CPB Discussion Paper

No 53

January, 2006

Testing Consumers' Asymmetric Reaction to Wealth Changes

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ISBN 90-5833-250-0

Abstract in English

This study contains several tests to show that individuals overreact to negative wealth changes, relative to positive wealth changes. This asymmetry, that is found using micro data, suggests that economists should not treat symmetrically the relation between economic variables (consumption for instance) and wealth in their models when wealth decreases. We find that this asymmetry increases with age and picks at retirement.

Abstract in Dutch

Deze studie bevat een aantal toetsen die laten zien dat individuen sterker reageren op een negatieve ontwikkeling van hun vermogen dan op een positieve verandering. Deze asymmetrie, die wij in onze microgegevens vinden, suggereert dat economen de relatie tussen economische variabelen en vermogen niet als symmetrisch zouden moeten behandelen. We vinden dat deze asymmetrie toeneemt bij het toenemen van de leeftijd en op zijn hoogst is bij pensionering.

Contents

Summary

Different governmental agencies and international institutions have failed in the last couple of years their predictions of net private consumption, by overestimating it. In this study we argue that this may be partly due to the fact that changes in financial wealth are perceived asymmetrically. It is therefore plausible that these changes may have an asymmetric effect on economic variables. Consumption may be the most evident example of this asymmetric relation. We do not directly relate wealth gains and losses to consumption patterns. We only test whether individuals over react to financial losses relative to financial gains. As yearly time series with sufficient variation in financial wealth levels (that enter household portfolios in a non negligible way) will only become available in the future, we base our analysis on micro data. We do not have sufficient data at macro level to enquiry this phenomenon therefore we suggest that our micro results may be of inspiration for solving the macro problem. However the link between micro and macro level is only tentative. Aggregation of micro wealth data derived from surveys misrepresents the stock of wealth and it's variation, as reported by national accounts. This is due to the under-representation in surveys of the top percentiles of the wealth distribution.

The tests we perform are both non parametric and fully parameterised. The first analyse whether individuals form symmetrical expectations in terms of positive and negative changes of financial wealth. These non parametric tests study the subjective distribution of expectations in order to understand whether individuals report a symmetric moment of this distribution. This hypothesis is largely rejected in all tests. We show that there is a remarkable drop in expectations at age 64. This expected drop does not come true at age 65. As this is a remarkable piece of evidence, we also tried to explain what causes it and we find that more than one third of the drop is due to the eligibility to mandatory retirement.

Later we drop self reported expectations and study self reported realisations. Disposing of financial realisations and portfolio composition data, we test parametrically whether the perceived changes in financial wealth correspond to the observed changes. Our models, that also take into account unobserved heterogeneity, show that indeed individuals do not evaluate symmetrically changes that occurred in their wealth. The models also allow an indicative measurement of this asymmetric response and show that typically individuals tend to over react to small decreases in financial wealth. The perceived threshold of a wealth increase is on average one and half times larger than the one of a wealth decrease. The literature suggests a little higher relation, however our results show that this asymmetry is larger as the population ages. The parametric analysis shows plausible results for most of the indicators that we introduced, and shows that not only financial indicators, but also shocks, are a determinant of the asymmetric reaction to wealth changes.

Combining the last two remarks (older individuals tend to be more 'asymmetric', retirees expectations of financial wealth show unjustified drops) with the current population dynamics of

the Dutch society, we suppose that in the future economists will need to take even more care of the asymmetric wealth perceptions.

[0] I thank Rob Alessie, Marcel Das, Bas van der Klaauw, Marcel Lever, Rocus van Opstal, Arthur van Soest and Daniel van Vuuren for commenting on previous versions of this study. In addition I also thank the participants into the the Tilburg AGE Meeting (9-10-2004). I also thank Thomas L. Steinmeier and Arie Kapteyn for their comments at the 'Improving Social Insurance Programs' conference at Maryland University (13-09-2003).

1 Introduction

In the last three years several governmental offices and major economic institutions in Europe have systematically failed to forecast the percentage change of real private consumption expenditures relative to the previous year. According to the OECD *Economic Outlooks* in the Netherlands in 2002 economists expected an increase of private consumption expenditures by 1.7% in 2003 and 2.7% in 2004. Dutch private consumption in 2003 has fallen by 0.9% and preliminary 2004 figures show a modest increment by 0.1%[1].

Why these large forecasting errors? And why an overestimation and not an underestimation? This phenomenon is not common in the time series of private consumption forecasts, which is a prominent item in the national accounts.

The most obvious consideration is that economists could not properly estimate the impact of the economic difficulties that slowed down most industrialised economies and financial markets in the last few years. However larger recessions, for instance with more important repercussions on the labour market, had not generated in the past decades such large discrepancies between forecasts and realisations of private consumption. The most obvious explanation for the forecasting error is that financial markets are largely unpredictable, both in dimension and returns. How financial wealth will affect any economic variable is therefore difficult to anticipate. However good predictions about the size of the financial markets may not be enough to fix our forecasting models.

If we pursue further at micro level the example of private consumption (which is however not central in this study, as it will be clear soon) we may try to partly 'translate' this phenomenon using the following argument. Since the mid 90's more and more households have begun to differentiate their financial portfolio and have also allocated the positive returns of their portfolios to consumption. The recent economic slow down has affected the (perceived) value of these returns, and more in general of households' assets. In turn this had a repercussion on consumption levels that was unprecedented, because most households never invested on financial markets before.

Again this argument alone does not explain the failures by economists in forecasting consumption. Indeed most governmental and international agencies do take into account the elasticity of (household) consumption to (financial) wealth in their forecasts. We need therefore to get into the specifics of these models to understand what may have determined these recent discrepancies.

Since this is an empirical study, and we will use data concerning the Netherlands as a study case, let's propose an example that will make our point clear. Two independent institutions in the

[1] Germany, Portugal, Switzerland or Italy had a similar problem. See Annex Table 3 "Real private consumption expenditures"OECD Economic Outlook no. 72 December 2002, no.74 December 2003, no.76 December 2004.

Netherlands make forecasts of consumption growth: the *Dutch Central Bank* (DNB) and the governmental agency *Netherlands Bureau for Economic Policy Analysis* (CPB). Both agencies have failed their consumption forecasts using different models. However a common feature of both models is that the elasticity of consumption to wealth is calibrated and does not differ for different levels of wealth. Moreover this elasticity is symmetric, in the sense that their models assume that the effect of a variation in wealth will proportionally affect consumption, not withstanding whether this variation in wealth is positive or negative.

This feature is common to models used also in other countries. The symmetry of this elasticity may therefore be partly responsible for the forecasting errors quoted above (together with the most general difficulty of assessing the size of the financial market, which we don't discuss in this study). If individuals react more to negative developments of their wealth relative to what they would do with positive variations, the wealth elasticity should be asymmetric. In order to support this claim empirically we need to test whether individuals overreact to wealth losses relative to their behaviour when wealth increases.

Since portfolio differentiation for a broad number of households is in most EU countries a phenomenon of the last decade, we should constraint the analysis to this period and consider older data as non informative. Evidently this poses a problem of sample dimension since (financial) wealth has increased steadily in virtually all industrialised countries in the last decade, and only in the last two or three years we registered some decrements.

This implies that macro data contain insufficient information to construct any reliable estimation, even if we take into account multiple countries. This was already noted by Poterba (2000) "the only way to learn more about these effects maybe by experiencing a downturn in stock market value". Nevertheless also the negative developments after the turn of the century do not provide sufficient information at country level. We have therefore decided to shift the analysis to a micro level and to look at how individuals think about their wealth gains or losses. Therefore our aim needs to be humble, in the sense that we only want to suggest a possible operational direction in which to search for model improvements. In the remaining of this study we aim therefore to test whether individuals react asymmetrically to wealth variations. We do not aim to measure the difference in elasticities to consumption of different wealth changes. We only want to test whether asymmetric reaction to wealth changes are plausible and suggest a magnitude for this asymmetry. If we succeed, we believe that we have made a point to recommend dropping symmetric elasticities of any economic variable to wealth in forecasting models.

We admit that the link between micro and macro will stay disjoint, however this is inevitable as survey data measuring wealth typically fail to reproduce the wealth figures at macro level[2]. The remaining of this study is organised as follows. In the next Section we describe the set up of the analysis and the data. In Section 3 we present the non parametric tests based on reported expectations and realisations of wealth changes. In Section 4 we present the models that are needed to take into account several characteristics of the individuals that seem to be relevant when describing the data. In Section 4.3 we also present a test that briefly attempts a quantification of the effects under scrutiny. Two appendices are added. The first one explains the imputation of social security wealth. The second shows the ownership rate and the value of the different items that compose net financial wealth.

[2] We observe for instance that multiplying the average household wealth hold in shares by the amount of households present in the country, we make up approximately half of the value of shares registered by National Accounts. This feature is common to almost all survey data that contain wealth information (see Alessie et al. (2000)). This is due to the fact that the top percentiles of the wealth distribution are normally seriously underrepresented in survey data and the definition of household in National Accounts is broader than in survey data.

2 Set up and data

The aim of this study is to present some (non) parametric tests to understand whether individuals are asymmetrically judging losses and gains in their financial wealth. We position this study within the micro econometric literature of consumer's behaviour. We investigate therefore the reaction of individuals to positive and negative shocks in their wealth, as derived from their answers to categorial and subjective questions concerning wealth changes and from observed wealth data. The use of subjective questions to evaluate asymmetric reactions is in line with suggestions already proposed in the literature as wealth expectations are an indicator of "consumer confidence or the uncertainty that consumers perceive about future economic conditions" Poterba (2000).

2.1 Set up

This study investigates whether many people fear an unexpected shock in their financial situation and how they evaluate wealth changes. We use Dutch panel data containing subjective information on the respondents' present expectations of household finances over the next year and their subjective evaluation of the realised changes asked one year later. We show that, in general, realised changes exceed expectations, and that this finding is extremely more evident around age 65 (normal retirement age). This suggests that dissaving, as implied by the stripped down version of the life cycle model without bequest and uncertainty, is mostly expected just prior to retirement. In the analysis we will not ignore this retirement related pattern observed in the data. Sudden changes over time to family composition and the occurrence of labour-market-related shocks may also play a role and are therefore also considered. The data also include reported financial wealth, which will be used together with the subjectively perceived wealth variation.

We begin our analysis by looking at the main trend over age of qualitative expectations and realisation of financial wealth. As these show interesting patterns around the age of retirement we link this study to the literature that has studied consumer's expectations and realisations over the life cycle with different approaches. A peculiar coincidence which is worth noting is that also at micro level expected changes in consumption, as derived by a standard Euler equation model, overestimate realised patterns of consumption (after retirement). This is the well known consumption-savings puzzle (Banks et al. (1998), Hamermesh (1984), Haider and StephensJr (2004)). Again the literature indicates that after retirement this is a major and undisputable phenomenon. More recently different studies have investigated directly reported expectations, as we do in this study, rather than the ones derived from the standard model (BenitezSilva et al. (2004), Mastrogiacomo (2005)). These studies recognise that most of the action takes place around retirement as at that moment individuals experience an income shock and have

accumulated higher wealth relative to younger groups. Studying expectations and realisations allows one to understand whether individuals can for instance anticipate the drop in consumption upon retirement. On this issue the literature is divided. Using data from a new survey, Ameriks et al. (2002) show that many working households experience an unexpected fall in consumption when they retire[3]. However, more recently, Hurd and Rohwedder (2003) have also analysed a similar cross-section and claim that individuals anticipate properly the magnitude of the drop in consumption. We will also use expectations and realisations data, but we do not ask ourselves whether these suggest anticipation of future events. We want to understand whether these variables indicate that individuals evaluate the future or the past financial situation of the household symmetrically. As our study looks at individual perceptions it also recalls findings in the psychological-economic literature. Our findings point in the direction of the existence of an endowment effect Knetsch (1989), and are also in line with the most common results in loss aversion studies (for a summary see Rabin (1998)).

Our results are also in line with those reported in the wealth consumption literature that investigates the asymmetric effect of wealth changes on consumption at macro level (Poterba (2000) Dynan and Maki (2001) , Case et al. (2003) Apergis and Miller (2004)). The conclusions of this stream of the literature suggest that though wealth effects on consumption are small these may well be asymmetric. However these studies do not focus on household financial situation but rather on cross country analysis or time series analysis of financial data.

The contribution of our study is therefore diverse. Thanks to our data we partly extend the studies of Ameriks et al. (2002) and Hurd and Rohwedder (2003) because we use a panel data set and account for individual effects. We tackle the question of whether individuals have an asymmetric evaluation of their realised wealth changes relative to what they had expected, which indirectly brings consumers' confidence into consideration. This can also be seen as a novel contribution since most studies have looked at loss aversion effects in experimental settings or cross country studies rather than using micro wealth data. Finally, as the literature has dedicated much attention to the asymmetric behaviour of consumer, we will also try to quantify it using wealth data for the Netherlands.

2.2 Data

We use the Dutch Social Economic Panel (SEP). It is administered by Statistics Netherlands (CBS), and contains approximately 5000 households per year. In structure and contents, this panel survey is similar to the German Social Economic Panel (GSOEP) and the American PSID.

[3] Unfortunately, they only have a cross-section, and their respondents are only selected among highly-educated academics. They divide the sample into two groups: the currently-employed and the currently-retired. Those who are already retired report significantly smaller falls in consumption as compared with those falls expected by respondents who are still in work.

The aim of the SEP is to provide a description of the most important elements of individual and household welfare, and to monitor changes in these elements over time [4].

The sample includes non-self-employed respondents who have been in the survey in the period 1990 to 2001 (derivation of self-employed's financial wealth requires manipulations that we found unreliable). We are therefore left with about 50000 observations[5] . The sample selection is reported in table 2.1.

Table 2.1 Steps of the Sample Selection

	Initial amount of observations	60593
Reason for removal	Removed	Left
Full sample		
Observed only once	1800	58793
Age panel inconsistent	24	58769
Year gaps	2277	56492
Item non response	11129	45363
Sub-sample		
Age selection (50-70)	31071	14292

Explanatory note: The initial amount of observation is the result of appending the 12 year cross sections, only dropping item non responses for age and year of birth. Further we keep only those present at least in two adjacent waves, that age of one year each year, and where all waves are adjacent (year gaps are not allowed). Finally we drop those observations with item non responses on questions like education and gender.

Source: SEP, own computations

In the SEP, the questions eliciting subjective expectations and realisations refer both to 'household financial situation'. As we observe all financial items owned by each household we can also quantify it. Hence, the question about expectations is: " How do you think the financial situation of your household will develop in the next 12 months?" . It is answered by choosing one of the five ordered categories listed from 1 to 5: " significantly worsen" , " somewhat worsen" , " remain the same" , " somewhat improve" , " significantly improve" [6]. The question about realisations has the same five ordered categories as possible answers and is formulated as follows: " How did your financial situation develop in the last 12 months?" . The answers to these two questions given by the head of the household are used in our study, that therefore

[4] The SEP is representative of the Dutch population, but it excludes individuals living in special institutions such as nursing homes. Statistics Netherlands applies a two-stage sampling procedure. Firstly, municipalities are drawn with probability depending on the number of inhabitants (big cities are drawn with certainty). Next, addresses are selected randomly. All households present at the selected address are interviewed, up to a maximum of 3 households. Over the years 1984 to 1989, households were interviewed twice a year. Since 1990 the survey has been held annually.

[5] For some pieces of analysis we only look at potential retirees aged 50 to 70 and in that case the sample consists of approximately 15.000 observations.

[6] " Don't know" answers are accepted but not used in this analysis.

explores the head's perception of household finances[7].

Figure 2.1 shows the pattern of these variables according to the age of the head of the household. After age 35, expectations tend to be lower than realisations, and typically also below 3, that is the value indicating no change in household finances. Expectations and realisations decrease with age, indicating that as time goes by individuals expect and experience their wealth changes as being lower. In order to make the two lines comparable, we report expectations in period $t-1$ and realisations in t. This means that the pick down in the graph shows the low expectations expressed at age 64 about finances the year after. The big gap between expectations and realisations at that age, will be studied more carefully later on.

Figure 2.1 Expectations and Realisations according to age of the head of the household.

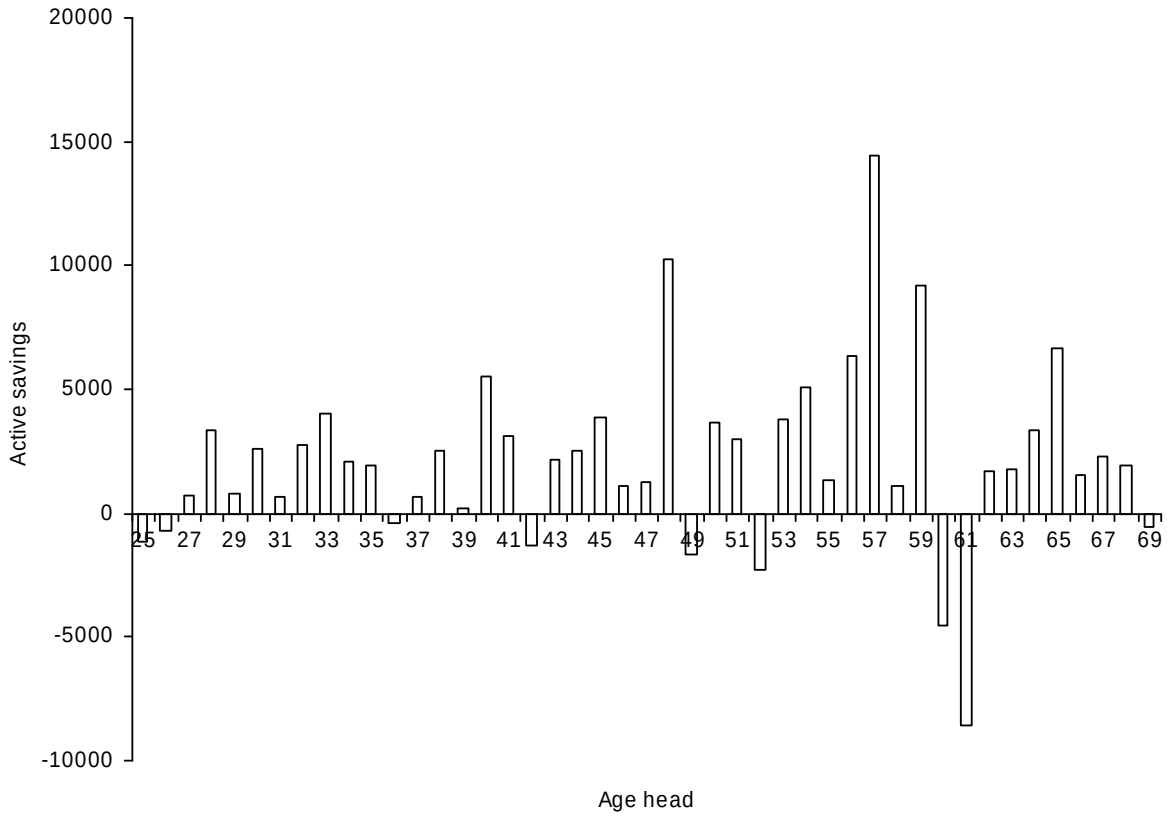
Explanatory note: Expectations are defined over the next 12 months. The drop at age 65 is therefore reported when the respondent is 64. Realisations are instead within the same wave and therefore these reported for age 65 are reported at age 65. In this way the vertical difference between expectations and realisations refers to a comparison over the same period. Expectations and Realisations are ordered from 1 to 5 where one stands for "large decrease" and 5 for "large increase" .
Observations 56492. Period 1990-2001.
Source SEP, own computations.

For the moment, it is worth noting that at that age individuals stop receiving their salary or early retirement benefit and receive the combination of old age pension and occupational pension, which means that their income may drop significantly. Disposing of data concerning the

[7] In two adults households with adults of different genders, Netherlands Statistics defines the man as "head". Households with multiple heads had to be dropped.

financial position of households in each year we can also define their active savings as the delta of their total financial wealth Engelhardt (1995). These include therefore the variations of checking and saving accounts, bonds, stocks and other financial assets. In figure 2.2 we report results of active savings according to the age of the head.

Figure 2.2 Active savings according to the age of the head of the household.



Explanatory note: Active savings are defined as the delta of net financial wealth. This sums up checking and savings accounts, savings certificates, bonds, stocks and other financial assets. It also deducts the negative balance of checking accounts, consumer credit, retail debt, pledge, debt with family, study loans and other debt. The negative values around age 60 may be associated to early retirement phenomena. Period 1990-2001.
Source SEP, own computations.

A first comparison of figures 2.1 and 2.2 shows that while in the monetary perception active savings tend to increase with age, individuals evaluate these changes as lower. This is also a well known phenomenon in the literature that economists label as *diminishing* sensitivity Kahneman and Tversky (1979). Another possible explanation is that those experiencing losses in their financial wealth overreact in their subjective judgment relative to those who experience financial gains, that are milder in their positive evaluations. In addition the subjective evaluation of these changes varies with age, with older respondents reporting lower outcomes, mostly when they get closer to the age of retirement. We will take this into consideration.

We extract from the data some covariates that may be linked to the two subjective responses to financial wealth changes. These are: time effects, taste shifters, shocks, financial indicators and, as anticipated, retirement indicators.

Time effects will control for macro-shocks common to all individuals over time. Taste shifters will include the usual exogenous regressors, like education and family size.

Retirement indicators will detect the exact timing of retirement which is not observed directly in the data, but that is relevant to our study (also to compare our results with the literature above). In order to identify the potential early retirees, different definitions of (partial) retirement are combined[8].

Table 2.2 Future expectations of household finances around retirement

		Different definitions relative to the head of the household				
Expected category	Value associated with the category	Self-reported definition	Worked hours	Income definition	Old age pensioners	Non-retirees
		%	%	%	%	%
Big decrease	1	4	4	3	12	3
Decrease	2	18	18	16	29	12
Equal	3	71	67	74	46	67
Increase	4	7	9	7	11	17
Big increase	5	1	1	1	2	2
Observations		8730	946	1436	643	5090

Explanatory note: We include only respondents aged 50 to 70 and dispose of 14942 observations. The self reported definition is based on a question concerning the main activity. *Worked hours* and *Income definition* refer to transitions over time consistent with retirement. Old age pensioners are all those older than 65. Non retirees are not included in any of these categories.
Source: SEP, own computations

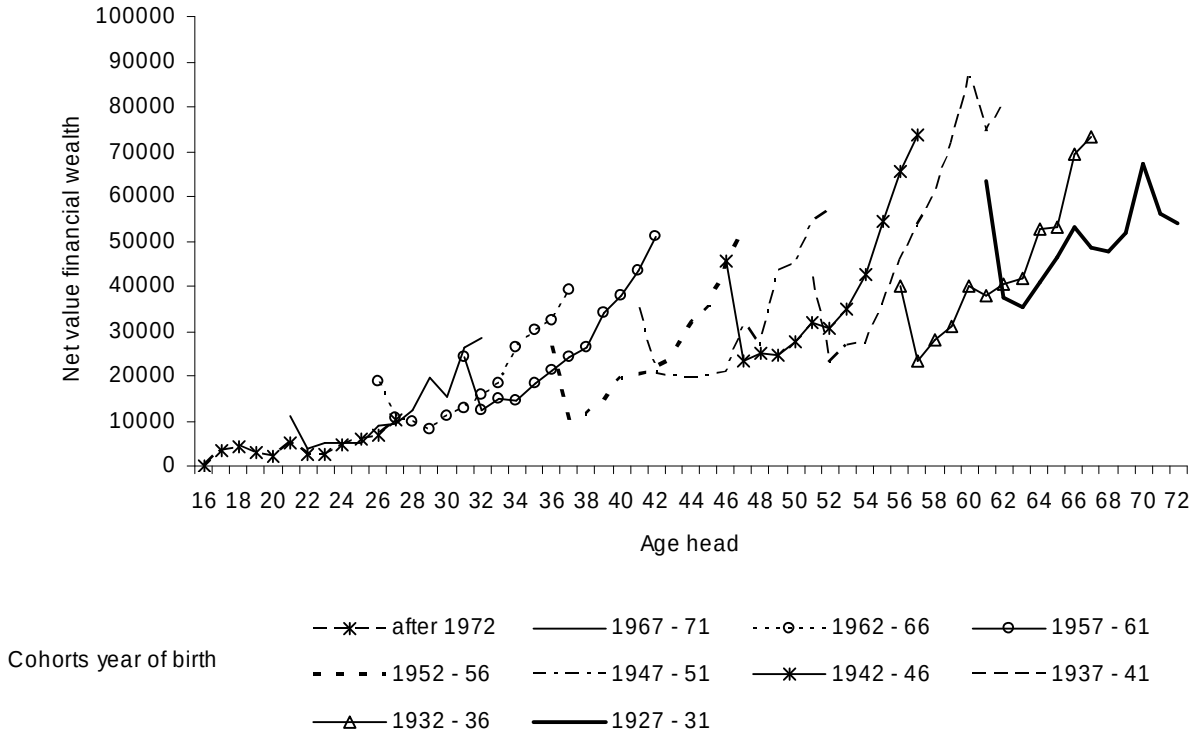
As shown in table 2.2, in which we select a subgroup of elderly individuals age 50 to 70, individuals in any of the retirement categories that we combine have lower future expectations relative to the others.

Financial indicators, changes in the family composition (like divorce and widowhood), in the health status of the respondent or other household member are also extracted from the data and used later in the analysis.

Among the financial indicators, we introduce a proxy of social security wealth (SSW).

[8] Respondents who retire in the year of observation (year t) are identified using the question about their main activity. Then, using the amount of weekly working hours we define partial retirement as the status of those individuals for whom participation drops at least by 25% of the working schedule relative to the panel observation in $t-1$. A third definition of partial retirement looks at income sources, an individual is defined as 'retiring in panel wave t if he or she declares in $t+1$ an income for period t that is composed of 50% of retirement income, provided that the individual was working in period $t-1$'. A fourth definition will mark the shift into old age pension (AOW) when respondents turn 65.

Figure 2.3 Net Financial Wealth by cohort and age of the head of the household.



Explanatory note: the horizontal ax shows the average cohort age of the head, for instance for the cohort 1932-1936 respondents are aged from 54 to 58 in 1990 and therefore we report age 56 as an average for this cohort in the first year. Source SEP, own computations.

Appendix A provides some details about the construction of this variable. This variable will be introduced in the estimation to test whether individuals expecting a more generous pension treatment, form higher expectations over the next year. Also income, active savings and financial wealth are introduced. In figure 2.3 we show the pattern of net financial wealth according to age for different cohorts. We define it as the difference between assets and liabilities[9]. If we abstract from time effects, the vertical distance between each segment shows that in general, given age, younger cohorts are richer. This figure is based again on the whole sample. After age 40 we see that cohort effects are particularly evident, and that net financial wealth is definitely higher relative to the youngest cohorts.

[9] For a more precise definition see Appendix B.

3 Non parametric tests of asymmetry

When individuals answer the question about expectations of future financial wealth they report a location of their individual subjective distribution relative to a perspective event. As in Das and Van Soest (2000) and Das et al. (1999) individuals with good anticipative skills should report a location of their individual subjective distribution that coincides with the one relative to the distribution of the realisation. This simple reasoning offers the possibility to check whether individuals think 'symmetrically' about their future wealth. If so respondents should report a symmetric location of their individual subjective distribution Mastrogiacomo (2005).

Therefore we compare subjective predictions with self-reported outcomes. Evidently such comparison is not straightforward since there is no reason to expect that the distribution of expectations across the population is the same as the distribution of the actual variable. Even when realisations and predictions coincide the two variable are not comparable. While the outcome is based on the distribution of the actual variable, expectations reflect some location of the individual subjective distribution (mode, mean etc.). We will try to study such locations by considering different models generating best predictions of the prospective realisations. One could think of respondents minimizing a loss function. Respondents could for instance refer to the modal category or to some quantile of the subjective distribution. In the first case, when confronted with the five ordered categories of the question, respondents could report the mode of their subjective distribution. In the second instead, for instance, they could report the median.

The data contain questions eliciting expectations of outcome y = financial situation; where respondents may choose among ordered categories. Let $f(y|s)$ be the subjective probability density of outcome y given information s. Respondents choose one of the K categories $C_1,...,C_K$ of the form $C_k = (m_{k-1}, m_k]$, with $-\infty = m_0 < m_1 < ... < m_{k-1} < m_K = \infty$. The threshold values m_k are subjectively determined and ordered models may be used to estimate their values. The answer to the expectation question is denoted by p. The minimisation of some loss function will return p (see formula 3.2). If the respondents answer the question having in mind the most likely outcome they will report the mode of their subjective distribution. This means that they report the category

$$p = \arg\max_k P\{y \in C_k|s\}. \tag{3.1}$$

This corresponds to minimizing, with respect to k, the expected loss function: $E1(y \notin C_k)|s$. Here the behaviour of an individual forming some point expectations p^* and choosing the category p that contains p^* is treated. The general form of the problem is minimizing the expected loss for some loss function L:

$$p^* = \arg\min_{\pi} \int_{-\infty}^{\infty} L(y-\pi) f(y|s) dy$$

$$p = k \text{ iff } p^* \in C_k . \tag{3.2}$$

If respondents interpret the question as eliciting the median of $f(y|s)$ the relative loss function will be $L(u) = |u|$ while for the category containing the mean the loss function will be $L(u) = u^2$ Das et al. (1999).

If individuals are good predictors the categorised answer to the question about expectations and to the question about realisations should mirror a location from the same distribution. Assuming these distributions are normal[10], if individuals are "symmetrical" this location should be either the mode, the median or the mean of such individual distribution. By comparing expectations and outcomes we perform the following tests to show that what individuals report may not be any of those locations. This will therefore test whether expectations of financial wealth are symmetric.

[10] Or more in general symmetrical and unimodal.

Table 3.1 Tests for Modal Category and Median Category Assumption

		Modal category assumption $P\{c_i = k \mid x_i, p_i = k\} \geq P\{c_i = j \mid x_i, p_i = k\}$					Median category assumption $P\{c_i < k \mid p_i = k\}$		$P\{c_i > k \mid p_i = k\}$	
		c=1	*c=2*	*c=3*	*c=4*	*c=5*	lower	upper	lower	upper
		%	%	%	%	%	%	%	%	%
k=1	90 - 91	22	23	39	10	6	.	.	70	86
strong	91 - 92	31	31	27	8	2	.	.	62	76
decrease	92 - 93	37	24	24	10	6	.	.	55	71
	93 - 94	31	29	30	8	3	.	.	63	75
	94 - 95	31	28	29	10	2	.	.	64	75
	95 - 96	35	21	30	9	4	.	.	58	71
	96 - 97	34	26	28	9	3	.	.	60	73
	97 - 98	28	27	25	13	8	.	.	65	78
	98 - 99	23	25	32	13	7	.	.	70	84
	99 - 00	25	20	32	16	7	.	.	66	83
	00 - 01	31	27	23	12	8	.	.	61	78
k=2	90 - 91	14	30	44	8	4	11	17	52	60
decrease	91 - 92	12	29	45	11	4	10	14	56	62
	92 - 93	11	35	43	9	2	9	13	51	57
	93 - 94	10	35	41	10	2	9	12	51	57
	94 - 95	10	31	47	10	3	8	11	57	62
	95 - 96	12	31	44	10	3	10	14	54	60
	96 - 97	9	31	44	14	3	7	11	57	64
	97 - 98	8	25	46	17	4	6	10	63	70
	98 - 99	7	31	42	15	5	5	10	57	65
	99 - 00	7	27	41	21	4	5	9	62	70
	00 - 01	8	26	37	21	7	6	11	61	70
k=3	90 - 91	4	12	62	18	4	15	17	21	24
no	91 - 92	4	15	61	16	4	18	20	19	21
change	92 - 93	3	17	60	16	3	20	22	18	21
	93 - 94	4	17	59	17	2	20	23	18	21
	94 - 95	4	13	64	16	3	16	18	17	20
	95 - 96	4	17	61	15	3	20	22	17	19
	96 - 97	3	14	61	18	3	16	18	20	23
	97 - 98	3	10	59	23	5	12	14	26	29
	98 - 99	3	11	63	20	3	12	15	22	25
	99 - 00	2	9	59	24	5	11	13	27	30
	00 - 01	3	12	53	28	4	14	16	30	33
k=4	90 - 91	4	8	41	33	14	50	56	12	16
increase	91 - 92	5	11	40	32	13	53	59	11	15
	92 - 93	2	14	42	33	9	55	61	7	11
	93 - 94	6	15	36	34	9	54	60	7	10
	94 - 95	4	13	38	36	9	51	57	7	11
	95 - 96	4	14	35	38	9	50	56	7	11
	96 - 97	4	11	36	38	12	48	54	10	13
	97 - 98	3	8	34	43	12	42	48	10	14
	98 - 99	2	10	32	45	11	41	47	9	12
	99 - 00	3	6	29	47	16	35	40	14	18
	00 - 01	2	7	24	50	17	31	36	15	19

Table 3.1 Tests for Modal Category and Median Category Assumption (continued)

		c=1	*c=2*	*c=3*	*c=4*	*c=5*	lower	upper	lower	upper
k=5	90 - 91	4	8	22	34	32	61	75	.	.
strong	91 - 92	6	5	35	22	32	61	75	.	.
increase	92 - 93	7	12	24	27	29	64	77	.	.
	93 - 94	4	11	28	28	30	63	78	.	.
	94 - 95	8	13	25	25	29	64	78	.	.
	95 - 96	8	8	28	29	27	67	79	.	.
	96 - 97	5	9	24	33	29	65	77	.	.
	97 - 98	3	6	26	25	41	53	66	.	.
	98 - 99	4	9	23	34	30	64	75	.	.
	99 - 00	2	5	18	32	43	51	63	.	.
	00 - 01	4	7	19	30	39	55	67	.	.

Explanatory note: k = predicted category, c = realised category. Respondents are selected when participating for 2 consecutive years in the survey.

Source SEP: own computations.

3.1 Modal category

Following Das et al. (1999) we formalise the modal category assumption for individual i , given the available information x_i, as:

$$P\{c_i = k|x_i, p_i = k\} \geq P\{c_i = j|x_i, p_i = k\}, \quad j = 1, ..., K \tag{3.3}$$

Where c_i is the realised category and k is the predicted category. For those individuals with $p_i = k$ most outcomes will be located in category k. Realisations, in the best-case scenario, are based upon drawings from the same distribution leading to probabilities 3.3. We can use observations of c_i to see whether 3.3 holds. Define for notational convenience $P_j \equiv Pc_i = j|x_i, p_i = k$. Let $\hat{P}_j$ be the sample equivalent of P_j[11]. Under the hypothesis of the independence of realisations , frequencies of financial situation can be used to estimate the probabilities in 3.3. Assuming $x_i =$ year of observation table 3.1 reports the frequencies.

Table 3.1 shows that only for the case $k = 3$ the modal category assumption could be used as a model generating expectations. For $k = 2$ for instance this is never true. Globally 30 cases out of 55 behave according to the modal category assumption[12].

[11] That is the number of observations with $c = j$ and $p_i = k$ and the given value of x_i.

[12] We have also estimated table 3.1 conditional on several covariates of x_i such as gender and education. The results are confirmed.

3.2 Median category

If the survey responses corresponds to a category that contains a point prediction that minimises a loss function, it is natural to interpret p_i as containing the α-quantile of the respondent's subjective distribution of y_i. For $\alpha = 0.5$ the category is the one containing the median. If p_i^* is the α-quantile (corresponding, for convenience, to the cumulative probability α) than in the best case scenario it must be:

$$P\{y_i - p_i^* \leq 0 | x_i\} = \alpha \tag{3.4}$$

Since we observe the category c_i , we focus on the case with $c_i = k$. Then:

$$P\{c_i \leq k-1 | s_i, p_i = k\} < \alpha \leq P\{c_i \leq k | s_i, p_i = k\}$$

that implies the following inequalities:

$$P\{c_i > k | x_i, p_i = k\} \leq 1 - \alpha \tag{3.5}$$

$$P\{c_i < k | x_i, p_i = k\} < \alpha \tag{3.6}$$

To fit in the best case scenario the α-quantile of c_i must fall in category k, given that $p_i = k$; with no more than 100 α% of realised values in lower categories and no more than 100 $(1-\alpha)$% in higher categories. A test for 3.5 and 3.6 is reported in the right panel of table 3.1 using the data of the left panel of the same table:

$$\sqrt{n}\left(\sum_{j=k+1}^{K} \hat{P}_j - \sum_{j=k+1}^{K} P_j\right) \xrightarrow{d} N\left(0, \left(1 - \sum_{j=k+1}^{K} P_j\right) * \sum_{j=k+1}^{K} P_j\right).$$

Where n is the number of observations and x_i is only includes year of observation. In the table the value of $\alpha = 0.5$ should be included in the confidence intervals in order to conclude that individuals are reporting a median as a point expectation.

This test uses the ordering of the categories. This suggests that the assumption required for the modal category case were less stringent. For the case of $\alpha = 0.5$ we see that 3.5 and 3.6 for all k do not imply that 3.4 holds for all k and j , and vice versa. It is though true that for the extreme values of the k categories the inequalities 3.5 and 3.6 will hold (namely for $k = 1$, that is the first category, (3.5) implies (3.4), while for the last category $k = K = 5$, (3.6) implies (3.4)).. Such test imposes that an absolute majority should fall into a certain category, rather than a relative majority as in the modal case. In this sense the median category assumption is more restrictive and it does not come as a surprise that the results are poor in terms of predictive capacity.

3.3 Mean category

When the loss function is $L(u) = u^2$, than p_i reflects the category containing the mean. To test this implication we need the rich data that in the SEP approximates the concept of y_i rather than the ordered category c_i. We use net financial wealth as a proxy of household financial condition as mentioned in the question eliciting c_i.

In this case the answer p_i is the category containing $E\{y_i|x_i\}$. When $p_i = k$, then p^* will fall within two adjacent thresholds (m_{k-1} and m_{k1}). That is:

$$E\{y_i|x_i, p_i = k\} \in (m_{k-1,i}, m_{k,i}].$$

In table 3.2, x_i is defined by gender to keep the amount of observations higher in any cell.

In table 3.2 standard deviation increases with k in the case of females, but not the sample means, as we would expect. For males instead the sample means are conveniently ordered. Also this table produces mixed results. This could depend on the definition of y that we adopt (that for instance does not include housing wealth). More likely it suggests that also other covariates, and not only gender, may be related to financial wealth and affect m. Overall none of the three hypothesis tested produce convincing results in terms of respondents symmetry, probably indicating that individuals may actually be minimizing asymmetric loss functions that attach more weight to lower expectations categories (which would indicate asymmetry). However our computations may have been too simple, as these only condition on one observable. A multivariate analysis is therefore a logical extension. Ordered models can be estimated that also estimate the thresholds between reported categories. We can study the relative distance between these thresholds to test the presence of asymmetry. This will be done in the next two sections.

Table 3.2 Test of Mean Category Assumption

	Value of household financial situation in the last 12 months			
	Subjective evaluation	Observed financial wealth changes	Standard deviation	Observations
Male	Large decrease	− 4125	71038	2129
	Decrease	− 212	69730	6433
	Equal	1327	82147	22591
	Increase	4850	76810	10504
	Large increase	10554	97077	3153
Female	Large decrease	− 1188	41338	882
	Decrease	− 2771	38694	2056
	Equal	893	54755	6144
	Increase	3567	28650	1997
	Large increase	4821	38631	473
Observations				56362

Explanatory note: The table reports the difference in the value of financial wealth in two adjacent years. In this table the sample is not selected on age and item non responses. We have also dropped 130 outliers.

Source: SEP, own computations

4 Parametric approach

We have seen above that expectations and realisations of financial wealth may depend on a multiplicity of factors. Age, the business cycle or the occurrence of retirement have already been quoted. Such a multivariate analysis is difficult to handle non parametrically, but can easily be implemented in an ordered model. This is the aim of the tests reported in this section. Some regressors that we will introduce, have not been mentioned yet. Income shocks are derived from two subjective questions that identify a mismatch between expected income increases and realised income decreases in household income in the last 12 months. These may well be related to the perception of realised and expected wealth changes. For the same reason also household income is introduced as the sum of the non capital income of all household members. Health shocks to the respondent or family members are derived from self reported information contained in the data and we expect these to be inversely related to financial expectations and realisations. Changes in family status over time (like divorce or widowhood) are derived exploiting marital status information over adjacent waves. *Social security and pension wealth* is imputed, details are available in Appendix A. We include this variable separately in order to understand whether individual perceive pension wealth as a component of their current financial situation. The construction of net financial wealth is explained in Appendix B. Active saving is defined as the first difference over time of liquid wealth. We expect these two financial indicators to be highly correlated to the qualitative evaluation of household finances. This set of variables will be included in the multivariate analysis together with some endogenous variables, like the individual mean of the financial indicators over the observation period.

4.1 Model

The parametric test will be based on the estimation of a model for the categorised answer to the expectations and realisations questions. We will carry out some Wald tests on the estimated parameters and some computations in order to test asymmetrical responses. Therefore in the models, $y_{i,t}$ denotes in turn the categorised answer to the question about expectations, the one about realisations as well as their difference[13]. As in a standard ordered response model, the dependent variable is related to the underlying latent variable $y^*_{i,t}$ in the following way:

$$y_{i,t} = j \quad if \quad (m_{j-1} < y^*_{i,t} \leq m_j) \qquad\qquad j = 1, ..., 4. \tag{4.1}$$

The boundaries $-\infty = m_0 < m_1 < ... < m_4 < m_5 = \infty$ are constant across individuals and will be estimated.

[13] As the difference between the two ordered variables has 9 possible values we summarise the extreme categories and generate a variable with only 5 categories.

The underlying latent variable is modeled by the equation:

$$y^*_{i,t} = \beta_0' x_{i,t} + \lambda_t + \tilde{\alpha}_i + u_{i,t} \qquad i = 1,...,N,\ t = 1,...,T, \tag{4.2}$$

where $x_{i,t}$ is a vector of taste shifters reflecting, for example, education, gender and family composition. Time effects λ_t are included to allow for macro-shocks, common to all respondents and not varying with $x_{i,t}$. The parameter $\tilde{\alpha}_i$ is an individual specific (random) effect indicating unobserved heterogeneity across individuals.

The white noise, which is the individual time-specific error term $u_{i,t}$, is normally distributed and independent of the regressors $x_{i,t}$ and of the individual effect $\tilde{\alpha}_i$. The latter is treated as a random effect. We allow for an underlying correlation in Mundlak form Mundlak (1978). This means that the relation between $\tilde{\alpha}_i$ and $x_{i,t}$ is specified as $\tilde{\alpha}_i = \alpha_i + \beta_1' \overline{x_i}$. In $\overline{x_i}$ only those variables expected to be correlated with $\tilde{\alpha}_i$ are included.

4.2 Results

Table 4.1 shows the model results. It shows probit coefficients and not marginal effects. Significant parameters are highlighted.

The left panel of the table contains results for the model in which qualitative realisations in t are the dependent variable (Models 1 and 2). In the second model we drop the shock indicators as one may doubt that some family related events occurred as completely unexpected. We describe the results of Models 1 and 2 together. The time effects are significant and indicate that after 1991 individuals perceived a decline in their financial wealth. This follows the business cycle as, beginning with 1998 (please notice that in 1998 individuals report the development of their wealth in 1997), individuals experienced qualitative improvements in their financial wealth. Taste shifters are also generally significant though the effect of owning to an age-cohort[14] gets very small when we drop the shock indicators. Male heads report having experienced lower financial wealth in the last year, as lower educated heads do or heads of larger households. Retirement indicators should capture the effect of retirement on wealth changes as this is a basic relation in the standard life-cycle model. However, as we do not observe retirement directly, we imputed it in 4 different ways and combined these definition in one indicator (see above). All coefficients are significant and negative. The effect of retirement (which occurs in any case at age 65) can be derived from the sum of the three indicators included. Such effect is therefore negative. Two of those indicators interact with (are multiplied by) the educational level and show that higher educated retirees tend to perceive lower financial wealth changes. This means that overall entering retirement is inversely related to outcomes of financial wealth, and that this is

[14] We have also attempted an estimation with an age polynomial and the results did not change significantly. However since the definition of retirement is highly correlated to age we prefer to show results with year of birth cohorts.

more so for lower educated individuals. This may therefore suggest that individuals begin to perceive some dissaving after retirement. The observed income shock is derived by the questions eliciting expectations and realisations of household income and is, as expected, negative and significant. Perception of financial wealth development also lowers when a member of the family gets into health problems or exits the households. Among the financial indicators, pension wealth and active savings are significant. The latter is defined as the first difference (over time) of net financial wealth. It shows a positive effect in line with our expectations. Pension wealth, which we impute on the base of income profiles and institutional rules, has a negative impact on perceived wealth changes. As this is counterintuitive it may indicate that individuals do not include pension wealth in their perception of household financial wealth. Among the endogenous variables, that are those variables correlated to the unobservable individual effects, household income, social security wealth and net present financial wealth have a positive and significant coefficient. This means that those unobservables that are correlated to these household characteristics are also positively correlated to the perceived realisations of financial situation. Finally the table also reports the estimated thresholds and the standard deviation of the simulated individual effect. The simulated individual effect, that brings unobserved heterogeneity in the model, is significant and positive.
We will use the estimates of Model 1 in the computation of some tests later on.

Table 4.1 Multivariate analysis

	Qualitative realisations		Expectations		Expectations minus realisations	
	Model 1 Coeff	Model 2 Coeff	Model 3 Coeff	Model 4 Coeff	Model 5 Coeff	Model 6 Coeff
Time effects						
Year 1992	− 0.099*	− 0.114*	− 0.001	− 0.001	0.006	0.022
Year 1993	− 0.167*	− 0.154*	− 0.136*	− 0.135*	0.074*	0.076*
Year 1994	− 0.196*	− 0.219*	− 0.111*	− 0.135*	0.008	0.018
Year 1995	− 0.166*	− 0.157*	− 0.025	− 0.035	− 0.040	− 0.038
Year 1996	− 0.217*	− 0.170*	− 0.009	− 0.015	0.076*	0.060*
Year 1997	− 0.113*	− 0.070*	0.099*	0.093*	− 0.022	− 0.036
Year 1998	0.095*	0.125*	0.234*	0.227*	− 0.116*	− 0.128*
Year 1999	0.040	0.083*	0.245*	0.239*	0.022	0.004
Year 2000	0.173*	0.224*	0.319*	0.313*	− 0.102*	− 0.124*
Year 2001	0.204*	0.247*	0.244*	0.238*	− 0.082*	− 0.098*
Taste shifters						
Cohort head	− 0.018*	0.002*	− 0.005*	− 0.005*	− 0.001	− 0.004*
Male head	− 0.109*	− 0.112*	− 0.062*	− 0.064*	0.017	0.021
Family size	− 0.031*	− 0.023*	0.049*	0.044*	− 0.009	− 0.016
Intermediate education head	0.086*	0.071*	0.048*	0.048*	− 0.033*	− 0.026
Higher education head	0.189*	0.173*	0.041*	0.041*	− 0.112*	− 0.103*
Experience head	− 0.008*	− 0.010*	− 0.015*	− 0.015*	− 0.003*	− 0.001
Head's retirement indicators between t-1 and t						
Retiree	− 0.226*	− 0.329*	− 0.187*	− 0.194*	0.023	0.095*
Retiree* Intermediate education	− 0.075*	− 0.086*	0.045	0.044*	0.077*	0.082*
Retiree* Higher education	− 0.137*	− 0.138*	0.061*	0.060*	0.089*	0.087*
Observed micro-shocks						
Income shock	− 2.119*		− 0.087*		1.134*	
Health shock	0.021		− 0.005		− 0.015	
Family member becomes not self-sufficient in t	− 0.134*		− 0.100*		− 0.006*	
Head becomes divorced or widow in t	− 0.524*		0.039		0.359*	
Financial indicators						
Social security and pension wealth (head)	− 0.013*	− 0.017*	− 0.013*	− 0.014*	0.010	0.014*
Household net financial wealth	− 0.088	− 0.149	− 0.301*	− 0.308*	− 0.071	− 0.022
Net household income	0.250	0.221	− 0.632*	− 0.635*	− 0.388*	− 0.385*
Active savings	0.507*	0.498*	0.118	0.119*	− 0.289	− 0.300*
Endogenous variables						
Mean family size	− 0.017	− 0.028*	− 0.100*	− 0.099*	0.005	0.012
Mean SSW	0.018*	0.024*	0.027*	0.027*	− 0.009	− 0.014*
Mean net financial wealth	0.365*	0.434*	0.114	0.123	− 0.238	− 0.298*
Mean household income	1.655*	1.510*	2.292*	2.296*	0.073	0.103
Mean active savings	0.096	0.096	0.203	0.201	− 0.024	− 0.032

Table 4.1 Multivariate analysis (continued)

	Model 1 Coeff	Model 2 Coeff	Model 3 Coeff	Model 4 Coeff	Model 5 Coeff	Model 6 Coeff
Other statistics						
m1	− 2.477*	− 2.074*	− 2.531*	− 2.529*	− 1.734*	− 1.845*
m2	− 1.446*	− 1.241*	− 1.595*	− 1.595*	− 0.768*	− 0.884*
m3	0.101	0.231*	0.283*	0.283*	0.646*	0.504*
m4	1.156*	1.272*	1.422*	1.423*	1.533*	1.342*
σ_α	0.118*	0.126*	− 0.065	− 0.064	− 0.097	− 0.105
Log likelihood	− 53510	− 56701	− 47581	− 47598	− 57886	− 58944
Observations	45363					

Explanatory note: The variables excluded are: Year 1991, Lower education, Lower education*Retiree, Female head. The retirement and shock indicators are defined as a transition between year $t-1$ and t. *Cohort head* is a ordered variable defined in the interval 1(young cohort) to 10 (older cohort). Asterisks indicate significance at conventional level. The unbalanced panel looses approximately 11000 observations due to item non responses on several regressors.

Source: SEP, own computations

Model 3 and 4 show results for the estimation with expectations as a dependent variable. Dropping shocks does not significantly affect the model performance. Time effects are in general significant and follow the same business cycle-related pattern as in models 1 and 2. The analysis of the coefficients relative to the taste shifters shows that older cohorts have lower expectations in terms of household finances. The same is true for male heads and for low educated respondents. All significant retirement indicators are negative. The old age indicators also reveal that higher educated respondents have lower financial expectations relative to the low educated. Experienced income shocks affect negatively expectations over the future, like a family member who becomes non-self-sufficient. Among the financial indicators SSW is negatively correlated to the dependent variable. Those unobservables correlated to income are also correlated to higher expectations. The individual effect's standard deviation is not significant.

We employ these estimates to explain what generates the expectations drop at age 64. We want to understand whether the large drop in expectations at age 64 shown in figure 2.1, is mostly determined by retirement. We use the results of Model 3 to enquiry this further. We decompose the observed drop in expectations of individuals eligible for old age pension as determined by two different effects. The first effect is determined by all individual characteristics, the second exclusively by eligibility for old age benefit (e). In order to identify these two effects, an Oaxaca-alike decomposition is computed.

In order to isolate the effect of eligibility, which enters the model with some indicators (d_e), the following steps are followed. First, the estimates of Model 3 are used to predict the mean value of expectations (y) for those who are not eligible ($E(y_{e=0}|d_e=0)$), separately from those who are eligible ($E(y_{e=1}|d_e=1)$) . For this second group, which is aged 64 in $t-1$, a second prediction is computed, the same as the previous one, but dropping the eligibility indicator

$(E(y_{e=1}|d_e=0))$.

In this way, the overall effect $E(y_{e=0}|d_e=0)-E(y_{e=1}|d_e=1)$ is decomposed into two effects:

$$\underbrace{[E(y_{e=0}|d_e=0)-E(y_{e=1}|d_e=0)]}_{characteristics}-\underbrace{[E(y_{e=1}|d_e=1)-E(y_{e=1}|d_e=0)]}_{eligibility} \quad (4.3)$$

where the second term of 4.3 identifies the effect of the eligibility indicators on average expectations, since these are the only parameters that differ between the two predicted values.

In the observed data, expectations drop at age 64 from 2.87 to 2.61. The result of the decomposition[15] indicates that individual characteristics account for an average drop of 0.16, while eligibility indicators account for the remaining drop of 0.09. This means that 36% of the drop in expectations is attributable to an eligibility effect, while the remaining 64% may be attributed to all other characteristics together.

The right panel of table 4.1 is reserved to Models 5 and 6. The dependent variable is the difference between expectations and realisations. As explained in the introduction several researches have looked at similar variables to study whether individuals are able to anticipate future events. We estimate these models as a reference to this literature. In order to produce this table we have generated a new dependent variable. The original 9 possible categories (from -4 to 4, including zero) have been reduced to 5 by grouping the extreme values -4,-3,-2 and 2,3,4. The variable is then re-coded from 1 to 5, where 1 stands for “expectations a lot lower than realisations”; 2 stands for “expectations somewhat lower than realisations”; 3 stands for “expectations equal to realisations”; 4 stands for “expectations somewhat higher than realisations”; and 5 stands for “expectations a lot higher than realisations”. This means that the higher the dependent variable, the more unjustifiably optimistic the respondent. Of course interpreting the estimated coefficients is complicated since a unitary positive difference between expectations and realisations may both mark a shift between an expected large financial gain and an experienced small financial gain, as well as a shift between an expected small loss and an experienced large loss. This means that our dependent variable may have the same value for experienced small gains or large losses and does not capture the fact that overestimating a gain may well be a different story than underestimating a loss. Nevertheless it may still be interesting to understand whether there is any specific determinant of the mismatch. The table shows that older cohorts’ individuals are more unjustifiably pessimistic, as we had seen in the descriptive analysis. The retirement status itself did not turn out to be significant when we also account for shocks (income shocks may well be related to retirement of course). If we omit the shock indicators the retirement indicator gets a significant positive effect. This indicates that

[15] We compute this on a more homogeneous sample of individuals aged 50 to 70, who may actually qualify for retirement.

respondents are around retirement unjustifiably optimistic, which seems counterintuitive when compared to the descriptive statistics. Income shocks are also positively related to the dependent variable, but again these positive effects may well be correlated to the underestimation of a loss rather than the overestimation of a gain. The main result of these last two models is actually that not all observed characteristics are insignificant. This suggests that individuals have taken certain individual characteristics into account when forming their financial plans but not all. One could claim that if a characteristic is a significant determinant of the mismatch, it has not properly been taken into account when forming expectations (Disney and Tanner (1999), Mastrogiacomo (2005)). If it had it would not explain a mismatch, but a matching. This of course if we assume out that the mismatch may be determined elsewhere.
In the remaining of the study we do not analyse this mismatch further, as the anticipative behaviour of respondents is not the object of this study. We exploit the complete version of the model with realisations (Model 1) to explain the main implications that we have discussed.

4.3 Parametric tests

The estimation of Model 1 delivers also the four thresholds $m_j \ \ (j = 1...4)$. We have performed some basic tests on these parameters and their sequence, that are summarised in table 4.2. This is a common approach in the literature that studies market entry thresholds (see for instance Bresnahan and Reiss (1991)), which is hardly ever used to describe consumers' perceptions.
In the table we show the thresholds and the results of some tests (for the whole sample or when we disaggregate by educational level). We have tested whether there are significant differences in the thresholds within different educational levels. Overall we reject the null hypothesis of these tests for all cases with exception of the last. Also the symmetric case $m_2 + m_3 = 0$ is overall rejected. We have also tested whether there are differences between the thresholds across the educations groups (we don't show these tests in the table). For this second series of tests we can always reject the null hypothesis of the thresholds being jointly equal across the different groups ($\chi^2_{(8)} = 40.2$). Though if we test the thresholds separately in some cases we reject the null at 5% confidence level. However we can't always reject it at a 1% level.

4.4 Extent of the asymmetry

The results of the tests indicate that in general the thresholds are not arranged symmetrically between positive and negative wealth changes. This seems to be the case in particular for households in which the head has an intermediate level of education. However we are silent about the extent of the asymmetry that we may be facing. Nor the estimated thresholds themselves give sufficient information, being those auxiliary parameters that do not yet have a direct economic interpretation. Measuring this asymmetry requires possibly a study of its own,

Table 4.2 Test of model estimated thresholds

	Education of the head of the household			
	Elementary	Intermediate	Higher	All levels
m_1	− 2.46	− 2.26	− 2.97	− 2.48
m_2	− 1.37	− 1.23	− 2.04	− 1.45
m_3	0.38	0.26	− 0.69	0.10
m_4	1.43	1.35	0.35	1.16
Chi Square (1)				
Test $m_1 = m_2$	2986.06	3011.99	1534.11	7539.96
Test $m_2 = -m_3$	12.89	12.07	61.85	65.94
Test $m_3 = m_4$	2915	5572	3928	12424
Test $m_1 = -m_4$	13.91	10.67	57.02	63.45
Test $m_2 - m_1 = m_3 - m_2$	606.43	371.65	187.40	1115.68
Test $m_3 - m_2 = m_4 - m_3$	703.82	385.10	156.70	1320.19
Test $m_2 - m_1 = m_4 - m_3$	2.07*	5.62	13.19	2.47*
Observations	15858	18793	10985	45636

Explanatory note: The upper part of the table reports the values of the thresholds when we estimate the model selecting different education levels. In the lower part numbers with asterisks are values of the χ^2 that do not allow rejection of the null hypothesis being tested. The unbalanced panel looses approximately 11000 observations due to item non responses on several regressors.

Source: SEP, own computations

which is the aim of a joint CPB-DNB project currently still in progress, and that is not possible to carry out on the SEP data as these do not contain information on consumption. However the estimated model (Model 1) allows us to infer what one could expect from such a study. We rewrite model 4.2 more explicitly.

$$y^*_{i,t} = \beta_0' q_{i,t} + \beta_1' z_{i,t} + \lambda_t + \tilde{\alpha}_i + u_{i,t} \qquad i = 1,...,N,\ t = 1,...,T, \tag{4.4}$$

$$y_{i,t} = j \quad if \quad (m_{j-1} < \beta_0' q_{i,t} + \beta_1' z_{i,t} + \lambda_t + \tilde{\alpha}_i + u_{i,t} \leq m_j) \qquad j = 1,...,4.$$

where q is a vector, subset of x , that does not include active savings (z). We define active savings as the difference in net financial wealth between t and $t-1$ (therefore this definition also includes assets appreciation, but excludes income items such as dividends). As we estimate the model in the form of an order probit we can rewrite the model, simplifying the notation, as:

$$P(y_{i,t} = j) = \Phi\left(m_{j-1} < \beta_0' q_{i,t} + \beta_1' z_{i,t} \leq m_j\right) \tag{4.5}$$

$$= \Phi\left(m_j - \beta_0' q_{i,t} - \beta_1' z_{i,t}\right) - \Phi\left(m_{j-1} - \beta_0' q_{i,t} - \beta_1' z_{i,t}\right). \tag{4.6}$$

where the m_j thresholds are estimated. We are interested in the average value of z corresponding to the m_j $(j = 1,...,4)$ thresholds. This is not difficult to compute as we observe j and can invert equation 4.6 once $P(y_{i,t} = j)$ has been estimated. For each observation we replace then the corresponding $z_{i,t}$. We can normalise $m_1 = 0$ and rewrite the estimated probability of the first outcome as

$$P(y_{i,t} = 1) = \Phi\left(-\beta_0' q_{i,t} + \beta_1' z_{i,t}\right). \tag{4.7}$$

As the ordered probit is based on normality we can rewrite 4.7 as

$$\Phi^{-1}(P(y_{i,t} = 1)) = -\beta_0' q_{i,t} + \beta_1' z_{i,t} \tag{4.8}$$

as the $P(y_{i,t} = 1)$ is estimated and therefore known we can compute $z_{j=1}$, that is the average value of z corresponding to alternative $j = 1$. We can work out the computations in 4.6 in a more general form in order to derive:

$$z_j = \frac{\hat{\beta}_0 \bar{q}_{i,t} - m_j - \Phi^{-1}\left(1 - \sum_{k=1}^{j} \Pr(y_{i,t} = j)\right)}{\hat{\beta}_1}, \tag{4.9}$$

where $P(y_{i,t} = j)$ are predicted by the model, the beta's and the thresholds are estimated, and the rest is known ($\bar{q}_{i,t}$ is the sample mean value). However we are not interested in the thresholds themselves, but in the relation between thresholds separating positive and negative changes in wealth. We define the ratio $s = \frac{z_3}{-z_2}$, which we call the *symmetry ratio*[16]. Though this is a new concept it is intuitive that if individuals were symmetrically evaluating decreases and increases in their wealth, s would be 1. This would for instance mean that a small negative variation and a small positive variation would amount to the same value (with opposite sign of course). However if the symmetry ratio is larger (say $s = 2$) it means that the amount of wealth necessary to identify a small increase is twice as large as the sum needed to report a small decrease. In table 4.3 we show the value of the symmetry ratio for the whole sample and when we take into account some age-related sub-samples.

The table shows that, made 1 the amount qualifying a small decrease, an average individual needs 1.5 the same amount in order to report a small increase in financial wealth. This is very much in line with other findings in the endowment effect literature[17](see Kahneman et al. (1990) and Tversky and Kahneman (1991)) that finds a relation between gains and losses approximately equal to 2. We also find that the symmetry ratio increases with age.

[16] The second threshold separates the perception "no change in financial wealth"from the perception "little decrease". The third threshold instead separates "no change"and "little increase". The translation of the thresholds in terms of financial wealth-changes (active savings) quantifies therefore the asymmetry that we have so far suspected.

[17] Contrary to these studies however we make use of survey data and not experimental evidence.

Table 4.3 The symmetry ratio over age

Sample age	Symmetry ratio
All	1.5
30-40	1.3
40-50	1.5
50-60	1.9
60-70	4.8

Explanatory note: We define the symmetry ratio as the ratio between the threshold separating no change in financial wealth from a small increase, over the threshold separating no change in financial wealth from a small decrease. The thresholds are transformed from their parameters value to a wealth value using the probabilities predicted after the estimation of the order probit model.
Source: SEP, own computations

The other interesting symmetry ratio would be $\frac{z_4}{-z_1}$. However the amount of respondents reporting "large increases"of their wealth is unfortunately to small to get a reliable estimate of z_4.

Appendix A SSW

The present discounted value of future incomes and benefits is included as a RHS variable in the ordered probit model (SSW). This variable is derived under several assumptions concerning both the behaviour of individuals towards the pension system and the evolution of their income profile till age 100.

Previous research demonstrates that the institutional and financial incentives related to ER are so favourable in the Netherlands that the vast majority of individuals who are eligible for ER do actually opt out as soon as they become eligible (see e.g. Mastrogiacomo et al. (2004)). Unfortunately in the SEP the ER entitlement age is not observed. That is why we roughly impute it. We assume that civil servants will retire at age 60 and private sector employees at age 62, unless they will fulfil the maximum requirements (40 years of contribution) at younger ages. For those currently older than 62 we assume that they will retire next period, if maximum requirements are fulfilled. We keep labour income constant at current level and compute pensions following the standard formula. We compute therefore the following present discounted value of the following sum:

$$\sum_{t=\tau}^{V} w_t + \sum_{t=V}^{R} VUT_t + \sum_{t=R}^{T} AOW + \min(40, ten - t - \tau) * 1.75\% * (w_t - fra).$$

In the formula τ is the current period. Further $\tau < V < R < T$, V is the age of eligibility to an early retirement benefit (VUT), R is the year in which one turns 65 and becomes eligible to the old age benefit (AOW), w is the current salary and fra is the free part of the salary that does not enter the computation of the employment pension and is closely related to the level of the AOW. We use a discount rate of 2% (not shown in the formula).

Appendix B Net financial wealth

The computation of net financial wealth is described in table B.1, while table B.2 shows the ownership rates of assets and liabilities in the SEP.

Table B.1 Assets and liabilities in guilders per year by age of the head of the household

	Under 30	30-39	40-49	50-59	60-69	70-79	80-100
Total financial assets	14589	27446	33124	43104	45637	45054	43015
Checking and saving accounts	11893	18994	22329	29063	32870	34219	30454
Positive balance checking accounts	2973	4375	5299	6233	6183	6779	7571
Saving accounts	10610	17466	19988	27169	32872	36700	37749
Saving certificates	9162	11857	15769	20608	26310	30772	14340
Bonds	15952	22502	21534	27989	44417	44781	53664
Stocks	16617	34016	43130	48561	53612	66879	98083
Other financial assets	8730	18706	21587	30015	35670	51653	54408
Total financial debt	9869	13819	14494	14192	12493	7386	4156
Negative balance checking accounts	998	2017	3627	3325	2913	3265	2908
Consumer credit	8879	11792	13284	13434	12040	8576	9433
Retail debt	1088	1369	1364	1324	1568	1737	764
Debt for public support	5955	7829	8964	7856	8950	8017	2250
Pledge	.	.	30815	29689	.	.	.
With other family members	6312	13759	14733	9565	15404	5194	.
Study loans	10150	13549	7580	6437	.	.	.
Other debt	12398	22215	21997	33235	27265	.	.

Explanatory note: Figures are in Dutch guilders non-deflated. Sample period 1990-2001. The first and last percentile the financial wealth distribution is dropped in order to avoid the presence of outliers.

Source: SEP, own computations

Table B.2 **Assets and liabilities ownership rate by age of the head of the household**

	Under 30	30-39	40-49	50-59	60-69	70-79	80-100
	%	%	%	%	%	%	%
Total financial assets	93	94	94	94	94	96	94
Checking and saving accounts	92	93	93	93	94	95	94
Positive balance checking accounts	82	86	88	88	91	93	92
Saving accounts	77	77	77	75	73	69	57
Saving certificates	3	3	4	5	5	3	1
Bonds and Stocks	10	17	19	21	18	13	12
Bonds	1	3	3	5	6	6	7
Stocks	9	16	18	19	15	11	8
Other assets	9	11	11	10	7	4	4
Total financial debt	47	38	35	30	16	6	3
Negative balance checking accounts	16	10	9	8	6	3	2
Consumer credit	20	23	24	20	9	2	1
Retail debt	3	3	3	2	2	1	1
Debt for public support	2	2	2	1	1	0	0
Pledge	0	0	1	1	0	0	0
With other family members	11	6	4	3	1	1	0
Study loans	14	4	2	2	0	0	0
Other debt	3	3	2	2	1	0	0

Explanatory note: Ownership is based on reported values of each item. Sample period 1990-2001.

Source: SEP, own computations

References

Alessie, R., S. Hochguertel and A. van Soest, 2000, Household Portfolio in the Netherlands, CentER working papers serie, no. 55.

Ameriks, J., A. Caplin and J. Leahy, 2002, Retirement Consumption: Insights from a Survey, NBER Working Papers, no. 8735.

Apergis, N. and S.M. Miller, 2004, Consumption Asymmetry and Stock Market: Empirical Evidence, Mimeo.

Banks, J., R. Blundell and S. Tanner, 1998, Is there a retirement-savings puzzle?, *American Economic Review*, no. 88(4), pp. 769–788.

BenitezSilva, H., D.S. Dwyer, W.R. Gayle and T.J. Muench, 2004, Expectations in Micro Data: Rationality Revisited, Mimeo , no. WP 2003-059.

Bresnahan, T.F. and P.C. Reiss, 1991, Entry and competition in concentrated markets, *The Journal of Political Economy*, vol. 99, no. 5, pp. 977–1009.

Case, K.E., J.M. Quigley and R.J. Shiller, 2003, Comparing Wealth Effects: the Stock Market Versus the Housing Market, IBER working paper series, no. W01-004.

Das, M., J. Dominitz and A. van Soest, 1999, Comparing predictions and outcomes: Theory and application to income changes, *Journal of the American Statistical Association*, vol. 94, pp. 75–85.

Das, M. and A. van Soest, 2000, Expected versus Realized Income Changes: a Test of the Rational Expectations Hypothesis, CentER Discussion Paper, no. 200/105.

Disney, R. and S. Tanner, 1999, What can we Learn from Retirement Expectations Data, IFS working paper, vol. W99-17.

Dynan, K.E. and D.M. Maki, 2001, Does Stock Market Wealth Matter for Consumtpion?, Mimeo.

Engelhardt, G.V., 1995, House Prices and Home Owner Saving Behavior, NBER Working Papers, no. 5183.

Haider, S.J. and M. StephensJr, 2004, Is There a Retirement Consumption Puzzle? Evidence Using Subjective Retirement Expectations, NBER Working Papers, no. 10257.

Hamermesh, D.S., 1984, Consumption during retirement: The missing link in the life cycle, *The Review of Economics and Statistics*, vol. LXVI, no. 1.

Hurd, M.D. and S. Rohwedder, 2003, The Retirement-Consumption Puzzle: Anticipated and Actual Declines in Spending at Retirement, NBER Working Papers, no. 9586.

Kahneman, D., J. Knetsch and R. Thaler, 1990, Experimental tests of the endowment effect and the coase theorem, *Journal of Political Economy*, vol. 6, no. 98.

Kahneman, D. and A. Tversky, 1979, Prospect theory: An analysis of decisions under risk, *Econometrica*, vol. 2, no. 47.

Knetsch, J., 1989, The endowment effect and evidence of non reversible indifference curves, *American Economic Review*, vol. 5, no. 79.

Mastrogiacomo, M., 2005, Income expectations and outcomes at mandatory retirement in the netherlands, in E. Fornero and P. Sestito, eds., *Pension Systems: Beyond Mandatory Retirement*, Edward Elgar.

Mastrogiacomo, M., R. Alessie and M. Lindeboom, 2004, Retirement behaviour of dutch elderly households, diversity in retirement patterns across different household types, in J. Rust, N. DattaGupta and B.J. Christensen, eds., *Special Issue of the Journal of Applied Econometrics: The Econometrics fo Social Insurance*, John Wiley and Sons, Ltd.

Mundlak, Y., 1978, On the pooling of time series and cross section data, *Econometrica*, vol. XXVII, no. 46, pp. 69–85.

Poterba, J.M., 2000, Stock market wealth an consumption, *The Journal of Economic Perspectives*, vol. 14, no. 2.

Rabin, M., 1998, Psychology and economics, *Journal of Economic Literature*, vol. XXXVI.

Tversky, A. and D. Kahneman, 1991, Loss aversion in riskless choice: A reference dependent model, *Quarterly Journal of Economics*, vol. 4, no. 106.