

# **Know more, spend more?**

## **The impact of financial literacy on household consumption**

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### **Abstract**

This paper examines the relationship between household consumption and financial literacy for Dutch households. The economic framework is a simple life-cycle model of consumption in which financial literacy affects the rate of return on assets. We empirically test two theoretical predictions using data from the LISS panel, a representative survey of Dutch households. Our findings are in support of the prediction that lifetime consumption is positively related to financial literacy, but do not support the prediction of a positive relationship between consumption growth and financial literacy. In addition, we examine the role of different levels of financial literacy within couples. Our findings suggest that for couples, financial literacy of the man plays a large role and a higher financial literacy score of the women decreases consumption.

**Keywords:** life-cycle model, financial literacy, household consumption

**JEL codes:** D14, D91, G11, E21

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# 1. Introduction

Saving behavior is a means to smooth consumption and if accumulated savings are invested wisely it increases lifetime consumption. Understanding household saving and consumption decisions is important for the current discussion on the general lack of interest in dealing with pensions and not always making wise and timely investment decisions. For instance, Krijnen, Breugelmans & Zeelenberg (2014) discuss the issues around postponing retirement planning in the Netherlands. It is often argued that this lack of interest is related to financial knowledge of households and their ability to make feasible financial plans for the future (Lusardi & Mitchell, 2007b; Lusardi & Mitchell, 2011). The consequences of such an aversion can be that a household enters retirement with too few financial means to satisfy consumption needs (cf. de Bresser & Knoef, 2015). Such a gloomy prospect has caught the attention of policymakers and calls for public intervention. Additionally, it underlines the importance and social relevance of academic research in this area and the subsequent implementation of the research results. A road less often travelled by - with the exception of Japelli and Padula (2013) - links financial savviness and consumption. We follow this road with the aim to examine the role of financial literacy in households' consumption decisions.

In particular, this paper examines how financial literacy is related to household consumption and investment decisions for Dutch households. We are interested in finding out whether different levels of financial literacy lead to different consumption profiles and additionally what the role of investing in stocks and bonds and other financial assets is. Possibly, whether one invests in stocks and bonds can be seen as a mediator that influences the relationship between household consumption and financial literacy. We will focus on total household consumption which includes household expenditures on rent, mortgages, insurances and food. We use a simple life-cycle model as an economic theoretical framework and utilize data from the LISS panel, a representative survey of Dutch households. With this analysis, we want to contribute to the discussion of the importance of financial literacy for the decision making process of individuals and households.

In its basic form, financial literacy “relates to a person’s competency to manage money” (Remund, 2010: p.279). Remund (2010) offers a synthesized conceptual definition<sup>1</sup> that

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<sup>1</sup> Financial literacy is a measure of the degree to which one understands key financial concepts and possesses the ability and confidence to manage personal finances through appropriate, short-term decision-making and sound, long-range financial planning, while mindful of life events and changing economic conditions [p. 284].

combines multiple dimensions in order to create a holistic image of what financial literacy is. Financial literacy is not only about knowledge of financial concepts but comprises also the ability to use that knowledge for financial planning. The four questions we use in this paper to measure financial literacy focus mostly on the first dimension. This has been the classical approach to measure financial literacy since Lusardi developed the questions and implemented them for instance in the Health and Retirement Study (HRS) (Lusardi & Mitchell, 2007a<sup>2</sup>; Lusardi & Mitchell, 2008), the RAND American Life Panel (Lusardi & Mitchell, 2007c) and other (inter)national surveys such as the England Longitudinal Survey of Ageing (ELSA), the Survey of Health Ageing and Retirement in Europe (SHARE) (Christelis et al., 2010) and the Dutch DNB Household survey (DHS) (van Rooij et al., 2011).

The questions on financial literacy are multiple choice questions. For the exact wording of the questions, please refer to appendix C. The first question tests the knowledge on interest compounding – a simple setting that does not require computing skills but is concerned with understanding the concept of earning interest on interest. The second question is a question on inflation and does not require computation skills either but understanding the difference between real and nominal interest rate. The third question tests the knowledge on risk diversification – a more advanced financial concept and the fourth question tests knowledge on the relationship between bond prices and interest rates. Our analysis confirms the findings of other studies using data from the United States (Lusardi & Mitchell, 2009), Germany (Bucher-Koenen & Lusardi, 2011) and the Netherlands with data from the DHS (van Rooij et al., 2011b): The level of financial literacy across countries is dramatically low – especially concerning the concepts of risk diversification and bond prices.

So far, literature on financial literacy has been mainly focused on the role of financial literacy in savings behavior and stock market participation (e.g. Deuflhard et al., 2014; van Rooij et al., 2011a) with the notable exception of Japelli and Padula (2013). They provide a meticulously described life-cycle model on financial literacy and consumption growth, which we take as a starting point for our model. This model is based on the assumption that consumers want to smooth marginal utility over time (see Hall, 1979 and Doppelhofer, 2009) and that higher financial literacy levels and hence interest rates lead to postponed consumption. Lusardi et al. (2011) developed a stochastic life cycle model that features endogenous financial literacy and a sophisticated saving technology. They found that the

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<sup>2</sup> Note that the wording of the questions used in the HRS in 2004 differed from the implementation of the financial literacy questions in later surveys.

optimal financial literacy profile is hump-shaped over the life cycle. Related work by Deuflhard et al. (2014) found that more financially literate investors earn on average higher savings returns and that more literate households are more able to identify bank accounts yielding higher rates of return across banks. In other words, the rate of return on investments is an increasing function of financial literacy. Our paper confirms those findings and extends the analysis to the household level – we have data on individual financial literacy that we are able to link to monthly household expenditures and to whether members of the same household hold investments in stocks, bonds or in growth funds.

Research has also been conducted on financial literacy and stock market participation – van Rooij et al. (2011a) show that a low level of financial literacy acts as a significant deterrent to stock ownership. Additionally, they extend their model with risk aversion, cognitive ability (as a complement to financial literacy) and peer effects and still find positive and statistically significant estimates.

Recent research has also found robust evidence for the existence of a gender gap in financial literacy (Bucher-Koenen et al., 2014): women score consistently lower than men in the financial literacy questions and exhibit a disproportional preference for the “do not know” option. We can only confirm those results and hence we estimate separate models for single male, single female and couple households. The identified gender gap is a relevant issue in our paper as we find higher predicted consumption levels for single men than for single women. Moreover, we predict for couples for which the man has a high financial literacy level, a financially savvy wife contributes to a lower consumption level.

The structure of this paper is as follows: The second section of this paper outlines the theoretical model, a life-cycle model with uncertainty. In the third section, several descriptive statistics on financial literacy and household consumption and demographic variables as age, gender and education are presented. We continue with first regression results that explore the relationship between financial literacy and the time that individuals spend on thinking about old age as well as the likelihood to invest in stocks and bonds and the likelihood to hold a savings and or current account. Lastly, we provide a short conclusion.

## 2. Theoretical framework

In order to be able to take closer look at the interaction between financial literacy, the rate of return and consumption patterns, we use a simple life-cycle model. We assume a constant real interest rate over time and that income is constant over time as well. The latter assumption has the purpose of eliciting different consumption profiles due to changes in the rate of return on investment keeping income constant. Additionally, we assume that there is no bequest motive, hence  $A_\tau = 0$ , where  $\tau$  is the last period in the life cycle. We formulate the following value function:

$$V_0(A_0) = \max_{\{c_t\}} \sum_{t=1}^T \beta^{t-1} u(c_t) \quad (2.1)$$

subject to the dynamic budget constraint

$$A_t = (1 + r(\varphi))A_{t-1} + y - c_t$$

where  $A_t$  is wealth in period  $t$ ,  $r(\varphi)$  is the real rate of return which is a function of the financial literacy level, the discount factor  $\beta^{t-1} = \left(\frac{1}{1+\rho}\right)^t$  measures time preferences<sup>3</sup>,  $y$  being labor income and  $c_t$  being consumption at period  $t$ .

Formulating the Bellman equation, optimizing it with respect to  $A_{t+1}$  (wealth in period  $t+1$ ) and using the Envelope Theorem, yields the following Euler equation for a broader time horizon:

$$u'(c_t) = \left(\frac{1 + r(\varphi)}{1 + \rho}\right)^{\tau-t} u'(c_\tau) \quad (2.2)$$

Please refer to the appendix for a detailed derivation of the model and a full listing of the underlying assumptions. The utility function is defined as quadratic. It has convenient algebraic properties: it is relatively simple concave function allowing us to compute a closed-form solution for household consumption. Furthermore, it is a common function when modelling investor's behavior simplifying the expected utility theory to a mean-variance approach to decision making under uncertainty. Quadratic preferences typically take the following shape:

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<sup>3</sup> When  $\rho = r$ , then consumption is constant over the life cycle.

$$u(c_t) = -0.5(c_t - \bar{c})^2 \quad (2.3)$$

where  $\bar{c}$  is the bliss level of consumption being constant over time. When consumption is equal to  $\bar{c}$ , then utility from consumption takes on its maximum value. The utility function is not defined for consumption levels exceeding the bliss level as then the marginal utility from consumption is negative (Lewbel, 1987). Using quadratic preferences, the Euler equation for period  $t$  and  $\tau = t + 1$  becomes:

$$c_{t+1} - c_t = \left( \frac{r(\varphi) - \rho}{1+r} \right) (\bar{c} - c_t). \quad (2.4)$$

We can make the following observations about the change of consumption: it depends on the level of consumption (subtracted from the bliss level) and it is non-negative for  $r \geq \rho$ . In addition, the change in consumption decreases in the consumption level. Consequently, consumption rises faster at the beginning of the life cycle (in case of an upward sloping consumption profile). We can also show that the steepness of the slope equation (2.4) increases with  $r(\varphi)$ .

For the sake of overview, we write  $r(\varphi)$  as  $r$  for the next rather lengthy equations. Rewriting the Euler equation using the preferences defined above and plugging this into the intertemporal budget constraint of the maximization problem given by

$$\sum_{\tau=t}^L \frac{c_\tau}{(1+r)^{\tau-t}} = (1+r)A_{t-1} + y \sum_{\tau=t}^L \frac{1}{(1+r)^{\tau-t}} \quad (1.5)$$

eventually yields the following rather complicated expression for household consumption:

$$c_t = \left[ (1+r)A_{t-1} + y \sum_{\tau=t}^L \left( \frac{1}{1+r} \right)^{\tau-t} - \bar{c} \left( \sum_{\tau=t}^L \left( \frac{1}{1+r} \right)^{\tau-t} - \sum_{\tau=t}^L \left( \frac{1+\rho}{(1+r)(1+r)} \right)^{\tau-t} \right) \right] * \left[ \sum_{\tau=t}^L \left( \frac{1+\rho}{(1+r)(1+r)} \right)^{\tau-t} \right]^{-1} \quad (2.6)$$

Note that the intertemporal budget constraint only holds when  $A_L = 0$  implying that there are no bequests. For illustration purposes, we will simulate equation (2.6) for different rates of return, setting  $\rho = 0$  in order to elicit the pure effect of  $r(\varphi)$  on the consumption level. The expression for household consumption simplifies to:

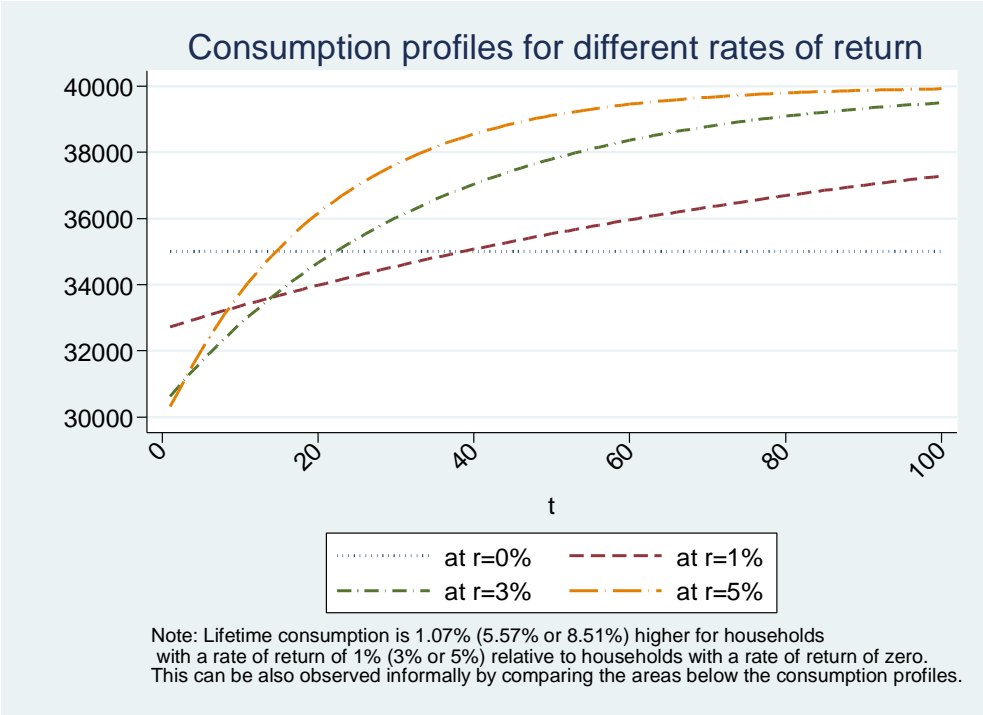
$$c_t = \frac{(1+r)}{\sum_{\tau=t}^L \left( \frac{1}{(1+r)(1+r)} \right)^{\tau-t}} A_{t-1} + y \frac{\sum_{\tau=t}^L \left( \frac{1}{1+r} \right)^{\tau-t}}{\sum_{\tau=t}^L \left( \frac{1}{(1+r)(1+r)} \right)^{\tau-t}} + \bar{c} \left( 1 - \frac{\sum_{\tau=t}^L \left( \frac{1}{1+r} \right)^{\tau-t}}{\sum_{\tau=t}^L \left( \frac{1}{(1+r)(1+r)} \right)^{\tau-t}} \right) \quad (2.7)$$

In order to gain insights in equations (2.6), we simulate the closed-form solution for household consumption given by equation (2.7) for different levels of  $r(\varphi)$ . It is not our intention to create a realistic profile of a median household in the Netherlands but rather to illustrate the mechanisms behind our theoretical model. For this purpose, we (more or less) arbitrarily choose values for the bliss level and household income that we keep constant across the different scenarios. We set the bliss level at 40000 Euros. We set annual household income at 35000 Euros, an educated guess based on statistics provided by Statistics Netherlands (CBS): annual disposable household income in the Netherlands in 2014 has been about 34200 Euros (CBS, 2016).

The figure below displays consumption profiles for households with different rates of return. When the rate of return is zero, hence in the absence of financial literacy, annual consumption is projected to be constant over the life cycle. It is then equal to annual household income. For households with positive returns to financial literacy, the consumption profiles become steeper: The higher the rate of return, the higher the consumption level. The choice of parameters (especially the bliss level and the number of time periods) can change the shapes of the profiles in absolute terms. The main takeaway message from this graph is that keeping age constant, we can distinguish between different consumption profiles due to a difference in the rates of return. At different  $t$ , the model suggests different consumption levels across different rates of return. This indicates that there might be an interaction going on between financial literacy and age. Note, that according to equation (2.7), consumption is also dependent on age – age enters through the summations. In the context of the theoretical model, we can posit the following hypotheses: Firstly, lifetime consumption is positively

related to financial literacy and secondly, there is a positive relationship between consumption growth and financial literacy. In the following sections, we will empirically test those two theoretical predictions.

Figure 1: Consumption profiles for different rates of return.



### 3. Data description

*Dataset composition*

We use data from the LISS panel that is a part of the Measurement and Experimentation in the Social Sciences (MESS) project of CentER data in Tilburg, the Netherlands. This panel is a representative household survey and consists of 5000 Dutch households and 8000 individual respondents for the years 2008-2014. Knoef and de Vos (2009) have thoroughly tested whether the LISS panel is representative of the Dutch population by comparing some key statistics with data from Statistics Netherlands (CBS) and have in general come to a positive conclusion.

Our dataset has information on the demographics of the individual respondents, their reported net income, their financial literacy level, household consumption and information on



asset holdings and the amount of assets held. The data is retrieved from several modules and merged based on household and individual identifiers resulting in a panel. All waves have information on the age of all household members, the position in the household (e.g. household head or (un)wedded partner), the household size, net monthly household income and marital status. Those demographics are part of the background variables module of the LISS panel and are available for every month between 2008 and 2014. In case that respondents have participated in modules during different months within the same year (for instance the questions on consumption and assets), we computed the average net household income within each year yielding one representative value of monthly net household income per year. We distinguish two types of households: single person households and couples. A couple is defined as a household head who lives together with an (un)wedded partner. In our analysis of couple households we will only include households with responses of both adult household members.

We use the single wave study from August 2011 on financial literacy – where four questions on financial literacy have been answered by 4858 respondents (from 3298 households) corresponding to a response rate of 71.7%. The questions tested knowledge on interest compounding, inflation, risk diversification and the relationship between bond prices and interest rates. For the exact wording of the questions please refer to Appendices C through E. The first three questions test basic financial literacy concepts and the fourth financial literacy question is testing advanced financial literacy knowledge (cf. Lusardi, 2015). The questions are multiple choice questions and include the option for respondents to answer with “don’t know” or “refuse”. We created two separate factors – the first being the sum of the first two financial literacy questions and the second one the sum of the third and fourth questions. The first factor captures the numeracy dimension of financial literacy and the second factor – the ability to grasp more advanced financial concepts in order to engage in sound investment decisions. Note that when a question is not correct, it is devised a score of 0. This does not imply that the question is incorrect as respondents also had the possibility to refuse to answer or to choose the “don’t know” option.

Consumption data has been retrieved from the Consumption and Time Use longitudinal study comprising three waves – the first wave has been collected in 2009, the second in 2010 and the third and last wave in 2012. On average, there are 5200 observations per wave which corresponds to a response rate of 67% - the first wave has a significantly lower response rate than the last wave from 2012. Data are available on expenditures on items

that are consumed at a household level and expenditures that are personal which are aggregated to the household level. The LISS panel has asked respondents to indicate (in Euros) their expenditure per month while distinguishing between household and personal expenditures. We will look at total reported household consumption being the sum of the following subcategories: mortgage/rent, utilities, transport, insurances, debt/loans, food (excluding restaurants) and alimony payments. We exclude expenditures for personal use such as buying clothes, out-of-pocket medical expenses, gifts, leisure activities, tobacco and alcohol. As the amount of household consumption is sensitive to household size, we adjust total household consumption by dividing by the square root of household size. For couples, we condition the reported expenditures on the response of the household head in case the responses of two household members differ or the partner's answer is missing as household head is most likely to give the most accurate answer.

The data on the questions whether one invests in financial assets and what the balance on the respondents' current and or savings account was, have been taken from the LISS longitudinal core study on assets and comprises four waves (2008, 2010, 2012 and 2014). For each wave there are around 5500 observations available which corresponds to an actual response rate of between 70% and 75% per wave. Household heads were asked to indicate the amount of the assets that are on their own name and also to provide information on joint assets. The partners or spouses were asked to only provide information on financial assets that are exclusively on their own name. Adding the responses of the household head and their partner gives then the total amount of asset holdings for couples. The responses to whether one holds investments in stocks or bonds have been aggregated conditional on the response of the household head.

#### *Data cleaning*

For the years 2009, 2010 and 2012 we observe 2399 distinct single households and 4414 distinct couple households, after having removed the answers of other respondents than the households head or the (un)wedded partner. This accounted for 33.3 percent of the sample. Unfortunately, the overlap between the assets core study and the time use and consumption study is only present for the years 2010 and 2012. This and the fact that the questions on financial literacy are asked once in 2011, considerably reduces the number of households that we can follow. Removing the households from our sample with no or incomplete observations of financial literacy (when only one partner responded to the

financial literacy questions) leaves us with 763 distinct single households and 688 couple households. We lose 2 more households that gave incomplete answers to the consumption questions. The final issue we needed to clean the data for was the reported balance on the current and or savings account of the respondent. We aggregated the answers to the household level conditional on the response of the household head. 26,17% of the responses to this question were “refuse” or “don’t know”. The final step was to adjust the sample for outliers in reported household consumption. Removing the observations below the 1<sup>st</sup> percentile and above the 99<sup>th</sup> percentile of the sampling distribution of household consumption reduced the sample by 11 households leaving us with 670 distinct single households and 278 distinct couple households.

### *Summary statistics*

We will discuss the performance of the respondents for every financial literacy question while distinguishing between gender, age groups and education levels. The first three tables use raw financial literacy data and do not take into account the overlap with consumption and asset holdings – hence the high number of observations.

Table 1: Percentage share of correct answers by gender (n=3062)

	Interest	Inflation	Risk	Bonds
<b>Female (n=1624)</b>				
Correct	87,78	73,40	32,01	12,86
Incorrect	5,59	11,47	16,47	30,38
DK	5,01	13,21	49,59	54,89
Refuse	1,63	1,92	1,92	1,86
<b>Male (n=1438)</b>				
Correct	91,27	84,72	54,70	25,99
Incorrect	4,76	8,33	14,88	38,29
DK	2,84	5,56	28,70	34,79
Refuse	1,12	1,39	1,72	0,93

For both male and female respondents, there is a large difference in the percentage of correct answers for the first two questions and the last two questions (cf. table 1). The questions about interest compounding and inflation were perceived as easier than the questions on risk diversification and bond prices. You can observe that the percentage of correct answers for female respondents is consistently lower than their male counterparts. Most interestingly, the share of DK answers is two times larger for females. This is consistent with the findings of Bucher-Koenen et al. (2014) who point out that at the bottom of this gender gap lie both lower knowledge and lack of confidence. The differences between men and women are statistically significant (F- statistics range from 12.56 to 182.64 with p-values of 0.000).

In order to obtain a first impression at the type of answers to the financial literacy questions by age, we split the sample into three age groups: The first one comprises respondents that are younger than 40 years, the second and most numerous one are respondents between 40 and 64 years and to the last group belong respondents that are 65 years or older. This division is quite intuitive when you make the analogy to an individual's life cycle – respondents that belong to the second age group already participate in the labor market and are not starters as opposed to the younger group and accumulate income, whereas the last group is about to or already exited the labor market. Table 2 summarizes the share of answering type (correct, incorrect, DK or refuse) by age group. The youngest group fares worst in terms of their share of correct answers to the four financial literacy questions. 87.72 percent of the respondents of this age answered the interest rate question correctly as compared to a share of 90.19 (this is the only statistically significant difference,  $p=0.044$ ) and 89.06 percent respectively for the second age group and the group of the elderly respondents. The answers to the second question about inflation reveal some interesting insights: Whereas for the youngest age group the share of correct responses drops compared to the interest compounding question, the share of correct responses for the above 65 years olds is above 80 percent. This is the only financial literacy question in which the older respondent group fares better than the 40-64 years old. A plausible explanation is that the generation of the elderly respondents has lived in an age where the concept of inflation was more prevalent in everyday life. The differences between the middle and the old age group are not statistically significant; the other groups differ significantly at the 0.1% level. The last two questions and notably the last question testing the knowledge of respondents on risk diversification and the relation between bond prices and interest rates have been perceived as the most difficult questions by

all respondents. The first age group had the highest share of correct responses to the risk question (but the difference is not statistically significant). Note also that the share of respondents that indicated that they did not know the answer to the risk and bond questions is consistently higher for all age groups. Concerning the last question, the difference in means relative to the youngest age group is statistically significant at the 0.1% level, but not between the second and third age group. We cannot confirm a hump-shaped relationship.

Table 2: Percentage shares of correct answers for each FL question by age group (n=3062)

	Interest	Inflation	Risk	Bonds
<b>&lt;40 yrs (n=533)</b>				
Correct	87,72	75,28	45,14	18,98
Incorrect	5,10	8,13	13,08	26,00
DK	4,31	13,56	38,44	51,83
Refuse	2,87	3,03	3,35	3,19
<b>40-64 yrs (n=1670)</b>				
Correct	90,19	78,78	44,78	19,27
Incorrect	4,93	10,72	14,79	35,15
DK	3,67	8,83	38,70	44,21
Refuse	1,20	1,66	1,72	1,38
<b>65+ yrs (n=859)</b>				
Correct	89,06	81,02	36,44	18,51
Incorrect	5,82	9,90	19,56	37,83
DK	4,42	8,38	43,07	43,42
Refuse	0,70	0,70	0,93	0,23

We also examined the share of correct (incorrect etc.) answers by question by education categories. The highest education category comprises respondents that hold a degree at least of a university of applied sciences (a Dutch hbo certificate), to the medium education category belong respondents with a certificate from intermediate vocational training (mbo) or from secondary high school (havo/vwo) and to the lowest education category belong respondents with a certificate from primary school or intermediate secondary school (vmbo). Table 3 summarizes the results by financial literacy question and educational level. A quick glance already reveals that the share of correct responses increases with the educational level. What is also interesting to observe is that the span of the correct answers within each education group ranging from the interest compounding question, the question that always has been answered with the highest correctness score, to the question on bonds – the question

with the lowest correctness score, decreases the higher the education level. For instance, for respondents belonging to the lowest education category, the share of correct answers for the bond question is eight times lower than the question about interest compounding. In contrast, for respondents belonging to the highest education category, the share of correct answers for the bond question is about three times lower than the share of correct answers to the interest compounding question. All differences between education levels for every financial literacy question are statistically significant (F-statistics range from 52.16 to 135.46 with p-values of 0.000). The gist of the above tables is that there is considerable heterogeneity in the answers when distinguishing between gender, age groups and education levels.

Table 3: Cell percentages by education level and answer type (n=3062)

	Interest	Inflation	Risk	Bonds
<b>Low (n=1123)</b>				
Correct	82,28	68,27	26,33	10,89
Incorrect	8,10	14,68	18,23	33,67
DK	7,26	14,26	52,57	53,50
Refuse	2,36	2,78	2,87	1,94
<b>Medium (n=976)</b>				
Correct	91,50	80,58	45,02	19,71
Incorrect	4,54	8,41	14,59	32,75
DK	2,71	9,57	38,65	45,89
Refuse	1,26	1,45	1,74	1,64
<b>High (n=963)</b>				
Correct	95,82	89,14	59,46	27,69
Incorrect	95,64	89,01	59,31	27,82
DK	2,48	6,14	13,96	35,94
DK	1,49	4,26	26,04	35,64
Refuse	0,40	0,59	0,69	0,59

Table 4: Share of respondents by number of Correct, Incorrect and DK answers (n=3060)

	<b>None</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>All four</b>	<b>Total</b>
Correct	5,98	13,56	37,68	30,31	12,48	<b>2,30</b>
Incorrect	49,85	36,84	11,8	1,48	0,03	<b>0,65</b>
DK	42,06	27,13	23,11	5,04	2,66	<b>0,99</b>
Refuse	96,98	0,99	0,81	0,17	1,05	<b>0,07</b>

Table 4 provides an overview of the shares of how many financial literacy questions (out of four) were answered correctly, incorrectly or with “don’t know” or refuse. The last column returns the mean value of how many questions were answered correctly, incorrectly etc. The most important information that can be retrieved from this table is that 12.48% of the respondents answered all four questions on financial literacy correctly. On average, 2.30 out of the four questions were answered correctly. Those results are disquieting – the share of correct answers is very low and there is a high share of respondents that chose the do not know (DK) option providing evidence for lack of confidence regarding their knowledge of the financial concepts being tested.

Having discussed the descriptives of the measures of financial literacy by selected demographic categories, it is time to take a look at the dependent variable of our research: household consumption. In figure 1, we plot household consumption in Euros as reported by the household head against age category, education level and the financial literacy score of the household head. The first two charts in figure 1 display median adjusted household consumption by age categories for single households to the left and for couples to the right. Displaying the results using median values rather than mean has the advantage that the median is less sensitive to outliers. For single households it is hard to see differences in reported consumption between the three age groups. For couples, the differences are a bit more visible: the youngest age group appears to have a higher consumption level than the older two groups. The implication of this chart for our empirical specification is that we use individual age as a continuous variable rather than a categorical variable.

Next, we look at the relation between household consumption and education levels. Respondents with low level have the lowest household consumption. Consumption levels for singles are relatively higher than consumption levels as reported by the household head of a

couples household. In general, we can observe that for both household types, median household consumption is increasing with education level. Finally, we turn to the relationship between financial literacy and household consumption. The graphs in the third row of figure 1 shows median adjusted household consumption as reported by the household head by the number of correct answers provided by the household head to the four questions on financial literacy. The more questions are answered correctly, the higher the adjusted household consumption. This graph provides suggestive evidence in support of the first empirical implication of our theoretical model – a positive association between household consumption level and financial literacy.

The summary statistics of the main variables are displayed in table 5. A more detailed overview of all covariates can be found in Appendix B. We can observe that standardized household consumption for single women is around 200 Euros lower than for single men. For couple households, adjusted household consumption is slightly higher than single women's consumption. This is hardly surprising as expenditures do not linearly increase with the household size. For all households, average consumption growth is positive. 16% of single women indicate that they hold investments in stocks or bonds in contrast to 26% of single men. Couples have a considerably lower share of investments holdings.

As we will combine the financial literacy question on interest and inflation into one factor and the risk diversification and bond prices questions into a second factor, we present the summary statistics of the two subgroups. When a respondent answered a question correctly, the score is one, otherwise zero. Hence, we have two separate factors that range from zero to two. Consistent with the previous analysis of the individual financial literacy questions, the average score on questions 3 and 4 (risk diversification and bond prices) is consistently lower across all groups. Interestingly, women that are part of a couple fare better than single women. It is also interesting to take a glance at the cross-tabulations of individual scores on the questions within couples (cf. table 6). For the first two financial literacy questions, the frequency of both partners having both answers correct is the highest (198 couples out of 278). The second most frequent combination - with 50 observations - is when the man answered both questions correctly and the female partner scored one out of two. As to the third and the fourth question, it is more difficult to identify certain patterns. The highest frequency occurs for both partners scoring zero, followed by the combination of both partners scoring one and the man scoring one while the woman scores zero. Due to the small sample



size, we do not have observations for every possible combination of scores which imposes certain limitations for our empirical estimations.

Figure 2: Median household consumption by age, education level and number of correct answers to financial literacy questions for single households and couples

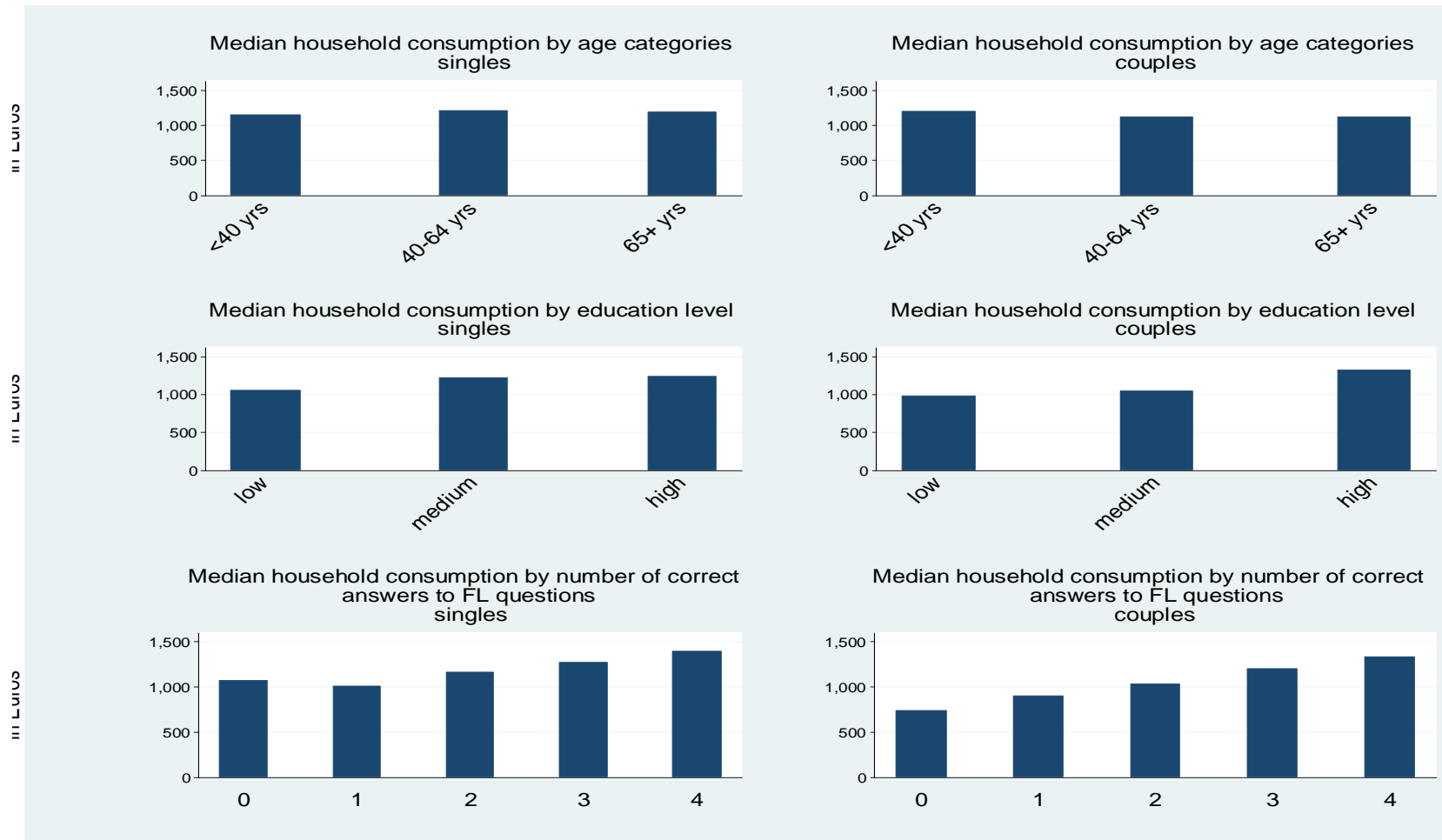


Table 5: Summary statistics of main variables

<b>Singles</b>		<b>women</b>		<b>men</b>	
<i>household level</i>	<i>Variable</i>	<i>mean</i>	<i>sd</i>	<i>mean</i>	<i>sd</i>
	Household consumption	1275,35	510,00	1515,73	626,32
	adj Household consumption	1226,89	504,77	1441,84	599,64
	$\Delta$ log HH consumption	0,02	0,27	0,01	0,29
	$\Delta$ log adj. HH consumption	0,02	0,27	0,02	0,29
	Investment dummy	0,16	0,37	0,26	0,44
<i>individual level</i>					
	Score on Q1 and Q2 (out of 2)	1,64	0,56	1,81	0,48
	Score on Q3 and Q4 (out of 2)	0,42	0,61	0,89	0,80
	<b>n</b>	<b>360</b>		<b>310</b>	
<b>Couples</b>		<b>women</b>		<b>men</b>	
<i>household level</i>	<i>Variable</i>	<i>mean</i>	<i>sd</i>	<i>mean</i>	<i>sd</i>
	Household consumption	1943,58	796,44	1943,58	796,44
	adj Household consumption	1238,31	475,35	1238,31	475,35
	$\Delta$ HH consumption	0,03	0,36	0,03	0,36
	$\Delta$ adj. HH consumption	0,03	0,36	0,03	0,36
	Investment dummy	0,05	0,23	0,05	0,23
<i>individual level</i>					
	Score on Q1 and Q2 (out of 2)	1,71	0,51	1,88	0,38
	Score on Q3 and Q4 (out of 2)	0,53	0,66	0,88	0,76
	<b>n</b>	<b>278</b>		<b>278</b>	

Table 6: Cross tabulations (frequencies) for financial literacy questions for couple households (N=278)

		<b>Women's score on Q1 and Q2</b>		
<b>Men's score on Q1 and Q2</b>		<b>0</b>	<b>1</b>	<b>2</b>
<b>0</b>		4	2	0
<b>1</b>		0	12	8
<b>2</b>		4	50	198
		<b>Women's score on Q3 and Q4</b>		
<b>Men's score on Q3 and Q4</b>		<b>0</b>	<b>1</b>	<b>2</b>
<b>0</b>		76	22	2
<b>1</b>		52	52	8
<b>2</b>		28	22	16

#### **4. Methodology**

In this section, we propose specifications in order to test our empirical predictions formulated in the theoretical section. Firstly, we want to gain more insight in the relationship between financial literacy and whether household members hold investments in stocks, bonds or growth funds. Secondly, we test the relationship between financial literacy and household consumption levels by estimating the closed-form solution derived in the theoretical section. And finally, we will examine the relationship between financial literacy and percentage consumption growth. Lusardi and Mitchell (2007), Lusardi and Mitchell (2008) and Bucher-Koenen et al. (2014) point out the importance of the gender gap when researching financial literacy, and following this line we decided to test separate models for single households for males and females and a separate model for couples. This holds for all specifications.

##### *Investments in financial assets and financial literacy*

The first step towards understanding the relationship between growth and financial literacy is to take a closer look at household investments in financial assets. The purpose of testing this relationship is to examine how financial literacy enters the intertemporal budget constraint and what the role of financial investments is. We will estimate equations (4.4) and (4.5) using the binomial probit model.  $Inv_{it}$  is a binary variable that measures whether the household at least one of the partners holds investments in stocks, bonds and growth funds. The actual dependent variable in the model is latent, hence the superscript in equations (4.4)

and (4.5) and denotes the predicted probability of a household holding investments in financial assets, hence  $\Pr(Inv_{it}) = 1$ . The first two coefficients in the singles model (first four in the couples model) capture the two financial literacy factors.  $\delta'X'_{it}$  is a vector including all covariates such as the respondent's age (in logarithms), education level, gender of the household head, household size (in logarithm) and the position in the assets distribution (the balance of savings/ current accounts at the household level, in quintiles). We will also include a specification where we control for the position of the household in the income distribution to check whether the association might disappear in the presence of income. The covariates vector for the couples includes the individual characteristics of both partners.

Singles

$$Inv_{it}^* = \beta_1 Q1Q2_{it} + \beta_2 Q3Q4_{it} + \delta'X'_{it} + u_{it} \quad (4.4)$$

Couples

$$Inv_{it}^* = \beta_1 Q1Q2^{woman}_{it} + \beta_2 Q1Q2^{man}_{it} + \beta_3 Q3Q4^{woman}_{it} + \beta_4 Q3Q4^{man}_{it} + \delta'X'_{it} + u_{it} \quad (4.5)$$

### *Consumption level and financial literacy*

To test whether the relationship between household consumption levels and financial literacy of the household head and his or her partner is positive, we will estimate equation (4.6) for singles and equation (4.7) for couples. In the theoretical section, we have seen that the closed-form solution for consumption depends on financial literacy (through the rate of return) and household assets. The simulations of the model suggested that there is an interaction between age and the financial literacy level – remember that the steepness of the consumption profiles differed across different rates of return. The dependent variable is standardized consumption at the household level. The second and third term in equations (4.6) and (4.7) refer to the individual financial literacy levels, followed by their interactions with the logarithm of age.  $\delta'X'_{it}$  is a column vector including the control variables household size (in logarithms), education level, gender of the household head and the position of the household in the asset holdings distribution. We will estimate specification with and without household income to check the feasibility of our theoretical assumption of constant income over time. For now will estimate the models using pooled OLS.

Singles

$$\begin{aligned} \text{adjHC}_{it} = & \beta_0 + \beta_1 Q1Q2_{it} + \beta_2 Q3Q4_{it} + \beta_3 Q1Q2_{it} * \log(\text{age}_{it}) + \beta_4 Q3Q4_{it} \\ & * \log(\text{age}_{it}) + \beta_5 \log(\text{age}_{it}) + \delta' X'_{it} + u_{it} \end{aligned} \quad (4.6)$$

Couples

$$\begin{aligned} \text{adjHC}_{it} = & \beta_0 + \beta_1 Q1Q2^g_{it} + \beta_2 Q3Q4^g_{it} + \beta_3 Q1Q2^g_{it} * \log(\text{age}_{it}) + \beta_4 Q1Q2^g_{it} * \\ & \log(\text{age}_{it}) + \beta_5 \log^g(\text{age}_{it}) + \delta' X'_{it} + u_{it} , \text{ where } g = \{ \text{men, woman} \} \end{aligned} \quad (4.7)$$

### *Consumption growth and financial literacy*

We estimate the Euler equation, equation (2.4) for single males, single females and couples using pooled OLS. The dependent variable for both specification in equations (4.8) and (4.9) is the first difference of household consumption. For now, we need to restrict our analysis on the years 2010 and 2012. We use standardized consumption so that we can compare the singles and couples models. For ease of interpretation we compute the logarithm of consumption before first-differencing – now we look at the variation of consumption growth in percentages. In the couples model (see equation 4.9), we include interaction terms for the scores of both partners on financial literacy questions on questions 1 and 2, and 3 and 4 respectively. This allows us to test whether the financial literacy score of the partner has a moderating or strengthening effect on the relationship between the financial literacy score of the respondent and household consumption growth. The term  $\delta' X'_{it+1}$  is a vector including the same covariates as the specifications above with the exception of the asset distribution. Naturally, the models for single men and single women do not include an interaction term. Note that we do not include an interaction term for age and financial literacy.

Singles

$$\begin{aligned} \Delta \log(\text{adjHC}_{it+1}) \\ = & \beta_0 + \beta_1 FL_{it+1}^{\text{Woman}} + \beta_2 FL_{it+1}^{\text{Man}} + \beta_3 FL_{it+1}^{\text{Woman}} \\ & * FL_{it+1}^{\text{Man}} + \delta' X'_{it+1} + u_{it+1} \end{aligned} \quad (4.8)$$

Couples

$$\begin{aligned}
\Delta \log(\text{adjHC}_{it+1}) &= \beta_0 + \beta_1 Q1Q2^{\text{Woman}}_{it+1} + \beta_2 Q3Q4^{\text{Woman}}_{it+1} + \beta_3 Q1Q2^{\text{Man}}_{it+1} + \beta_4 Q3Q4^{\text{Man}}_{it+1} \\
&+ \beta_5 Q1Q2^{\text{Man}}_{it+1} * Q1Q2^{\text{Woman}}_{it+1} + \beta_6 Q3Q4^{\text{Man}}_{it+1} \\
&* Q3Q4^{\text{Woman}}_{it+1} + \delta' X'_{it+1} + u_{it+1}
\end{aligned} \tag{4.9}$$

## 5. Results

In this section we will present and discuss the results of the estimations of the models described in the previous section. We start off with examining the relationship between financial literacy and the probability to hold financial assets. Then, we proceed with testing the two empirical implications posited earlier in this paper: firstly, by exploring the relationship between household consumption levels and financial literacy and secondly, by estimating the Euler equation describing the relationship between consumption growth and financial literacy.

### *Investments in financial assets and financial literacy*

As laid out in the methodology section, we seek to identify associations between the likelihood for a household to hold financial assets and the level of financial literacy by estimating a probit model. The dependent variable is a binomial dummy variable indicating whether a household holds investments in bonds, assets or growth funds. The main independent variables are the individual scores on the first two and last two financial literacy questions, where each can take on the value 0,1 or 2. We control for individual age (in logarithms), gender of the household head and other covariates. The regression results with all covariates is presented in appendix F.

In table 7, we show a compressed version of the estimated coefficients. As we do not seek to set causal links between the investment probability and the level of financial literacy, we estimate the raw coefficients of the probit model (rather than computing marginal effects). The first three columns of table 7 are estimations of the specification excluding net household income and the last three columns are estimations including the position of the household in the income distribution. We estimate separate models for single men, single women and couple households. The coefficients marginally differ between the two specifications, the

signs remain the same – this demonstrates that household income is not crucial for predicting the probability of investing in financial assets. The coefficients of the scores on the questions on interest compounding and inflation (financial literacy questions 1 and 2) are not statistically significant for all models. On the other hand, the coefficients of the scores on the questions on risk diversification and bond prices are statistically significant at the 0.01% level for single households and have a positive sign. Hence, this indicates that there is (though not consistently) a positive association between financial literacy and the likelihood to invest in financial assets.

To provide a more conclusive analysis, we predict the probabilities to hold financial assets for all available combinations of financial literacy scores. Panel A of table 8 displays the predicted probabilities for single households for the scores on questions 1 and 2 against the scores on questions 3 and 4. For single women that answered all questions correctly from both clusters, we predict that the probability of them holding investments in financial assets is 0.4 (p-value<0.01). The second-highest probability for single women, 0.312 (p-value<0.05), is predicted for women who answered both question 3 and 4 correctly and at the same time answered either question 1 or 2 correctly. For single men, the predicted probabilities are higher: men that answered all questions correctly have a likelihood of 0.485 (p-value<0.01) to hold investments in financial assets, followed by a predicted probability of 0.364 (p-value<0.01) for men who answered questions three and four correctly and only one question from the first financial literacy factor correctly. Now we can harvest the fruits of disintegrating financial literacy into two factors: we can see that there is a difference in predicted probabilities whether a respondent scores 1 at questions 1 and 2 and scores 2 at questions 3 and 4 and whether a respondent scores 2 at questions 1 and 2 and 1 at questions 3 and 4. The predicted probabilities for the former are higher, suggesting that demonstrating knowledge about the concepts of risk diversification and bond prices is more important when making investment decisions.

For couples (see panel B in table 8), we predict the probabilities given the scores of both partners on the same questions. Hence, we look at the first two and the last two financial literacy questions separately. For the first two questions, we could only predict probabilities for the cases that the man scored two. This is due to the small sample size and that not all combinations are equally (or at all) represented. Household where both partners answered question 1 and 2 correctly have a predicted probability of 0.4 (p-value<0.01) to invest in stocks, bonds and mutual funds. For the results on questions 3 and 4, it is more difficult to



identify some patterns. Interestingly, the predicted probabilities appear to decrease with an increasing score of the man, keeping the female score constant- the predicted probabilities being statistically significant when the woman scored 1. It is hard to draw a clear conclusion from these very results. What we can take away in any case is, that there is a positive association between financial literacy (especially questions 3 and 4 for singles) and the likelihood to invest in financial assets. Those are results that pave the way for testing the empirical implications of the theoretical model.

Table 7

<b>Investment - probit estimations (coeff.)</b>						
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	with covariates (no income) singles F	singles M	couples	with covariates (with income) singles F	singles M	couples
Women's Score on Q1 and Q2	0.247 (0.216)		0.433 (0.618)	0.277 (0.257)		1.055 (0.808)
Women's Score on Q3 and Q4	0.566*** (0.159)		0.329 (0.272)	0.615*** (0.208)		0.494 (0.456)
log_age_f	0.491 (0.395)		1.084 (3.118)	0.548 (0.509)		3.829 (3.913)
Men's Score on Q1 and Q2		0.311 (0.291)			0.329 (0.327)	
Men's Score on Q3 and Q4		0.663*** (0.119)	-0.0773 (0.268)		0.679*** (0.164)	-0.0654 (0.436)
log_age_m		0.106 (0.366)	0.319 (3.238)		-0.0511 (0.487)	-2.176 (3.884)
Constant	-4.402** (1.714)	-2.470 (1.651)	-14.26 (372.3)	-4.486** (2.194)	-2.033 (1.944)	-21.99*** (6.441)
Observations	321	310	165	321	302	116

Standard errors in parentheses

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Table 8: *Predicting investment probabilities for different levels of financial literacy (s.e. in parentheses)*

**A.**

single woman		single man			single woman		single man		
Q1+Q2	Q3+Q4	0	1	2	Q1+Q2	Q3+Q4	0	1	2
0	0.0307 (0.0262)	0.0961 (0.0739)	0.230 (0.171)		0	0.0236 (0.0330)	0.0931 (0.0990)	0.255 (0.205)	
1	0.0522** (0.0214)	0.145*** (0.0529)	0.312** (0.137)		1	0.0471 (0.0310)	0.156** (0.0694)	0.364*** (0.130)	
2	0.0843** (0.0345)	0.209*** (0.0512)	0.404*** (0.120)		2	0.0865** (0.0349)	0.242*** (0.0398)	0.485*** (0.0744)	

**B. Couples**

Q1+Q2 woman	man	Q3+Q4 woman	man	0	1	2
0	0.0843** (0.0345)	0	0.0738* (0.0427)	0.0666** (0.0326)	0.0601 (0.0486)	
1	0.209*** (0.0512)	1	0.111** (0.0558)	0.101*** (0.0293)	0.0919* (0.0521)	
2	0.404*** (0.120)	2	0.159 (0.107)	0.146* (0.0749)	0.135 (0.0833)	

*Consumption level and financial literacy*

Next, we provide estimates testing the first empirical implication of our life-cycle setting – we expect to find a positive association between the consumption level and financial literacy. Based on the shape of the closed form solution for different levels of financial literacy, we suggested including an interaction term between individual age and the financial literacy scores. We run three different specifications – one without interactions, a second with interactions and no covariates and a third specification including an interaction terms of age and financial literacy. The raw coefficients of the pooled OLS regression with all covariates can be found in appendix F. Table 9 presents the coefficients of the financial literacy variables and age. The coefficients of the financial literacy variable differ in sign, magnitude and statistical significance – especially for couples. The coefficients of the financial literacy variables that are statistically significant at the 0.01% level are positive. The magnitude of the coefficients is much higher for the specifications including the interaction terms with individual age. We constrain our analysis to the above observations due to the presence of the interaction terms. Nonetheless, table 9 provides suggestive evidence confirming the prediction of a positive association between consumption levels and financial literacy.

We can provide a more narrow interpretation of the results by moving on to the predicted consumption levels presented in table 10. The predicted consumption levels take into account the interaction with age. For single women, the highest predicted consumption levels are when they score one on questions three and four and scored two on the questions one and two. For single men, the predicted consumption levels differ less – the case a score of one for questions three and four marginally dominating the case of a score of two for those questions. Similar to the analysis of the probability to invest in financial assets, we consider the questions on inflation and interest compounding and the questions on risk diversification and bond prices separately. The predicted consumption levels at the different combinations of scores for the third and fourth question are higher than for the first and second question. Interestingly, the highest predicted household consumption level (1571 Euros) is for households in which the man scored 2 on the first two questions and the woman zero. The second highest consumption level (1327 Euros) is predicted for households in which the man scores 1 on the last two questions and the woman zero.

Table 9

**Pooled OLS Estimations of closed form solution for consumption**

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	with covariates - no income singles F	singles M	couples	age*FL single females no cov	single males	couples	age*FL with covariates single females	single males	couples
Women's Score on Q1 and Q2 = 1	43.49 (189.7)		-223.5* (133.2)	5,517*** (2,025)		1,060 (2,746)	3,653 (2,383)		3,263 (1,978)
Women's Score on Q1 and Q2 = 2	49.96 (185.6)		-233.1* (129.6)	3,607* (2,006)		1,470 (2,784)	1,791 (2,393)		1,876 (2,070)
Women's Score on Q3 and Q4 = 1	72.63 (81.87)		-85.47 (79.74)	-522.9 (1,446)		1,324 (1,319)	-988.1 (1,444)		218.2 (1,275)
Women's Score on Q3 and Q4 = 2	-173.8* (103.7)		-89.52 (142.9)	-1,533 (1,436)		-2,919 (2,533)	-1,949 (1,338)		-1,910 (2,074)
log_age_f	-95.26 (189.0)		-865.8** (407.2)	803.5* (456.6)		-90.60 (639.7)	240.2 (560.5)		-260.8 (476.7)
Men's Score on Q1 and Q2 = 1		241.4 (148.7)	206.3 (199.2)		1,819 (2,208)	-13,116** (5,213)		1,037 (3,306)	-10,368** (4,868)
Men's Score on Q1 and Q2 = 2		316.7** (138.0)	497.1*** (165.1)		2,065 (2,017)	-11,753** (4,840)		1,438 (3,329)	-9,562** (4,673)
Men's Score on Q3 and Q4 = 1		119.3 (113.8)	136.3* (72.18)		1,412 (1,368)	-837.6 (1,534)		1,344 (1,417)	278.8 (1,323)
Men's Score on Q3 and Q4 = 2		106.7 (113.8)	159.9 (100.6)		2,204 (1,514)	-403.1 (1,786)		2,329 (1,652)	302.7 (1,619)
log_age_m		104.0 (158.4)	367.2 (414.8)		717.5 (490.9)	-2,806** (1,273)		602.5 (805.8)	-2,130* (1,122)
Constant	1,529* (798.9)	659.0 (635.1)	3,116*** (776.4)	-2,263 (1,757)	-1,871 (1,974)	12,847*** (3,689)	135.0 (2,277)	-1,348 (3,242)	10,958*** (3,646)
Observations	360	310	278	360	310	278	360	310	278
R-squared	0.133	0.122	0.303	0.048	0.056	0.165	0.155	0.130	0.316

Robust standard errors in parentheses

\*\*\* p&lt;0.01, \*\* p&lt;0.05, \* p&lt;0.1

Table 10

## Predicting consumption levels for different FL levels

**A.**

single woman	Q3+Q4			single man	Q3+Q4		
Q1+Q2	0	1	2	Q1+Q2	0	1	2
0	1,148*** (172.0)	1,227*** (190.9)	986.8*** (185.8)	0	1,071*** (136.7)	1,194*** (137.5)	1,193*** (157.8)
1	1,226*** (58.42)	1,305*** (75.56)	1,065*** (91.35)	1	1,317*** (129.5)	1,439*** (116.5)	1,438*** (134.7)
2	1,228*** (48.11)	1,308*** (68.85)	1,067*** (79.94)	2	1,380*** (63.16)	1,503*** (94.25)	1,502*** (93.11)

**B.**

**Couples**

Q1+Q2 woman	man			Q3+Q4 woman	man		
Q1+Q2 woman	0	1	2	Q3+Q4 woman	0	1	2
0	1,080*** (98.08)	1,260*** (171.1)	1,571*** (139.6)	0	1,208*** (54.78)	1,327*** (58.40)	1,325*** (112.2)
1	804.1*** (130.3)	984.3*** (114.4)	1,295*** (87.34)	1	1,112*** (90.46)	1,231*** (76.43)	1,229*** (107.7)
2	770.1*** (127.0)	950.3*** (123.9)	1,261*** (38.45)	2	1,150*** (174.6)	1,269*** (170.0)	1,267*** (142.6)

*Consumption growth and financial literacy*

Here, we present the results of testing the second empirical prediction. According to our theoretical model, we expected a positive relationship between household consumption growth and financial literacy. We regress the first-difference of the logarithm of consumption on the financial literacy factors and the covariates. In table 11, you can find the regression results for the financial literacy variables and for individual age. A table with all covariates can be found in appendix F. All coefficients related to financial literacy are not statistically significant save for one though at the 10% level – the women’s score for the third and fourth financial literacy question. Breaking down the total effect of the financial literacy questions in table 12, enables us to be more specific. In table 12 we present predicted (standardized) consumption levels per amount of correct answers for the clusters of the first two and the last two financial literacy questions respectively. In panel A of table 12 we do not find any statistically significant predictions for the single households. In panel B, the results are equally modest with one exception. For couples where the man answered either the question about risk diversification or about bond prices correctly, while his female partner answered

neither correctly, we predict a consumption growth of 7.5%. We are cautious about a more detailed interpretation as this marginal effect is statistically significant at the 10% level.

Table 11

<b>Estimations Euler equation</b>			
VARIABLES	(1) single females	(2) single males	(3) couples
Women's Score on Q1 and Q2	0.00951 (0.0371)		0.0743 (0.0679)
Women's Score on Q3 and Q4	-0.0241 (0.0361)		-0.0800* (0.0469)
log_age_f	-0.170** (0.0772)		0.798* (0.413)
Men's Score on Q1 and Q2		-0.00621 (0.0532)	-0.174 (0.146)
Men's Score on Q3 and Q4		0.0352 (0.0316)	0.00674 (0.0444)
log_age_m		-0.139 (0.0927)	-0.929** (0.428)
Constant	0.742** (0.323)	0.518 (0.384)	0.791 (0.725)
Observations	180	155	139
R-squared	0.044	0.043	0.115

Standard errors in parentheses

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Table 12

## Predicting consumption growth for different FL levels

A.

single woman		single man					
Q1+Q2	Q3+Q4			Q1+Q2	Q3+Q4		
	0	1	2		0	1	2
0	0.0175 (0.0638)	-0.00654 (0.0707)	-0.0306 (0.0923)	0	0.00261 (0.100)	0.0378 (0.0993)	0.0730 (0.108)
1	0.0270 (0.0331)	0.00297 (0.0398)	-0.0211 (0.0684)	1	-0.00359 (0.0543)	0.0316 (0.0492)	0.0668 (0.0624)
2	0.0365 (0.0298)	0.0125 (0.0305)	-0.0116 (0.0598)	2	-0.00980 (0.0386)	0.0254 (0.0256)	0.0605 (0.0425)

B.

Couples							
Q1+Q2 woman	man			Q3+Q4 woman	man		
	0	1	2		0	1	2
0	0.232 (0.246)	0.0582 (0.129)	-0.116 (0.123)	0	0.0683 (0.0488)	0.0750* (0.0395)	0.0818 (0.0685)
1	0.306 (0.264)	0.132 (0.124)	-0.0414 (0.0596)	1	-0.0117 (0.0638)	-0.00498 (0.0367)	0.00176 (0.0506)
2	0.381 (0.296)	0.207 (0.152)	0.0330 (0.0334)	2	-0.0917 (0.101)	-0.0850 (0.0744)	-0.0782 (0.0695)

## 6. Conclusion and Discussion

Does knowing more about financial concepts imply consuming more? Based on our first findings we can tentatively provide a positive answer. Starting off with a simple life cycle model we used stochastic dynamic programming to arrive at an Euler equation that incorporates financial literacy as a determinant of the interest rate and entering a consumer's dynamic budget constraint. We have seen that there is a hump-shaped relationship between the share of correct answers of the financial literacy questions and education. We also have observed – consistent with previous literature – that there is a considerable gender gap. Additionally, we have illustrated that there is an upward trend of household consumption towards higher financial literacy. This served as a starter before empirically testing our predictions.

Concerning the relationship between investing in financial assets and financial literacy, we found – although not consistent – a positive association between the financial literacy level and the likelihood to invest in stocks, bonds or mutual funds. We also found some evidence to support the theoretical prediction that a higher financial literacy level is associated with a higher

household consumption level. The estimation of the Euler equation, linking financial literacy to consumption growth, does not lead to conclusive results.

The results, though preliminary, suggest two things: depending on whether we look at household consumption decisions or investment decisions, different concepts of financial literacy become more important. For investment decisions, understanding the concepts of risk diversification is crucial, whereas concerning consumption decisions, the concepts of interest compounding and inflation are decisive. The second observation is that the score of the man in a couple household plays a large role. The predictions of consumption levels even suggest that given a certain literacy level of men, a higher score of their female partner rather decreases household consumption. Naturally, those are not causal effects we elicit, but statistical associations. We control for the gender of the household head, hence the explanation must lie somewhere else. For instance, if the man in a couple has a high financial literacy level, the household might have chosen to contribute monthly to a pension plan driving the consumption level up. If the woman in the household is financially literate, she might have compared different health insurance policies and chosen for the least costly one, which drives monthly expenditures down. There appears to be something at hand here: The decision making process on household expenditures could become more equalized between partners the higher literate the woman is, pulling the consumption level down. A possible explanation that might be worth to take a look at is the role of risk aversion and the (difference in) propensity to spend for men and women.

## References

- de Bresser, J., & Knoef, M. (2015). Can the Dutch meet their own retirement expenditure goals? *Labour Economics*, 34, 100–117. <http://doi.org/10.1016/j.labeco.2015.03.014>
- Bucher-Koenen, T., Alessie, R., Lusardi, A. & van Rooi, M. (2014). Women, confidence, and financial literacy. Mimeo working paper.
- Bucher-Koenen, T. & Lusardi, A. (2011). Financial literacy and retirement planning in Germany. *Journal of Pension Economics and Finance*, 10(04), 565–584. Retrieved from [http://journals.cambridge.org/abstract\\_S1474747211000485](http://journals.cambridge.org/abstract_S1474747211000485)



- CBS (Statistics Netherlands). Gemiddeld inkomen; particuliere huishoudens naar diverse kenmerken. Retrieved March 23, 2016, from <http://statline.cbs.nl/StatWeb/publication/>
- Christelis, D., Jappelli, T., & Padula, M. (2010). Cognitive abilities and portfolio choice. *European Economic Review*, 54(1), 18–38.  
<http://doi.org/10.1016/j.euroecorev.2009.04.001>
- Deuflhard, F., Georgarakos, D. & Inderst, R. (2014). Financial literacy and savings account returns. Retrieved from [http://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=2444903](http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2444903)
- Doppelhofer, G. (2009). Intertemporal macroeconomics. *Survey Chapter for*. Retrieved from [http://www.nhh.no/files/filer/institutter/sam/cv/papers/intertemporal\\_macro\\_economics.pdf](http://www.nhh.no/files/filer/institutter/sam/cv/papers/intertemporal_macro_economics.pdf)
- Hall, Robert E. (1979). “Stochastic Implications of the Life Cycle-Permanent Income Hypothesis: Theory and Evidence.” *NBER Working Paper* (R0015).[http://papers.ssrn.com/sol3/Papers.cfm?abstract\\_id=225080](http://papers.ssrn.com/sol3/Papers.cfm?abstract_id=225080)(September 24, 2015).
- Jappelli, T. & Padula, M. (2013). Consumption growth, the interest rate, and financial literacy. Retrieved from [http://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=2244086](http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2244086)
- Knoef, M. & de Vos, K. (2009). The representativeness of LISS, an online probability panel. Retrieved August, 31, 2012. Retrieved from [http://www.researchgate.net/profile/Marika\\_Knoef/publication/242742051\\_The\\_representativeness\\_of\\_LISS\\_an\\_online\\_probability\\_panel/links/0f3175339ae828f081000000.pdf](http://www.researchgate.net/profile/Marika_Knoef/publication/242742051_The_representativeness_of_LISS_an_online_probability_panel/links/0f3175339ae828f081000000.pdf)
- Krijnen, J., Breugelmans, S., & Zeelenberg, M. (2014). Waarom mensen de pensioenvoorbereiding uitstellen en wat daar tegen te doen is. *NEA Paper*, (52). Retrieved from [https://pure.uvt.nl/ws/files/4351505/SocPsy\\_Krijnen\\_waarom\\_mensen\\_Netspar\\_2014.pdf](https://pure.uvt.nl/ws/files/4351505/SocPsy_Krijnen_waarom_mensen_Netspar_2014.pdf)

- Lewbel, A. (1987). Bliss Levels That Aren't. *Journal of Political Economy*, 95(1), 211–215.  
Retrieved from <http://www.jstor.org/stable/1831308>
- Lusardi, A. (2015). Financial literacy: Do people know the ABCs of finance? *Public Understanding of Science*, 24(3), 260–271. <http://doi.org/10.1177/0963662514564516>
- Lusardi, A., Michaud, P.-C. & Mitchell, O. S. (2011). Optimal financial literacy and saving for retirement. Retrieved from [http://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=1978960](http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1978960)
- Lusardi, A., & Mitchell, O. S. (2007a). Baby Boomer retirement security: The roles of planning, financial literacy, and housing wealth. *Journal of Monetary Economics*, 54(1), 205–224.  
<http://doi.org/10.1016/j.jmoneco.2006.12.001>
- Lusardi, A., & Mitchell, O. S. (2007b). Financial Literacy and Retirement Preparedness: Evidence and Implications for Financial Education. *Business Economics*, 42(1), 35–44.  
<http://doi.org/10.2145/20070104>
- Lusardi, A., & Mitchell, O. S. (2007c). *Financial Literacy and Retirement Planning: New Evidence from the Rand American Life Panel* (SSRN Scholarly Paper No. ID 1095869). Rochester, NY: Social Science Research Network. Retrieved from <http://papers.ssrn.com/abstract=1095869>
- Lusardi, A., & Mitchell, O. S. (2008). *Planning and financial literacy: How do women fare?* National Bureau of Economic Research. Retrieved from <http://www.nber.org/papers/w13750>
- Lusardi, A. & Mitchell, O. S. (2009). *How ordinary consumers make complex economic decisions: Financial literacy and retirement readiness*. National Bureau of Economic Research. Retrieved from <http://www.nber.org.proxy.library.uu.nl/papers/w15350>
- Lusardi, A., & Mitchell, O. S. (2011). Financial literacy around the world: an overview. *Journal of Pension Economics and Finance*, 10(04), 497–508.  
<http://doi.org/10.1017/S1474747211000448>

Remund, D. L. (2010). Financial literacy explicated: The case for a clearer definition in an increasingly complex economy. *Journal of Consumer Affairs*, 44(2), 276–295. Retrieved from <http://onlinelibrary.wiley.com.proxy.library.uu.nl/doi/10.1111/j.1745-6606.2010.01169.x/full>

Van Rooij, M., Lusardi, A. & Alessie, R. (2011a). Financial literacy and stock market participation. *Journal of Financial Economics*, 101(2), 449–472. Retrieved from <http://www.sciencedirect.com/science/article/pii/S0304405X11000717>

Van Rooij, M. C., Lusardi, A. & Alessie, R. J. (2011b). Financial literacy and retirement planning in the Netherlands. *Journal of Economic Psychology*, 32(4), 593–608. Retrieved from <http://www.sciencedirect.com/science/article/pii/S0167487011000195>

## Appendix

### A. Deriving the Euler equation using stochastic dynamic programming

Here, we show in detail how to derive the Euler equation using stochastic dynamic programming. We formulate the following value function

$$V_0(A_0) = \max_{\{c_t\}} \sum_{t=1}^T \beta^{t-1} u(c_t) \quad (3)$$

Subject to the dynamic budget constraint

$$A_{t+1} = (1 + r(\varphi))A_t + y_t - c_t \quad (4)$$

Or

$$c_t = (1 + r(\varphi))A_t + y_t - A_{t+1} \quad (5)$$

where  $A_0$  is given and  $A_T = 0$ .

$A_0$ : initial wealth at the end of period  $t=0$  is equal to zero

$c_t$ : consumption in period  $t$

$\rho$ : rate of time preference

$u(c_t)$ : utility from consumption, later specified as a quadratic utility function

$r(\varphi)$ : real interest rate as a strictly increasing and concave function of the financial literacy level, constant over time.

$y$ : income level - assumed to be constant

Rewriting the maximization problem in Bellman equation form yields

$$V_t(A_t) = \max_{\{c_t\}} \{u(c_t) + \beta^{t-1} V_{t+1}(A_{t+1})\} \quad (6)$$

Or

$$V_t(A_t) = \max_{\{A_{t+1}|A_t\}} \{u((1 + r(\varphi))A_t + y_t - A_{t+1}) + \beta^{t-1} V_{t+1}(A_{t+1})\} \quad (7)$$

The first-order condition for a maximum with respect to  $A_{t+1}$  is:

$$-u'(c_t) + \beta^{t-1} \frac{\partial V_{t+1}(A_{t+1})}{\partial A_{t+1}} = 0 \quad (8)$$

Or

$$u'(c_t) = \beta^{t-1} \frac{\partial V_{t+1}(A_{t+1})}{\partial A_{t+1}} \quad (9)$$

The Envelope Theorem implies:

$$\frac{\partial V_t(A_t)}{\partial A_t} = u'(c_t)(1 + r(\varphi)). \quad (10)$$

Iterating the above equation forward one period yields:

$$\frac{\partial V_{t+1}(A_{t+1})}{\partial A_{t+1}} = u'(c_{t+1})(1 + r(\varphi)) \quad (11)$$

Combining equations (10) and (11) results in the Euler equation:

$$u'(c_t) = \frac{(1 + r(\varphi))}{(1 + \rho)} u'(c_{t+1}) \quad (12)$$

This is the result for two subsequent periods  $t$  and  $\tau = t + 1$ . If we want to expand the analysis to other values of  $\tau$ , we will arrive at

$$u'(c_t) = \left( \frac{1 + r}{1 + \rho} \right)^{\tau-t} u'(c_\tau) \quad (13)$$

In order to obtain a closed form solution for  $c_t$ , we choose quadratic preferences due to their tractability and the properties. A typical quadratic utility function is given by

$$u(c_t) = -0.5(c_t - \bar{c})^2 \quad (14)$$

And its first-order derivative with respect to consumption is:

$$u'(c_t) = -(c_t - \bar{c}) \quad (15)$$

Euler equation:

$$u'(c_t) = \left( \frac{1 + r}{1 + \rho} \right)^{\tau-t} u'(c_\tau) \quad (16)$$

$$-(c_t - \bar{c}) = -\left( \frac{1 + r}{1 + \rho} \right)^{\tau-t} (c_\tau - \bar{c}) \quad (17)$$

(18)

$$(c_t - \bar{c}) = \left(\frac{1+r}{1+\rho}\right)^{\tau-t} (c_\tau - \bar{c})$$

which is the Euler equation using quadratic preferences.

Rewriting the above equation:

$$c_\tau = \left(\frac{1+\rho}{1+r}\right)^{\tau-t} (c_t - \bar{c}) + \bar{c} \quad (19)$$

Note that if  $\tau = t + 1$  and when subtracting  $c_t$  on both sides, we obtain

$$c_{t+1} - c_t = \left(\frac{r-\rho}{1+r}\right) (\bar{c} - c_t) \quad (20)$$

We can make the following observations about the change in consumption: it depends on the level of consumption (subtracted from the bliss level) and it is positive for  $r > \rho$ . Furthermore, as the bliss level is a constant, when the consumption level increases, the change in consumption decreases. Consequently, consumption rises faster at the beginning of the life cycle (in case of an upward sloping consumption profile). Taking the partial derivative of the change in consumption with respect to the rate of return yields

$$\frac{\partial(c_{t+1} - c_t)}{\partial r} = \left(\frac{1+\rho}{(1+r)(1+r)}\right) (\bar{c} - c_t) > 0 \quad (21)$$

Hence, the steepness of the slope of equation (18) increases with  $r$ . Translating this back to the context of financial literacy implies that the highly literate households have a steeper consumption profile.

In order to obtain a closed-form solution for consumption, we need to consider the intertemporal budget constraint given by

$$\sum_{\tau=t}^L \frac{c_\tau}{(1+r)^{\tau-t}} = (1+r)A_{t-1} + \sum_{\tau=t}^L \frac{y_\tau}{(1+r)^{\tau-t}} \quad (22)$$

It can be shown by backward induction that this constraint only holds when  $A_L = 0$ . Substituting equation (17) into the budget constraint gives

$$\sum_{\tau=t}^L \frac{\left(\frac{1+\rho}{1+r}\right)^{\tau-t} (c_t - \bar{c}) + \bar{c}}{(1+r)^{\tau-t}} = (1+r)A_{t-1} + \sum_{\tau=t}^L \frac{y_\tau}{(1+r)^{\tau-t}} \quad (23)$$

Rewriting the above equation and assuming constant income over the life cycle

$$\begin{aligned}
(c_t - \bar{c}) \sum_{\tau=t}^L \left( \frac{1+\rho}{(1+r)(1+r)} \right)^{\tau-t} + \bar{c} \sum_{\tau=t}^L \frac{1}{(1+r)^{\tau-t}} \\
= (1+r)A_{t-1} + y \sum_{\tau=t}^L \frac{1}{(1+r)^{\tau-t}}
\end{aligned} \tag{24}$$

Or

$$\begin{aligned}
c_t \sum_{\tau=t}^L \left( \frac{1+\rho}{(1+r)(1+r)} \right)^{\tau-t} \\
= (1+r)A_{t-1} + y \sum_{\tau=t}^L \left( \frac{1}{1+r} \right)^{\tau-t} \\
- \bar{c} \left( \sum_{\tau=t}^L \left( \frac{1}{1+r} \right)^{\tau-t} - \sum_{\tau=t}^L \left( \frac{1+\rho}{(1+r)(1+r)} \right)^{\tau-t} \right)
\end{aligned} \tag{25}$$

We need  $r \geq \rho$ . When setting  $\rho = 0$ , we obtain

$$\begin{aligned}
c_t \sum_{\tau=t}^L \left( \frac{1}{(1+r)(1+r)} \right)^{\tau-t} \\
= (1+r)A_{t-1} + y \sum_{\tau=t}^L \left( \frac{1}{1+r} \right)^{\tau-t} \\
- \bar{c} \left( \sum_{\tau=t}^L \left( \frac{1}{1+r} \right)^{\tau-t} - \sum_{\tau=t}^L \left( \frac{1}{(1+r)(1+r)} \right)^{\tau-t} \right)
\end{aligned} \tag{26}$$

Suppose now that  $\mathbf{r} = \mathbf{0}$  (a person's return on investment is the real interest, which we set to 0).

Then, if we go back to equation (24), we get:

$$c_t \sum_{\tau=t}^L 1 = (1)A_{t-1} + y \sum_{\tau=t}^L 1 - \bar{c} \left( \sum_{\tau=t}^L 1 - \sum_{\tau=t}^L 1 \right) \tag{27}$$

Or

$$c_t = \frac{A_{t-1}}{L-t+1} + y \tag{28}$$

Note that if initial wealth is zero, consumption is equal to income for every period.

Suppose now that  $\mathbf{r} > \mathbf{0}$ . Then equation (24) becomes

$$c_t = \frac{\left( (1+r)A_{t-1} + (y - \bar{c}) \sum_{\tau=t}^L \left( \frac{1}{1+r} \right)^{\tau-t} + \bar{c} \sum_{\tau=t}^L \left( \frac{1}{(1+r)(1+r)} \right)^{\tau-t} \right)}{\sum_{\tau=t}^L \left( \frac{1}{(1+r)(1+r)} \right)^{\tau-t}} \quad (29)$$

We can rewrite equation (27) as

$$c_t = \frac{(1+r)}{\sum_{\tau=t}^L \left( \frac{1}{(1+r)(1+r)} \right)^{\tau-t}} A_{t-1} + y \frac{\sum_{\tau=t}^L \left( \frac{1}{1+r} \right)^{\tau-t}}{\sum_{\tau=t}^L \left( \frac{1}{(1+r)(1+r)} \right)^{\tau-t}} + \bar{c} \left( 1 - \frac{\sum_{\tau=t}^L \left( \frac{1}{1+r} \right)^{\tau-t}}{\sum_{\tau=t}^L \left( \frac{1}{(1+r)(1+r)} \right)^{\tau-t}} \right) \quad (30)$$

The above equation demonstrates that consumption depends on the financial literacy level which enters through the rate of return, assets, income and the bliss level. As in our paper, we are mainly interested in the relationship between the rate of return and consumption, it is more insightful to simulate equation (28) and to plot aggregate consumption against the rate of return.

To make simulations easier, we can evaluate the summations in equation (27):

$$\sum_{\tau=t}^L \left( \frac{1}{1+r} \right)^{\tau-t} = \frac{1 - \left( \frac{1}{1+r} \right)^{L-t+1}}{1 - \left( \frac{1}{1+r} \right)} = \frac{1 - \left( \frac{1}{1+r} \right)^{L-t} + r}{r}$$

and

$$\sum_{\tau=t}^L \left( \frac{1}{(1+r)(1+r)} \right)^{\tau-t} = \frac{1 - \left( \frac{1}{(1+r)(1+r)} \right)^{L-t+1}}{1 - \left( \frac{1}{(1+r)(1+r)} \right)}$$



## B. Summary statistics all variables for singles and couples

<b>Singles</b>		<b>women</b>		<b>men</b>	
<i>household level</i>	<i>Variable</i>	<i>mean</i>	<i>sd</i>	<i>mean</i>	<i>sd</i>
	Household consumption	1275,35	510	1515,73	626,32
	adj Household consumption	1226,89	504,77	1441,84	599,64
	$\Delta$ log HH consumption	0,02	0,27	0,01	0,29
	$\Delta$ log adj. HH consumption	0,02	0,27	0,02	0,29
	Investment dummy	0,16	0,37	0,26	0,44
	1st quintile assets	1284,327	478,996	1727,120	631,620
	2nd quintile assets	2942,362	13617,109	1995,789	968,999
	3rd quintile assets	1487,493	606,625	1911,475	914,198
	4th quintile assets	1829,523	699,103	2164,671	891,636
	5th quintile assets	1958,504	859,848	2521,765	986,197
	1st quintile income	781,027	194,140	719,625	250,587
	2nd quintile income	1148,705	105,526	1170,680	95,498
	3rd quintile income	1583,569	140,241	1587,210	120,408
	4th quintile income	1985,297	139,397	1998,677	139,367
	5th quintile income	4747,067	14393,102	3076,594	887,467
<i>individual level</i>					
	Score on Q1 and Q2 (out of 2)	1,64	0,56	1,81	0,48
	Score on Q3 and Q4 (out of 2)	0,42	0,61	0,89	0,8
	Low education dummy	0,389	0,488	0,365	0,482
	Medium education dummy	0,236	0,425	0,300	0,459
	High education dummy	0,375	0,485	0,335	0,473
	Age	58,906	14,650	57,190	13,397
	<b>n</b>	<b>360</b>		<b>310</b>	
<b>Couples</b>		<b>women</b>		<b>men</b>	
<i>household level</i>	<i>Variable</i>	<i>mean</i>	<i>sd</i>	<i>mean</i>	<i>sd</i>
	Household consumption	1943,58	796,44	1943,58	796,44
	adj Household consumption	1238,31	475,35	1238,31	475,35
	$\Delta$ HH consumption	0,03	0,36	0,03	0,36
	$\Delta$ adj. HH consumption	0,03	0,36	0,03	0,36
	Investment dummy	0,05	0,23	0,05	0,23
	1st quintile assets	2256,190	875,252	2256,190	875,252
	2nd quintile assets	2532,114	876,907	2532,114	876,907
	3rd quintile assets	2967,178	966,456	2967,178	966,456
	4th quintile assets	2870,898	946,502	2870,898	946,502
	5th quintile assets	3332,349	1323,891	3332,349	1323,891
	1st quintile income	1493,696	241,425	1493,696	241,425
	2nd quintile income	2155,846	200,358	2155,846	200,358
	3rd quintile income	2755,548	152,881	2755,548	152,881

	4th quintile income	3352,280	244,634	3352,280	244,634
	5th quintile income	4650,182	654,391	4650,182	654,391
<i>individual level</i>					
	Low education dummy	0,504	0,501	0,331	0,471
	Medium education dummy	0,230	0,422	0,302	0,460
	High education dummy	0,266	0,443	0,367	0,483
	Age	57,993	12,436	60,723	12,438
	Score on Q1 and Q2 (out of 2)	1,71	0,51	1,88	0,38
	Score on Q3 and Q4 (out of 2)	0,53	0,66	0,88	0,76
	<b>n</b>	<b>278</b>		<b>278</b>	

### C. Questions on financial literacy

Financial literacy questions included in LISS panel

#### **Question on interest compounding**

Suppose you have 100 euros on a savings account and the interest is 2% per year.

How much do you think you will have on the savings account after five years, assuming that you leave all your money on this savings account: more than 102 euros, exactly 102 euros, less than 102 euros?

- 1 more than 102 euros
- 2 exactly 102 euros
- 3 less than 102 euros
- 4 I don't know
- 5 I would rather not say

#### **Question on inflation**

Suppose that the interest on your savings account is 1% per year and that inflation amounts to 2% per year. After 1 year, would you be able to buy more, exactly the same, or less than you could today with the money on that account?

- 1 more than today
- 2 exactly the same as today
- 3 less than today
- 4 I don't know
- 5 I would rather not say

#### **Question on risk diversification**

A share in a company usually offers a more certain return than an investment fund that only invests in shares.

- 1 true
- 2 not true
- 3 I don't know
- 4 I would rather not say

#### **Question on relation between bond prices and interest rate**

If the interest rate goes up, what should happen to bond prices?

- 1 they should increase
- 2 they should decrease
- 3 they should stay the same
- 4 none of the above
- 5 I don't know
- 6 I would rather not say

## D. Questions on household consumption

### Single households

#### bf12c066- bf12c077

Can you indicate for each type of expenditure how many euros your household spends on this on average, **per month**?

-Consider as reference period the past 12 months.

-If you do not have any expenditure in a particular category, please enter 0.

-If you don't know exactly how much, please give the best possible estimate.

- You can enter here whole numbers only.

How many euros does your household spend on average each month on:

	euro	I really don't know
<b>mortgage:</b> interest plus amortization (what matters is the gross amount, so before tax deduction)	<b>bf12c066</b>	<input type="checkbox"/>
<b>rent</b> (NOT including costs of gas and electricity)	<b>bf12c067</b>	<input type="checkbox"/>
<b>general utilities</b> (heating, electricity, water, telephone, Internet, etc; but NO insurances)	<b>bf12c068</b>	<input type="checkbox"/>
<b>transport and means of transport</b> (public transport; own car: gasoline/diesel and maintenance, but NOT insurances or the purchase of e.g. a car or [motor] bike)	<b>bf12c069</b>	<input type="checkbox"/>
<b>insurances</b> (home insurance, car insurance, health insurance, etc.)	<b>bf12c070</b>	<input type="checkbox"/>
<b>children's daycare</b> (day care center, out-of-school supervision, guest parents, homework guidance, etc.)	<b>bf12c071</b>	<input type="checkbox"/>
<b>alimony and financial support for children not (or no longer) living at home</b>	<b>bf12c072</b>	<input type="checkbox"/>
<b>debts and loans</b> (but NOT the mortgage)	<b>bf12c073</b>	<input type="checkbox"/>
<b>daytrips and holidays with the whole family or part of the family</b> (flight tickets, hotel, restaurant bills for the family, etc.)	<b>bf12c074</b>	<input type="checkbox"/>
<b>expenditure on cleaning the house or maintaining the garden</b>	<b>bf12c075</b>	<input type="checkbox"/>
<b>eating at home</b> (food, drinks, candy, etc.)	<b>bf12c076</b>	<input type="checkbox"/>
<b>other household expenditure</b> (but no expenditure meant only for yourself or another specific person in your household)	<b>bf12c077</b>	<input type="checkbox"/>

-999999 = I really don't know

#### bf12c078

Total amount of money spent per month based on the variables bf09a066 to bf09a077

## Households with multiple members

### **bf12c079 - bf12c089**

Can you indicate for each type of expenditure how many euros your household spends on this **on average, per month?**

-Consider as reference period the past 12 months.

-If you do not have any expenditure in a particular category, please enter 0.

-If you don't know exactly how much, please give the best possible estimate.

-You can enter here whole numbers only.

How many euros does your household spend on average each month on:

	euro
<b>mortgage:</b> interest plus amortization (what matters is the gross amount, so before tax deduction)	<b>bf12c079</b>
<b>rent</b> (NOT including costs of gas and electricity)	<b>bf12c080</b>
<b>general utilities</b> (heating, electricity, water, telephone, Internet, etc; but NO insurances)	<b>bf12c081</b>
<b>transport and means of transport</b> (public transport; own car: gasoline/diesel and maintenance, but NOT insurances or the purchase of e.g. a car or [motor] bike)	<b>bf12c082</b>
<b>insurances</b> (home insurance, car insurance, health insurance, etc.)	<b>bf12c083</b>
<b>alimony and financial support for children not (or no longer) living at home</b>	<b>bf12c085</b>
<b>debts and loans</b> (but NOT the mortgage)	<b>bf12c086</b>
<b>expenditure on cleaning the house or maintaining the garden</b>	<b>bf12c087</b>
<b>eating at home</b> (food, drinks, candy, etc.)	<b>bf12c088</b>
<b>other household expenditure</b>	<b>bf12c089</b>

### **bf12c090**

Total amount of money spent per month based on variables bf12c079 to bf12c089

## **E. Questions on Savings Accounts/Investments**

### **Assets/Investments**

On 31 December 2009<sup>4</sup>, did you possess one or more of the following assets?

You can checkmark the boxes that apply to you. More than one answer is permitted.

### **ca08a006**

Investments (growth funds, share funds, bonds, debentures, stocks, options,

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<sup>4</sup> If wave is from 2010 for instance.

warrants, and so on

**ca08a004**

Current accounts, savings accounts, term deposit accounts, savings bonds or savings certificates (in wave 1) – not yet included in regressions

**ca08a078**

Current accounts, savings accounts, term deposit accounts, savings bonds or savings certificates (in waves 2 and 3)

Note: bank saving schemes were added (banksparen)

*if ca14d078=1*

**ca14d012**

What was the total balance of your banking account or giro (current accounts), savings accounts, term deposit accounts, savings bonds or savings certificates and bank savings schemes on 31 December 2013? In case of a negative balance, please add a minus sign before the amount.

Please enter whole numbers (whole Euros) only, so without decimal points or commas.

-.999999999..999999999 Euro

99999999998 I prefer not to say

99999999999 I don't know

**Household income**

**nettohh\_f**

Net household income in Euros

*Imputed monthly income (nettoink\_f) of all household members combined.*

**nettoink\_f**

Personal net monthly income in Euros, imputed.

*Estimate based on bruttoink if net income not entered. For more information see on the LISS website: 'Imputation income LISS until sept 2011.pdf', Klaas de Vos, 2008. From September 2011 see file: 'imputation income LISS from sept 2011.pdf', Klaas de Vos, 2011.*

**F. Full versions of regression tables**

Investment and financial literacy – probit, raw coefficients with all covariates

**Investment - probit estimations**

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	(1)	(2)	(3)	(4)	(5)	(6)
				with		
				covariates		
				(with		
				income)		
VARIABLES	singles F	singles M	couples	singles F	singles M	couples

Women's Score on Q1 and Q2	0.247 (0.237)		0.433 (0.499)	0.277 (0.257)		1.055 (0.808)
Women's Score on Q3 and Q4	0.566*** (0.203)		0.329 (0.350)	0.615*** (0.208)		0.494 (0.456)
log_age_f	0.491 (0.441)		1.084 (3.301)	0.548 (0.509)		3.829 (3.913)
Low education dummy women	0.542 (0.411)		0.366 (0.802)	0.509 (0.472)		0.833 (1.050)
High education dummy women	0.912** (0.387)		0.552 (0.520)	0.803* (0.423)		1.010 (0.850)
d_pc_assets_s1	-0.283 (0.541)	-0.744** (0.364)		-0.352 (0.559)	-0.813** (0.371)	
d_pc_assets_s2	0.0772 (0.367)	-0.389 (0.298)		0.0114 (0.387)	-0.442 (0.307)	
d_pc_assets_s4	0.945*** (0.344)	0.208 (0.295)		1.008*** (0.359)	0.203 (0.298)	
d_pc_assets_s5	0.930*** (0.330)	0.479 (0.322)		1.071*** (0.344)	0.461 (0.317)	
log_aantalhh = o,	-			-		
t_cons	-0.174 (0.109)	-0.0153 (0.0712)	-0.112 (0.111)	-0.200* (0.120)	-0.0214 (0.0748)	0.0244 (0.187)
Men's Score on Q1 and Q2		0.311 (0.317)			0.329 (0.327)	
Men's Score on Q3 and Q4		0.663*** (0.160)	-0.0773 (0.376)		0.679*** (0.164)	-0.0654 (0.436)
log_age_m		0.106 (0.462)	0.319 (2.975)		-0.0511 (0.487)	-2.176 (3.884)
Low education dummy men		0.135 (0.346)	4.699*** (0.926)		0.143 (0.361)	6.645*** (1.380)
High education dummy men		0.192 (0.282)	4.950*** (0.988)		0.144 (0.300)	6.349*** (1.823)
log_aantalhh		0.214 (0.420)	1.763** (0.700)		0.170 (0.425)	3.199*** (0.816)
Men's Score on Q1 and Q2 = o,			-			-
pc_assets_c== 1.0000 = o,			-			-
pc_assets_c== 2.0000 = o,			-			-
pc_assets_c== 4.0000			0.844* (0.467)			2.813*** (0.847)
pc_assets_c== 5.0000			1.490*** (0.547)			2.759*** (0.918)
gender household head			-1.138 (0.857)			-1.452 (1.110)
d_pc_income_s1				0.327 (0.410)		
d_pc_income_s2				-1.032** (0.418)	0.230 (0.347)	
d_pc_income_s4				-0.833* (0.443)	0.404 (0.306)	
d_pc_income_s5				0.0589	0.227	

o.d_pc_income_s1				(0.346)	(0.307)	-
pc_income_c== 1.0000 = o,						-
pc_income_c== 2.0000						0.0135 (0.403)
pc_income_c== 4.0000 = o,						-
pc_income_c== 5.0000						1.930*** (0.644)
Constant	-4.402** (1.942)	-2.470 (1.825)	-14.26** (5.577)	-4.486** (2.194)	-2.033 (1.944)	-21.99*** (6.441)
Observations	321	310	165	321	302	116

Robust standard errors in parentheses  
\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

### Consumption level and financial literacy – pooled OLS, raw coefficients

#### Pooled OLS Estimations of closed form solution for consumption

VARIABLES	(1) with covariates - no income singles F	(2) singles M	(3) couples	(4) age*FL with covariates single females	(5) single males	(6) couples
Women's Score on Q1 and Q2 = 1	43.49 (189.7)		-223.5* (133.2)	3,653 (2,383)		3,263 (1,978)
Women's Score on Q1 and Q2 = 2	49.96 (185.6)		-233.1* (129.6)	1,791 (2,393)		1,876 (2,070)
Women's Score on Q3 and Q4 = 1	72.63 (81.87)		-85.47 (79.74)	-988.1 (1,444)		218.2 (1,275)
Women's Score on Q3 and Q4 = 2	-173.8* (103.7)		-89.52 (142.9)	-1,949 (1,338)		-1,910 (2,074)
Men's Score on Q1 and Q2 = 1		241.4 (148.7)	206.3 (199.2)		1,037 (3,306)	-10,368** (4,868)
Men's Score on Q1 and Q2 = 2		316.7** (138.0)	497.1*** (165.1)		1,438 (3,329)	-9,562** (4,673)
Men's Score on Q3 and Q4 = 1		119.3 (113.8)	136.3* (72.18)		1,344 (1,417)	278.8 (1,323)
Men's Score on Q3 and Q4 = 2		106.7 (113.8)	159.9 (100.6)		2,329 (1,652)	302.7 (1,619)
log_age_f	-95.26 (189.0)		-865.8** (407.2)	240.2 (560.5)		-260.8 (476.7)
log_age_m		104.0	367.2		602.5	-2,130*



		(158.4)	(414.8)		(805.8)	(1,122)
Low education dummy women	-114.1		14.06	-97.99		19.58
	(79.49)		(119.8)	(80.15)		(126.7)
High education dummy women	27.48		160.0	31.75		172.9
	(89.96)		(99.51)	(91.56)		(111.2)
Low education dummy men		-153.4	18.20		-161.9	7.000
		(135.6)	(76.86)		(138.3)	(79.65)
High education dummy men		131.0	241.8**		123.5	233.0**
		(119.0)	(97.94)		(120.6)	(103.9)
pc_assets_c== 1.0000			-225.6***			-216.3**
			(82.71)			(96.63)
pc_assets_c== 2.0000			-171.7*			-176.0*
			(100.6)			(104.6)
pc_assets_c== 4.0000			-120.3			-130.0
			(78.47)			(79.58)
pc_assets_c== 5.0000			-43.07			-57.17
			(129.8)			(138.5)
log_aantalhh	-423.1***	-371.0***	-429.7***	-431.7***	-360.8***	-429.4***
	(95.94)	(82.48)	(103.2)	(102.6)	(81.53)	(106.5)
gender household head			47.50			57.89
			(102.8)			(107.6)
t_cons	24.02	12.41	46.24	26.11	12.40	48.78
	(24.32)	(38.57)	(32.98)	(24.46)	(38.96)	(33.99)
d_pc_assets_s1	-8.124	22.86		0.654	19.98	
	(90.32)	(132.4)		(85.18)	(136.7)	
d_pc_assets_s2	-105.1	124.5		-100.00	149.4	
	(73.57)	(109.9)		(72.02)	(115.3)	
d_pc_assets_s4	124.5	-34.03		130.6	-40.45	
	(99.54)	(113.7)		(98.95)	(116.5)	
d_pc_assets_s5	133.3	-8.106		139.1	5.879	
	(103.3)	(139.1)		(107.0)	(142.8)	
0b.int_infl_f#co.log_age_f				0		0
				(0)		(0)
1.int_infl_f#c.log_age_f				-885.3		-877.4*
				(587.3)		(501.2)
2.int_infl_f#c.log_age_f				-423.5		-541.9
				(591.3)		(534.3)
0b.risk_bonds_f#co.log_age_f				0		0
				(0)		(0)
1.risk_bonds_f#c.log_age_f				264.4		-77.81
				(354.7)		(321.6)
2.risk_bonds_f#c.log_age_f				442.8		459.1
				(329.0)		(543.5)
0b.int_infl_m#co.log_age_m					0	0
					(0)	(0)
1.int_infl_m#c.log_age_m					-197.1	2,584**
					(830.8)	(1,193)
2.int_infl_m#c.log_age_m					-281.1	2,463**
					(830.6)	(1,146)
0b.risk_bonds_m#co.log_age_m					0	0
					(0)	(0)
1.risk_bonds_m#c.log_age_m					-304.2	-39.15
					(356.3)	(322.0)
2.risk_bonds_m#c.log_age_m					-549.7	-45.53

Constant	1,529*	659.0	3,116***	135.0	(408.7)	(406.3)
	(798.9)	(635.1)	(776.4)	(2,277)	-1,348	10,958***
					(3,242)	(3,646)
Observations	360	310	278	360	310	278
R-squared	0.133	0.122	0.303	0.155	0.130	0.316

Robust standard errors in parentheses

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

## Consumption growth and financial literacy – pooled OLS, all covariates

### Estimations Euler equation

VARIABLES	(1)	(2)	(3)
	coeff single females	coeff single males	coeff couples
Women's Score on Q1 and Q2	0.00951 (0.0371)		0.0743 (0.0679)
Women's Score on Q3 and Q4	-0.0241 (0.0361)		-0.0800* (0.0469)
Men's Score on Q1 and Q2		-0.00621 (0.0532)	-0.174 (0.146)
Men's Score on Q3 and Q4		0.0352 (0.0316)	0.00674 (0.0444)
log_age_f	-0.170** (0.0772)		0.798* (0.413)
log_age_m		-0.139 (0.0927)	-0.929** (0.428)
Low education dummy women	-0.0362 (0.0550)		-0.0169 (0.0948)
High education dummy women	-0.0687 (0.0542)		0.0144 (0.106)
Low education dummy men		0.0449 (0.0630)	0.00777 (0.0838)
High education dummy men		0.0903 (0.0605)	0.170** (0.0835)
log_aantalhh	0.0496 (0.0762)	-0.0138 (0.0804)	-0.0738 (0.101)
gender household head			0.0633 (0.104)
Constant	0.742** (0.323)	0.518 (0.384)	0.791 (0.725)
Observations	180	155	139
R-squared	0.044	0.043	0.115

Standard errors in parentheses

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1