i>	10,7	29,8	11,1	51,6
<i>Strong</i>	12,0	10,3	2,2	24,5
Total	24,3	53,3	22,4	100,0

Source: "Patrimoine 1997" INSEE survey.

Note: The "weak" categories correspond to the first quartile of the score distribution, "average" to the second and third quartiles, and "strong" to the top quartile.

The table should be read as follows: 1.6% of population belong to the first quartile of both the risk and time preference score distributions.

Table 2: Predicted Saving Behaviour of Different Groups

	Global Wealth	Housing and Housing savings	Business Assets¹	Risky Financial Assets (Stocks and Securities)	Annuities²	Life Insurance²	Insurance saving product : "PER-PEP"²	Life Insurance, Annuities and Retirement Saving²	Financial Wealth
"Armchair investor"	+	+	□	?	+	(+)	(+)	+	+
"Hothead"	□	□	(+)	(+)	□	□	□	□	□
"Entreprising"	?	?	+	(+)	?	+	(-)	?	(+)
"Short-sighted prudent"	(□)	(□)	□	□	□	□	(+)	(□)	?
"Middle Ground"									

Notes: 1. Calculated for a given level of wealth.

2. Calculated for a given level of financial wealth.

Table 3: Estimated Probabilities of Saver Group Membership

<i>Individual Characteristics</i>	"Armchair investor"	"Hothead"	"Enterprising"	"Short-sighted prudent"	"Middle Ground"
Age					
<i>30 years old</i>	0,165	0,423	0,078	0,126	0,207
<i>65 years old</i>	0,582	0,113	0,035	0,158	0,112
Occupation					
<i>Farmer, Manual Worker or Employee</i>	0,356	0,222	0,043	0,182	0,197
<i>Self-Employed</i>	0,294	0,333	0,096	0,127	0,149
<i>Management or Professional</i>	0,285	0,333	0,091	0,128	0,162
Sex					
<i>Male</i>	0,296	0,326	0,084	0,139	0,155
<i>Female</i>	0,348	0,226	0,048	0,176	0,202
Education					
<i><Baccalauréat</i>	0,280	0,282	0,057	0,204	0,177
<i>Baccalauréat</i>	0,445	0,263	0,060	0,099	0,133
<i>>Baccalauréat</i>	0,350	0,243	0,075	0,120	0,211
Marital Status					
<i>In a Couple</i>	0,365	0,246	0,061	0,139	0,189
<i>Single</i>	0,264	0,314	0,066	0,194	0,163
Number of Children					
<i>No Children</i>	0,284	0,322	0,053	0,141	0,200
<i>Three Children</i>	0,357	0,236	0,071	0,172	0,165
Sector					
<i>Private</i>	0,295	0,286	0,076	0,162	0,182
<i>Public</i>	0,413	0,230	0,038	0,148	0,171
Average Probability	0,326	0,272	0,063	0,159	0,181
Population Distribution	0,331	0,279	0,065	0,156	0,168

Source: "Patrimoine 1997" INSEE survey.

Note: The effects of individual characteristics on the probability of saver group membership are estimated using a multinomial logit. The age, income, and number of children variables are continuous. Amongst the right-hand side variables, only household labour income was insignificant (at a 5% level).

The table should be read as follows. A household with a reference person age 30 has a 16.5% probability of being an armchair investor. The estimated probabilities of being a hothead, enterprising and short-sighted prudent are 42.3%, 7.8% and 12.6% respectively.

Table 4: Wealth and Risk and Time Preference

Saver Type	Financial Wealth	Gross Wealth	Net Wealth
"Armchair investor"	127**	130*	120
"Hothead"	76**	66***	73***
"Entreprising"	85	93	94
"Short-sighted prudent"	76**	69***	68***
"Middle Ground"	103	106	112
Average	100	100	100

Source: "Patrimoine 1997" INSEE survey.

Note: ***, **, *: Coefficients significant at the 1, 5 and 10 per cent level respectively.

The effect of saver type is estimated holding all other variables constant.

Interpretation. The average household in the sample has wealth normalised to 100. "Hotheads" hold 26% less financial wealth (76/103) compared to those in the "Middle Ground" who are the reference category. This difference is statistically significant at the five per cent level.

Table 5: Saver Types and Asset Choice (%)

<i>Saver Type</i>	Shares	Shares, Sicav-Fcp	Securities	Life Insurance	Annuities	Retirement assets	Insurance saving product : "PER-PEP"	Life Insurance, annuities and Retirement Saving ²	Housing saving	Housing	Business Assets (self-managed or not)
"Armchair investor"	12,8	18,4	21,8	9,4	35,2	3,8	16,3	58,3	47,0	50,7	2,3
"Hothead"	13,8	18,9	25,7	5,2*	29,9*	3,2	6,8**	50,6**	36,0***	43,4*	4,3**
"Entreprising"	14,0	17,3	23,4	6,0	28,3	7,1**	11,6	57,9	48,8	54,7	4,5**
"Short-sighted prudent"	6,5**	10,0**	14,5**	3,4**	24,1**	2,2	15,9	46,8**	34,8***	48,8	1,5
"Middle Ground"	14,9	18,9	22,0	9,0	37,5	2,6	14,9	59,6	51,2	52,3	1,3
Average probability	12,3	17,0	21,7	6,9	31,8	3,3	12,5	54,6	42,9	50,9	2,5
Percentage of Holders	18,5	23,0	26,2	10,0	33,8	9,4	15,6	50,2	47,4	49,8	11,1

Source: "Patrimoine 1997" INSEE survey.

Notes. The probabilities of holding different assets are calculated holding all other variables constant, including wealth (financial or net) except for homeownership.

The results are qualitatively unchanged if we estimate asset demand using Tobit equations.

***, **, *: Coefficients significant at the 1, 5 and 10 per cent level respectively.

Interpretation. The average household in the sample has a 12.3% probability of owning shares. The "short-sighted prudent" have a 6.5% probability of owning shares, 8.4 percentage points less than those in the "Middle ground" who constitute the reference category. This difference is statistically significant at the five per cent level.

