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Factors Influencing Annuity Demands

An Empirical Study Based on the Netherlands

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--- an Empirical Study Based on the Netherlands"

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Abstract

Since people are expected to live longer which means they will have a longer retirement period, how to protect retirees from poverty has become an important public issue discussed widely. Annuity is such an insurance policy that pays their beneficiaries as long as beneficiaries are alive. It is playing an increasingly important role in retiree's retirement arrangement, especially under the trend of pension reform in the first and second pillar. So it is urgent to understand the determinants of annuity demands. This paper uses Dutch Household Survey data to investigate the factors influencing people's decisions to purchase annuities. We find strong impacts of gender, health, longevity expectation, wealth and corporate pension coverage on annuitization decisions. However, the influences of bequest motive, discount rate, risk averse and financial literacy is not as significant as expected.

Keywords: longevity risk; annuitization decisions; retirement

Contents

1 Introduction

1.1 Introduction to Annuities

How to manage the retirement wealth and insure the retiree's welfare is one of the most widely discussed financial issues. The optimal form of payout, annuities or lump sum, has been investigated ever since Yaari (1965) suggested full annuitization over 40 years ago. An annuity is a financial product that promises to pay out a certain stream of payments each time period until the policy holder dies. It can provide income insurance after retirement in case individuals live out of their wealth due to unexpected longevity. There are several reasons to annuitize individual's financial assets. First, annuitization can satisfy individual's consumption smoothing demands ensuring a responsible and sustainable stream of payment. Second, investing in annuity products could diversify the risks of other investments yielding badly. Third, some deferred annuity can enjoy tax advantages. Last but not least, annuity products can shift individual longevity risk to the insurance company where they can diversify the risk by a large pool. The individual longevity uncertainty comes from both sides: on the one hand, if they live longer than expected, they probably do not save enough to finance unexpected period; on the other hand, if they live shorter than anticipated, there would be a waste of resources. In neither case the individual welfare is optimized. There is a well-established theory suggesting that risk averse individuals with inter-temporally separable utility should annuitize a significant part of their wealth to get rid of longevity uncertainty (Yaari 1965, Davidoff, Brown and Diamond 2005). It can increase individual welfare because it eliminates financial risks associated with uncertain lifetimes and provides consumers with a higher level of lifetime consumption (Brown and Nijman, 2010).

However, the annuitization rate in reality is not as high as expected. Many researchers have devoted to investigate why many people don't annuitize any of their wealth in the real financial market even if the return of annuity products is higher than other investments such as bonds and stocks. Proposed explainations for the so-called "Annuity Puzzle" include high price of annuity products, intra-family risk sharing, pre-annuitized wealth, bequest motive, and high discount rates. Despite the fact that the private sector is increasingly involved in providing retirement insurance, private annuity markets are still very thin, and very little is known about annuity demand and its determinants. As far as we know, Hurd, Lillard and Panis (1998) are the first who analyze the annuitization decisions in the US. Three years later, Brown (2001) carried out a similar study correlating annuity decisions with a life-cycle model using Health and Retirement Survey (HRS) data in the US. Then researchers did similar studies based on different countries: Gardner and Wadsworth (2004) and Inkmann, Lopes and

Amichaelides (2010) did their analysis based on the UK where the people are mandated to annuitize their wealth in the second pillar at the age of 75; Butler and Teppa (2007) use Swiss employer-based pension administrative records to study the determinants of annuitization decisions. A recent result is provided by Cappelletti, Guazzarotti and Tommasino (2011) who use a survey data designed in accordance to the HRS to study Italian people's choice between annuities and lump sum. To the best of our knowledge, there is no empirical study based on the Netherlands. But the pension scheme in the Netherlands is different from that in other countries. It is meaningful to examine what are the factors Dutch people would consider when they choose between annuities and lump sum payouts.

Although the "annuity puzzle" phenomenon in the Netherlands is not as severe as the situation in the US due to the generous pre-annuitized wealth provided by the first and second pillar, it is still of great priority to discover the factors influencing people's annuitization decisions since the annuity is expected to be one of the crucial insurances linked with retirees' welfare. Just as citizens in most developed countries, Dutch retirees are relying less on the Social Security (AOW) and Corporate Pension system under the impact of financial crisis and current trend of pension reform. It means that retirees will have more freedom to manage their retirement wealth and individual longevity risk. Therefore, to find out the potential determinants of annuitization decisions will contribute a lot to the future development of the private annuity markets in the Netherlands.

This paper contributes to the existing empirical literature in the following aspects. Firstly, we use the real purchase of private annuity products rather than subjectively reported annuitization intentions revealed by hypothetical choice between annuity and lump sum done by previous studies (Brown et al, 2001, 2007, Gardner and Wadsworth 2004, Cappelletti et al. 2011). Secondly, following individuals through seven waves provides us with a large number of observations and allows us to control for unobserved heterogeneity. Thirdly, the target observations are those aged over 16 rather than people near their retirement age. Since people can purchase private annuity products at any period of life, it's more realistic to investigate all the people aged 16 and over. Fourthly, it also takes into account the effect of pre-annuitized wealth by including the presence of a corporate pension in the model. Besides it uses information about respondents' self-assessments about their longevity probabilities rather than merely health status, which makes the prediction about the existence of adverse selection more accurate. Finally, we distinguish different bequest motives to examine their effects on the annuitization decision. One limitation of using the DNB survey is that it lacks information about the prices of annuity products which make it difficult to measure the role of annuity

actuarial fairness.

1.2 Structure of the Thesis

The main aim of this paper is to investigate the factors influencing people's annuitization decision, especially focusing on the role of the bequest motive, financial plan time-horizon and risk attitude. This paper exploits the unique data set of Dutch households with seven waves following around 2000 households. This paper proceeds as follows. In section 2, we briefly introduce the Dutch pension system, and use the relevant literature to motivate the hypotheses we examine in this paper. The data are presented and discussed in Section 3. Section 4 reports the empirical results, and Section 5 concludes.

2. Literature Review and Hypothesis

2.1 Background information on Dutch Pension System

Dutch pension system consists of three pillars. The first pillar state pension (AOW) is a Pay-as-you-go system providing a basic flat-rate pension to all retirees. Everyone aged 65 and above can receive AOW benefits as long as they lived in the Netherlands for 50 years. Traditional second pillar pension rights are related to the income and working years. All the employees in the Netherlands are mandated to participate in a DB pension plan which can be treated as a periodical annuity-like scheme and the second pillar pension incomes are generally not allowed to be taken out in the form of lump sum. The Dutch pension-fund system covers more than 90% of the labor force (Ponds and Riel, 2007). Unlike the first and second pillar, the third pillar is an optional supplementary private pension pillar which leaves individuals to manage their personal savings at their own expenses. Individual pension saving plan provides a lump sum benefit that the policy holder then uses to purchase an annuity on the open market. Just like the annuity markets in other countries, the Dutch annuity market is relatively small. The total market size of single premium annuities is estimated to be just over Eur10.4 billion (Cardinale, Findlater and Orszag, 2002).

Compared to the situation in the US whose average replacement rate provided by Social Security is only 40%, the replacement rate in the Netherlands is relatively high. The first and second pillars of Dutch pension system provide the active worker with approximately 68% replacement rates (Brown and Nijman, 2011). Due to this fact, Brown and Nijman (2011) believe that many Dutch citizens are over-annuitized which can't provide financial flexibility when there occur unexpected shocks such as health shock after retirement. Their study suggests that the welfare of citizens in the Netherlands might be improved by reducing the

level of mandatory annuitization.

However, just as all the other European countries, the first pillar PAYG based system is facing foreseeable problems: a diminishing working young population to support increasingly more retirees. According to the data released by the World Bank, the age dependency ratio has been raised from 14.8% in 1960 to 22.3% in 2009. Meanwhile, the funded collective second pillar in the Netherlands also encounter falling funding ratio thus solvency problems under the attack of the financial crisis and new accounting rules. Besides, for the pension provision, there has been a trend of shifting from Defined Benefit (DB) to Defined Contribution (DC) around the world recently (especially UK and US). Netherlands is also undergoing a transferring from traditional average pay DB schemes to Collective Defined Contribution (CDC) even individual DC schemes. These changes indicate that retirees in the Netherlands have to face more risks in their pensions and their pre-annuitized part of wealth is expected to decrease. These foreseeable changes in the first and second pillars should raise public's attention to the importance of the third pillar and annuities. The annuitization decision is increasingly crucial for Dutch citizen's financial plan after retirement.

2.2 Possible determinants of annuitization decisions

This section briefly summarizes the potential determinants preventing people from choosing annuities investigated by previous literatures. At the same we propose hypotheses about the impacts of age, gender, health status, education, risk attitude, bequest motive and financial literacy on annuitization probability. These hypotheses will then be examined by the empirical analyses in the following section.

High price of annuities and liquidity constraints

Due to the essence of annuity product which promises to pay a stream of money until the beneficiary dies at exchange of a lump sum, the prices of annuities are relatively higher than other investment products. Many retirees have shied away from annuities because annuities' prices were perceived to be "too expensive". Besides, the nature of irreversibility implies that annuities cannot be sold or borrowed against if liquidity is needed. As poor people are more likely to incur a binding liquidity constraint after retirement, annuity products are not so attractive to them. Empirical findings have already proved that the annuitization probability is positively correlated with income (Hurd et al. 1998, Jonathan et al.2004, Butler 2007, Cappelletti 2011, Inkmann, Lopes and Michaelides 2010). So we expect that Dutch people's annuitization probability increases with their income.

Hypothesis 1: Rich people have a higher tendency to own annuity products.

Asymmetric information and adverse selection

The high price of an annuity product is not only due to the characteristics of the contract itself, but also due to adverse selection, high administrative costs and high profit margins of the insurance company. Brown and Nijman (2011) believe that although administrative and selection costs are quit low in Dutch first and second pillar, the costs are substantially larger in the third pillar which makes annuity products too expensive. Due to asymmetric information about individual health status, adverse selection can increase the price of annuity products by as much as 10 percent which will attenuate the attractiveness of annuities even more (Friedman and Warshawsky 1990, Mitchell et al.1999). Not only the raise of price caused by adverse selection would make annuities less attractive, but adverse selection itself contributes to low annuity participation rate. Many empirical studies based on different countries prove that people in good health status with high life expectancy would be more likely to annuitize their wealth (Hurd et.al 1998, Brown 2001, Gardner and Wadsworth 2004, Inkman et al. 2010, Cappelletti 2011). But Teppa (2011) also find an interesting phenomenon that people would lower their life expectation when they are making choices among annuities and a lump sum. So it is meaningful to examine whether there is an adverse selection phenomenon in the private annuity market.

Hypothesis 2: Healthy people with high life expectancy are more likely to annuitize their wealth.

Insurance provided by social security, DB plan and family

Some people believe that insurance provided by social security and other annuity-like pension scheme could provide sufficient annuity-like insurance (Dushi and Webb, 2004). Besides, due to moral hazard, adverse selection problem, transactions costs and deception in private annuity markets, people prefer to share the longevity risk in families. Moreover, within marriages and families, a degree of trust, information and love can assist the enforcement of risk sharing contract which cannot be achieved by private annuity products (Kotlikoff and Spivak 1981). Many empirical results support the view that married couples are less likely to annuitize than single individuals since couples can share risks each other (Brown 2001, Butler 2007). Brown (2001) also finds that people with high pre-annuitized wealth are less likely to buy annuities. Apart from marital status, Gardner and Wadsworth (2004) find that household size is negatively linked with the willingness to annuitize.

However, although Social Security could guarantee minimum living standard after retirement, it could not fully explain why rich people do not annuitize their wealth since rich people have higher consumption level while social security provide almost the same insurance to everyone. As to the intra-family risk pooling, obviously insurance companies have a larger size of pool and higher rate of return. Besides, both studies conducted in Italy and Swiss (Cappelletti et al. 2011, Butler, 2007) indicate that the presence of children do not affect people's annuitization decision significantly. The marital effect is also not significant in the Italian sample. Here, we suppose that:

Hypothesis 3: Married couples with more children have lower probability to annuitize.

Hypothesis 4: Existence of corporate pension would lower the possibility of buying private annuity contracts.

Risk aversion

In reality, individuals should balance the risk of consuming too aggressively and the risk of consuming too conservatively. So people's attitudes towards risks are closely related to the annuitization decisions. Generally risk averse people will benefit more from annuitization since annuities could provide insurance for individual longevity risk, in other words, annuities could hedge the risks of outliving retirement wealth when individual lives longer than expected. Women and elder people are often more risk averse than men and the young, so many researches assume that women and elder people are more likely to annuitize their wealth. Previtero (2008) found evidence proving this hypothesis, but the empirical results based on the Switzerland and Italy are the opposite (Butler 2007, Cappelletti et al. 2011). Recent behavioral studies find that people might fail to integrate annuity with other retirement insurance. They frame it as a risky gamble where potential losses loom larger than potential gains (Hu and Scott, 2007). If this is the case, more risk averse individuals are less likely to buy annuities. Besides, Gazzle and Walker (2009) actually find evidences that retirees effectively overweight the early death risk relative to the later longevity risk. So the impact of risk averse on annuitization deserves investigation.

Hypothesis 5: Women and elder people are more likely to own annuities.

Hypothesis 6: More risk averse people would buy annuities to hedge individual longevity risks.

Bequest motive

The role of the bequest motive is controversial in the academic literature. Yaari (1965) claims that a risk-averse individual without a bequest motive can get a higher rate of return from annuity products compared to ordinary bonds because apart from the interest rate, he can also benefit from the mortality premium if he lives longer than other people in the same pool. Since then many researchers believe that the bequest motive is the dominant determinant preventing people from annuitization. Lockwood's (2010) simulation results suggest that many people would not annuitize any wealth at available rates even if there were no reason other than bequest motives not to annuitize. Inkmann, Lopes and Michaelides (2011) also find evidence that annuitization decreases with the increase of bequest motive by using UK data. However, Davidoff et al. (2005) prove that even in the presence of the bequest motive, which makes full annuitization suboptimal, positive partial annuitization remains optimal in the incomplete annuity markets and with liquidity constraints. So it seems that bequest motive could not fully explain why the annuity participation rate is so low. At the same time, in some empirical studies, such as Hurd (1989), Brown (2001, 2008) and Cappelletti et al. (2011), little evidence of bequest motive's impact on annuitization intention was found when they use the marital status and the presence of children as an indicator of the bequest motive. So we propose Hypotheses 7 and 8 to examine whether bequest motive will lower the attractiveness of annuity products to the Dutch citizens.

Hypothesis 7: single people without children have higher tendency to annuitize their wealth.

Hypothesis 8: annuity products are less attractive to couples with strong bequest motive.

Financial literacy

Because of the complexity of annuity products, it requires annuitants have a basic level of financial literacy. They have to consider not only their future consumption and portfolio investments but also their longevity risk (Agnew and Szykman, 2010). But in practice, many households are unfamiliar with even the most basic economic concepts needed to make sensible saving and investment decisions (Lusardi and Mitchell 2007). Evidences show that annuity market participation increases with education and financial literacy (Mottola and Utkus 2007, Agnew, Anderson, Gerlach, and Szykman 2008, Inkmann et al. 2011). However, another possibility is that less financial knowledgeable individuals tend to follow financial

advisors' suggestions and choose less complicated products while high literate individual may over estimate their investment ability, and the existence of familiarity bias would induce them to over invest in stocks and bonds they are familiar with. So it is really interesting to investigate whether annuitization rate increases with the financial knowledge.

Hypothesis 9: Better educated people with high financial literacy are more likely to prefer annuities to lump sum.

3. Research methodology

The purpose of this thesis is to investigate the determinants that influence people's choice to buy annuities. The dependent variable "annuity demand" is a discrete binary variable with value 1 representing annuity purchases and 0 otherwise. We use a logit model with panel data consisting of 7 waves. The logit model is a non-linear probability model estimated by maximum likelihood. This model estimates the probability of dependent variable to be 1. After doing the Hausman Test, we decided to use a random effects logit model. In order to examine effects of different factors such as bequest motive and risk attitude on the annuitization decision, we set a baseline model including basic individual characteristics and then add bequest motive, longevity expectation, financial literacy and risk attitude to the baseline model step by step[1].

3.1 Dataset

The DNB data is collected for the purpose of studying the economic and psychological determinants of saving behavior of households. It collects economic data through a panel that consists of some two thousand households since 1993. Within each household, all persons aged 16 or over were interviewed. The questions about the annuity purchase and pension plans changed a lot in 2004 compared with previous years, so we only use the data from 2004 to 2010 for the sake of consistency. We restrict our sample in several ways. First, we only use observations providing annuity purchase information. Second, we rule out observations without information about education, income, health, corporate pension, partnership and number of children. Then, we exclude observations without information about bequest motive, financial literacy, longevity expectation, financial plan horizon and risk attitude gradually.

3.2 Descriptive Statistics

Although there are 14147 observations merged from seven waves of survey, not all the

[1] The detailed models could be found in Appendix 1.

respondents answered all the questions, especially for the questions linking annuity decision, pension arrangement and wealth. The final dataset of the baseline model consists of 8362 observations. Figure 1 presents the changes of annnuitization rate over year. Although the annuitization rate is always low at the level around 20%, there is a relatively large drop in year 2007 with a tendency to drop afterwards.[2]

Figure 1

In the sample of the basic model, every observation includes complete information about the annuity demands, year of birth, highest education completed, gender, self-reported health status, net total income, corporate pension, partnership and number of children. Table 1 describes the annuity market participation decisions and basic individual information. The average age of the sample is 52.86, and it seems that more elder people are present in our sample. But there are still 3612 observations aged smaller than 50. So we do not restrict the sample to the group of people near their retirement. As we can infer from the data description, this sample may not be representative of the Dutch labor force since there are more old people and relatively few women.[3]

3.2.1 Dependent variable

In the DNB household survey of Questionnaire of Assets and Liabilities, people are asked "Did you, in or before 2004 (2005/2006/2007/2008/2009/2010), take out SINGLE-PREMIUM INSURANCE and/or ANNUITY INSURANCE (pension insurance), which was still in effect on 31 December 2004 (2005/2006/2007/2008/2009)? Do not include annuity insurance that you have taken out by using money from your employer-sponsored savings plan, nor include pension arrangements provided by your employer or professional pension plans here." This survey question rules out the annuity product purchased though the corporate pension and focuses on the voluntary annuitization only. At the same time, in the Questionnaire of Household and Work, respondents are presented with the question "Have you made other arrangements for your pension apart from the customary pension you build up through your employer?" where one answer category is "Yes, through annuities". After examining the significance of both dependent variables, we decided to use the variable provided by the Questionnaire of Asset and Liabilities as the dependent variable to find out

[2] All the figures, descriptive table and regression tables can be found at the end of the main text.

[3] The sample using annuity demands information from the Questionnaire of Household and Work is less representative of Dutch labor force since the ratio of men and women is even more imbalanced (man: woman is 62.95 : 37.05). At the same time, all the observations selected according to this setting are covered by second pillar pension which makes it impossible to investigate the influence of corporate pension. So we use this alternative explained variable to check whether the results of baseline model change.

the factors that determine the annuity demand.

The dependent variable derived from the survey data is a dummy variable indicating whether people buy private annuities. It takes a value of 0 for respondents who do not buy private annuities and a value of 1 for those who buy private annuities. From Table 1 we find that 21.53% of the respondents choose annuities. The annuity participation rate in the private annuity market is low. Even for the sample using alternative explained variable, the annuitization rate is not so high (24.76%).

3.2.2 Independent variables

We treat **age**, **lninc** and **number of children** as continuous variables. **Lninc** represents logarithm of treated net total income. From the original survey data, the minimum net total income is -3243, so we create a new variable lninc which equals the logarithm of net total income plus 3244 in order that the minimum **lninc** is 0.[4] Variables **female**, **partner** and **corporate pension** are dummy variables. Here we use whether there is a partner present in the household instead of marital status because when respondent is living with a partner he/she is more likely to share individual longevity risk with the other regardless of their marital status. As expected, most of people are living with a partner. And observations of single women used in Model 2 are even fewer. The corporate pension coverage rate in Netherlands is really high. 81.37% from our sample has a corporate pension which is in line with the general Dutch household situation[5]. For the variable **corporate pension**, although there are still some companies or pension fund provide DC schemes in the Dutch second pillar, people participating in DC schemes are requested to draw out the money in the form of annuities. So we don't distinguish whether the corporate pension is provided in the form of DB or DC scheme. Variable **edu** is a category variable. In the original data setting, the respondents are asked to answer the highest level of education completed. They are also requested to reply to the highest level of education attended (regardless of certificate/ diploma). But we believe the highest level completed are more representative of their education status. Respondents can choose their education level under the categories of "1. (continued) special education; 2. kindergarten/ primary education; 3. VMBO (pre-vocational education); 4. HAVO, VWO (pre-university education); 5. senior vocational training; 6. vocational colleges; 7. university education; and 9. other sort of education/training". Considering that the numbers in the "special education" category and in the "other sort of education" category are relatively small and difficult to

[4] The detailed calculation of net total income can be found in Appendix 3.
[5] The second pillar pension coverage rate of the whole respondents without selection is 80.44%.

interpret, we ruled out the respective respondents from our analysis.[6] Category variable **health** is the self reported general health status in which 1 represents Excellent and 5 represents Poor. We use the status of Excellent as the benchmark to examine the impact of self reported health status on annuitization likelihood. As we can see from Table 1, most people are confident about their health situation, about 78.83% respondents believe their health is good or excellent. Only 0.78% of them think they are in poor health status. Since self reported health status is linked with individual longevity expectation, we will examine its effect on annuitization decision after adding the longevity variable in the following model.

Figure 2 provides information about how the annuitization rate varies among different ages. The annuitization rate reaches its peak around 50-60, before that the annuitization rate increases with the age for those working people. While after retirement, people are not willing to annuitize their wealth along with the age increases. In order to better understand the baseline model, we introduce variables **age2** and **singlefemale** into Model 2[7]. There are only 970 single female taking up 11.6% of the total sample. The total number of observations does not change in model 2.

Figure 2

In model 3, we examine the effect of longevity expectations on annuity demands. Respondents are presented with different questions according to their ages: Respondents aged 16 thru 65 are requested to answer "How likely is it that you will attain (at least) the age of 75?"; People aged 16 thru 70 are presented with "How likely is it that you will attain (at least) the age of 80?"; People aged 65 thru 75 are presented with "How likely is it that you will attain (at least) the age of 85?"; People aged 70 thru 80 are presented with "How likely is it that you will attain (at least) the age of 90?"; People aged 75 thru 85 are presented with "How likely is it that you will attain (at least) the age of 95?"; People aged 80 thru 90 are presented with "How likely is it that you will attain (at least) the age of 100?". For all cases questions are answered on a scale of 0 thru 10, where 0 means "no chance at all" and 10 means "absolutely certain". As we can infer from the setting of the questions, most respondents will answer 2 to 3 questions. For example, if a respondent is 65, he will be asked the likely hood of attain the age of 75/80/85. For those whose current age is 80, they will be required to reply their estimation of living up to 90/95/100.[8] So we generate a variable **longevity expectation**

[6] The number of respondents whose highest education level completed is (continued) special education is 34. The number of those whose highest education is other sort of education/training is 68.
[7] The detailed model information can be found in Appendix 1
[8] The description of detailed longevity expectation is present in Appendix 2.

from the questionnaire data. First we summarize the data of all the six questions and do a median split separately by dividing each sub-group into low life expectancy and high expectancy. For instance, the median level of probability of reaching 80 is 5, then we replace the value under and equal to 5 with 0 and 1 for the people whose probability of reaching 80 is above 5. As we can expect, the number of respondents decreases with the increase of age. The respondents replied to likely hood of reaching 85 and 90 are just around 1000, and the number responded to reaching 100 decreases immediately to 178. But at the same time those who already reached 80/90 in reality is certainly with highest life expectancy. Then we integrate the data further. Since many people respond to more than one question, we take the highest value representing the longest life expectancy. For example, if an individual aged 70 claim that the possibility of living up to 90 is 5, living up to 85 is 7 and living up to 80 is 9, in the first step we have already defined this individual is of high life expectancy under each subgroup 80/85/90 by median split. It could be the case that an individual aged 80 just answered the possibility of reaching 90. If this happen, we treat this individual as low life expectancy if his value of reaching 90 is under mean value. Last, we drop observations who do not answer any of the questions. And for observations whose highest life expectancy is above average, the value of longevity is 1, otherwise 0. Then we generate a dummy variable **longevity expectancy** for all the respondents to investigate its influence on annuitization decisions.

The **bequest motive** is well documented in the DNB survey. Respondents are asked to answer following question: "which of the following four statements about parents leaving a bequest to their children would be closest to your own opinion about this.

1. If our children would take good care of us when we get old, we would like to leave them a considerable bequest
2. We would like to leave our children a considerable bequest, irrespective of the way they will take care of us when we are old
3. We have no preconceived plans about leaving a bequest to our children
4. We don't intend to leave a bequest to our children
5 None of the above-mentioned statements"

Obviously, option 1 represents a strategic bequest motive while option 2 represents an altruist bequest motive. When dealing with the data, first we drop missing observations about the bequest motive. Then we drop observations whose answer to this question is "none of the above-mentioned statements" since this category is difficult to interpret. Next we merge the observations who don't intend to leave a bequest and those who have no preconceived plans about leaving a bequest because these two kinds of people don't have any specific intention to

leave a bequest, thus they won't take leaving bequests to their heir when they are doing financial decisions. Meanwhile, we take a value of 0 represents the group of no bequest motive and set them as benchmark in this bequest category variable. Surprisingly, the bequest motive is not as strong as presumed. Among those respondents in our sample, 77.41% do not have a bequest motive or do not have preconceived plans to leave bequest. And the strategic bequest motive is even weaker, only 2.47% (Table 1).

Brown (2001) considers "time horizon" to be an important determinant for financial decision-making, so we also examine whether people with different financial plan horizon will perform differently in annuitization decisions. The DNB Survey provides information about people's attitude towards discounting and financial plan horizon. People are asked "the time-horizons in their household most important with regard to planning expenditures and savings with options 1 next couple of months; 2 next year; 3 next couple of years; 4 next 5 to 10 years and 5 more than 10 years from now".[9] From Table 1 we find that 54.38% of respondents' financial plan horizon is shorter than 1 year. Those who plan expenditures and savings more than 10 years ahead only take up 3.11% of the whole population. So we treat variable **financial plan time-horizons** as a category variable to examine its influence on annuitization decisions.

As indicated previously, financial literacy, as a psychological explanation, might be a powerful solution to the so-called "annuity puzzle". Apart from education status, DNB also provide information about self-assessed financial literacy, so we generate a dummy variable **financial literacy** to measure its effect on annuitization decision. 59.05% respondents believe they are more or less knowledgeable, so we divide those who are knowledgeable and very knowledgeable as financial literate while the rest as financial illiterate. There is also information about the sources respondent would sort to when making financial decisions. Gardner and Wadsworth (2004) claim that there is a material level of distrust of insurance companies and financial institutions in general. We are curious whether people who do not trust financial institutions would be less likely to buy annuities. So we group the sources into three subgroups. Those who trust their parents, friends or acquaintances; information from the newspapers; and the advertisements on TV, in the papers, or other media are the kind of people trust others. The respondents believe the brochures from their bank or mortgage adviser and professional financial advisers are the group who trust financial institutions. The rest group who think the financial magazines, guides, books; financial computer programs;

[9] There is another question providing information about discounting, but the result of discounting rate is not significant. The description and result of that variable can be seen in Appendix 4.

and financial information on the Internet are more likely to make financial decisions by themselves. So in the category of **financial advice**, we use the people make decisions by themselves as a benchmark and compare them with other groups of people to see whether the way of financial advice would influence annuity decision significantly. As we can see from Table 1, around 36.12% respondents will trust financial institutions when making financial decisions.

The DNB data also provide specific information about individual risk attitudes towards investment. Respondents are asked to answer a serious of investment linked questions. [10] Then we merge these six questions according to the different attitude reflected. We take the values of questions 3), 5) and 6) as negative numbers and add them with the values of rest questions, and then create a new dummy variable **risk averse** by median split the sum where 0 represents risk like and 1 represents risk averse. [11]

Table 1

4. Results

From the baseline model which just includes unconditional correlations between annuity preference and some individual and household characteristics, we find some results against our hypotheses. First, age is negatively linked with annuity demands which implies that older people are less likely to annuitize their wealth. Although many literatures encourage younger people to buy annuity products for the purpose of diversifying investment risks and stimulating annuity sales, in fact older people are expected to be more inclined to buy annuities since they are more focusing on their retirement consumption and better informed of retirement arrangement and annuity products. Meanwhile, compared with the young cohorts, older people are more capable to afford high price of annuity products since they have cumulated wealth through their past working period. Second, the fact that females are less likely to buy annuities is also surprising. Since women are expected to live longer and more risk averse than men, they should buy annuities since they can benefit more from annuity contract. But the empirical result is the opposite. After controlling for longevity expectation in Model 3, women are still less inclined to annuitize their wealth. An explanation could be that

[10] The detailed questions can be found in Appendix 3

[11] The DNB data also provide information toward pension risk attitude. In the Questionnaire Household and Work, respondents are asked whether they would rather pay more/ less premium for a guaranteed pension/ more risky returns. Because in this variable, only 22.75% of total 5139 respondents indicate that they would rather pay less premium for a pension that final pension payment can be higher or lower due to the higher risk of the chosen investment form. So we also apply this pension specific risk averse variable in model 7.

man is more decisive when making financial arrangements in a household. Third, the presence of children and living with a partner are not influential to the annuitization decision. The presence of children was hypothesized to influence annuitization decisions in two ways. First, household with children may have a stronger bequest motive than families without children. Second, more children means that there is a larger pool to share individual longevity risks within family. We expect that living with a partner will also make individuals less likely to buy annuities while the empirical result is not significant. After controlling for **age2**, **bequest motive** and **longevity expectation**, the effect of children is significantly negative. There are also some results consist with expectations. Better educated people are more likely to buy annuities although this effect is not very significant (only some coefficients significant at 0.1 significance level) at each education level. Healthier people have a higher tendency to buy annuities. The negative coefficients for self-reported general health condition are because that the benchmark of this category variable is the best health status. Besides, the effects of income and corporate pension are significant. As Hypothesis 4 predicts, people covered by corporate pension, which can be treated as the group with high pre-annuitized wealth, are less inclined to annuitize their wealth. This finding might also indicate that rich people should buy greater amount of annuities to reach a desired annuitized portion of total wealth while poorer people should annuitize relatively less in case of unexpected shocks such as illness (Cappelletti et al. 2011).

When we apply alternative dependent variable collected from Questionnaire of Household and Work, the result of the baseline model is similar.[12] Elder people and single women are still less likely to annuitize their wealth. The effect of partnership and children is still insignificant. Richer healthier people with better educatation have higher tendency to purchase annuities. The only difference is about the influence of corporate pension. In this sample, all the respondents are covered by corporate pension.

As Figure 2 described previously, the annuitization rate does not change linearly with age. After controlling **singlefemale** and adding **age2**, the empirical results do not change a lot. The significances of **age** and **age2** remind us there is a turning point in the annuitization decisions. This is not consistent with our intuition. One possible explanation is that older people have a higher discount rate and a stronger bequest motive. We will examine whether the annuitization probability decreases with age by controlling for these factors in Model 3 and Model 5 below. It is also likely that people at the age near retirement are more concerned about their retirement income and make annuitization decisions during that period. In Model

[12] This result is present in Column 2 Table 3.

2, the signs and significances of coefficients gender, education, health status, wealth, partnership and corporate pension are similar. In Model 2, the annuitization possibility decreases with the number of children in the household. But the effect of single women is not significant as expected. A single woman is supposed to buy annuities since she cannot share risks with her partner while she enjoys higher life expectancy. This insignificant result might be due to small number of single women or the influences of other factors such as wealth and health may be larger than this effect.

Model 3 is aimed to examine the effect of longevity expectation. Compared with the baseline model, the effect of children's number become significant after controlling for **longevity expectation** and **age2**. The main finding from Model 3 is that longevity expectation is significantly positively linked with annuitization as Hypothesis 2 assumed. The life-cycle model predicts that people with high longevity expectations should value annuities more because they expect to receive a higher number of payments. This longevity expectancy is correlated with health condition to some extent. This finding also proves that there is adverse selection in the annuity market. As a consequence, insurance companies would take this potential adverse selection into account when they price annuities, leading to the unattractiveness of annuities further more.

Table 2

Unlike the findings of Brown (2001) and Hurd (1987, 1989) that bequest motives do not have a significant effect on annuity decisions, when we introduce **bequest motive** in Model 4, we find some interesting results. First, it seems that the significance of health status attenuates. Only the coefficient of poor health status is significant at the 0.1 confidence level. But it does not contradict the conclusion that people in poor health are less likely to annuitize their wealth. Then we find that the effect of living with a partner is significant at 0.05 confidence level. But the positive coefficient indicates that people living with a partner in a household are more likely to buy annuities. It is contrary to our hypothesis because we assume that people living with a partner can share longevity risk with the partner while the single people cannot. The effect of bequest is also tricky. Since we are using people without bequest motive as a benchmark, compared with this benchmark, people with a strategic bequest are less likely to buy annuities. This is in line with the intuition. Parents with a strategic bequest motive will have bequeathable wealth intentionally to manipulate their offspring's behavior (Bernheim et al. 1985). But the altruistic bequest does not lower annuity demands significantly.

Compare with baseline model, Model 5 introduces a new categorical variable **time-horizon**.[13] Unlike Brown (2001) who finds that annuity decision is stronger for non-myopic individuals, strangely in our findings, after considering financial plan time horizon, the coefficient for **corporate pension** turns to be positive and significant while the effect of **financial plan time horizon** on annuitization is not so obvious. It may be due to the fact that people who are not covered by corporate pension are mainly self-employed or entrepreneurs. They might have longer finance plan time-horizon while they care less about their own retirement pension arrangements at the same time. So after taking financial plan horizon into account, people entitled with corporate pension have higher tendency to choose annuities.

Table 3

Sometimes people's financial decisions are not only made by themselves but also driven by other sources from financial advisors' suggestions or commercial advertisement. So in Model 6, we include both the degree of **financial literacy** and s**ources of financial advice** since the highest education completed could not fully represent how well respondents are equipped with financial knowledge. We assume that annuitization probability increases with the degree of financial literacy. But compared with the baseline model, the salience of education decreased and neither financial literacy nor financial advice source play an important role in annuitization decision. Perhaps due to the correlation between financial literacy and education, the education does not play an important role in this model. At the same time, financial literate people might have confidence in their own investments in areas they are more familiar with, such as stocks and bonds. Although they are more likely to learn better about annuity products than less literate people, they may still choose other investment instruments. So the impact of financial literacy is not as high as supposed. We expect that perhaps people who have faith in financial institutions are more likely to buy annuities than other groups of people because professional financial institutions would encourage individuals to insure their clients' longevity risks by annuities. However, this effect is not significant. Maybe it is because the specific advices provided by different sources are unknown.

Model 7 introduce the variable **risk averse** to the baseline model. Interestingly, we find general high risk averse individuals are less likely to buy annuities. By contrast, when we use **pension specific risk attitude** as a comparison, the result is exactly opposite and significant:

[13] There is another way to measure people's discount rate. The regression result is similar to Model 5. But the impact of discount rate is insignificant. The result is shown in Appendix 4.

people who would rather pay more premium for a guaranteed pension are more likely to annuitize their wealth. The first risk averse result seems to prove the assumption that people treat annuity as a discrete gamble rather than insurance. But the later evidence is in line with Hypothesis 6. However, it seems that people are more risk averse when dealing with pension investments. In this sample, 77.25% respondents assert they would pay more premiums in return of a guaranteed pension. When using pension specific risk averse, the presence of corporate pension and health status lose its significance. We also try to analyze the interaction effect of general risk averse with other determinants, such as financial literacy, corporate pension, financial plan time-horizon and gender. But we find that only financial literate people with high general risk averse attitude would prefer annuities significantly.

Table 4

5. Conclusions and Limitations

Our study is based on the Survey data collected by DNB questionnaires analyzing individuals' purchasing decisions in the private annuity market. Several novel aspects are incorporated. First, the annuity demand is presented by real annuity purchase rather than hypothetical survey questions asking respondent's choice between lump sum and annuities. This real annuity purchase is restricted to voluntary annuitization since it rules out the annuities in the first and second pillars. Second, the Dutch pension system differs from other countries. Although current generous first and second pillar pension scheme make people's demand for private annuity insurance relatively small. But investigating the determinants of annuitization based on the Netherlands contributes to the flourish of private annuity market in the future. Third, we use unique measurement of subjective longevity expectation to investigate its impact on annuitization and find a significant adverse selection effect in the private annuity markets. Finally, respondents of our sample provide specific information about motives for leaving a bequest. We distinguish altruistic bequest motive and strategic bequest motive and find that only the strategic bequest motive leads to lower annuity demands.

Our findings are more or less in line with the economic intuitions and hypotheses proposed. The annuitization rate increases with wealth, goodness of health, longevity expectation and education. People covered with corporate pension, which could be interpreted as remarkable amount of pre-annuitized wealth, are less likely to choose annuities in most

cases[14]. The annuitization rate also decreases with the increase of number of children. It is obvious that pre-annuitized wealth and intra-family risk sharing play important roles in annuitization decisions. The findings about health status and longevity expectation demonstrate that adverse selection is serious in private annuity market. However, there are still some results against the hypothesis. First, the old people do not annuitize more than young cohort. Second, single women are significantly less likely to hedge longevity risk by annuities. Third, the longevity risk sharing with a partner in a household is not obvious. Besides, the significant impact of bequest motive, discount rate and financial literacy is not as large as expected. Strangely, general risk averse individuals even do not want to annuitize their wealth.

This paper also has some limitations. First, we cannot include the annuity product's price in our model which makes it impossible to measure the money's worth ratio of annuity contracts, thus missing a remarkable determinant-- whether the annuity product is actuarially fair. Due to lack of annuities' prices, we also failed to combine a life-cycle utility with the model while Brown (2001) and Butler (2007) find the annuity equivalent wealth (AEW) calculated within a life-cycle framework is a dominant determinant. Future study could adopt the AEW approach to examine whether it is an important determinant when Dutch people make their retirement arrangement. Second, about the measurement of financial literacy, it is self-reported information which cannot reveal the actual degree of financial knowledge, even the highest level of education completed could not directly measure how knowledgeable respondents are towards financial decisions. Third, although we can get information about whether people buy annuities apart from corporate pension, we failed to learn about whether the private annuity is immediate single premium or deferred. If data about the type of annuities is available, it is interesting to explore the effect of tax treatment on annuitization decisions.

More recently, Brown suggest future investigation in behavorial explanations since standard economic theory could not fully explain such a low annuity participation rate. Other possible psychological obstacles such as mental accounting, loss aversion, hyperbolic discounting, regret aversion and framing might matter for annuitization decision. If more psychological measurements, especially mental accounting and default options, are added in the model, the prediction results could be more precise.

[14] This conclusion is violated only when financial plan time-horizons or discount rate is introduced in the model.

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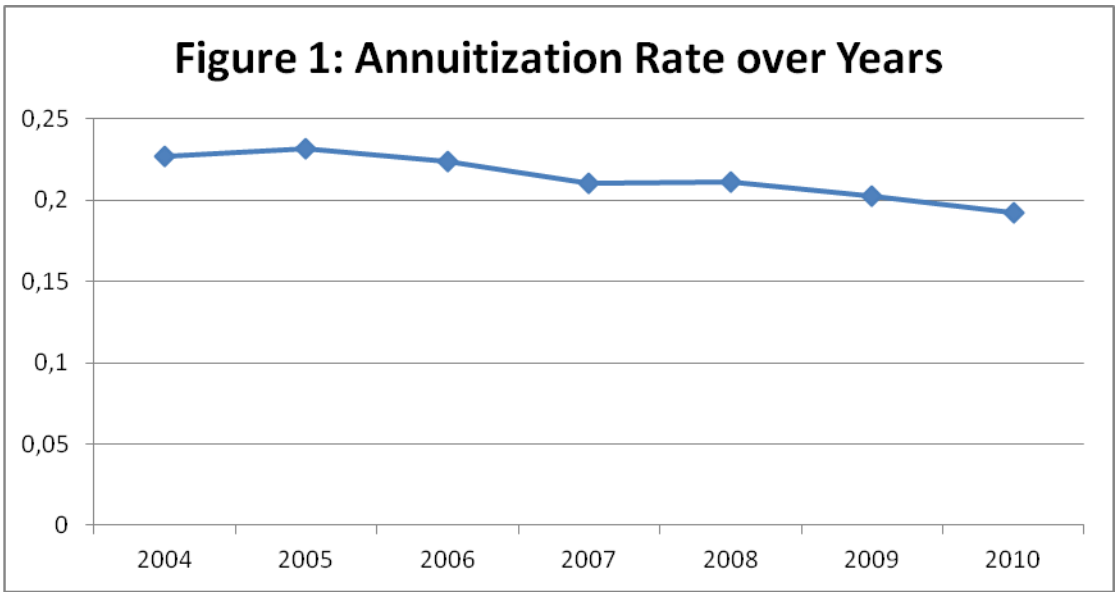

Figure 2: Annuitization Rate over Ages

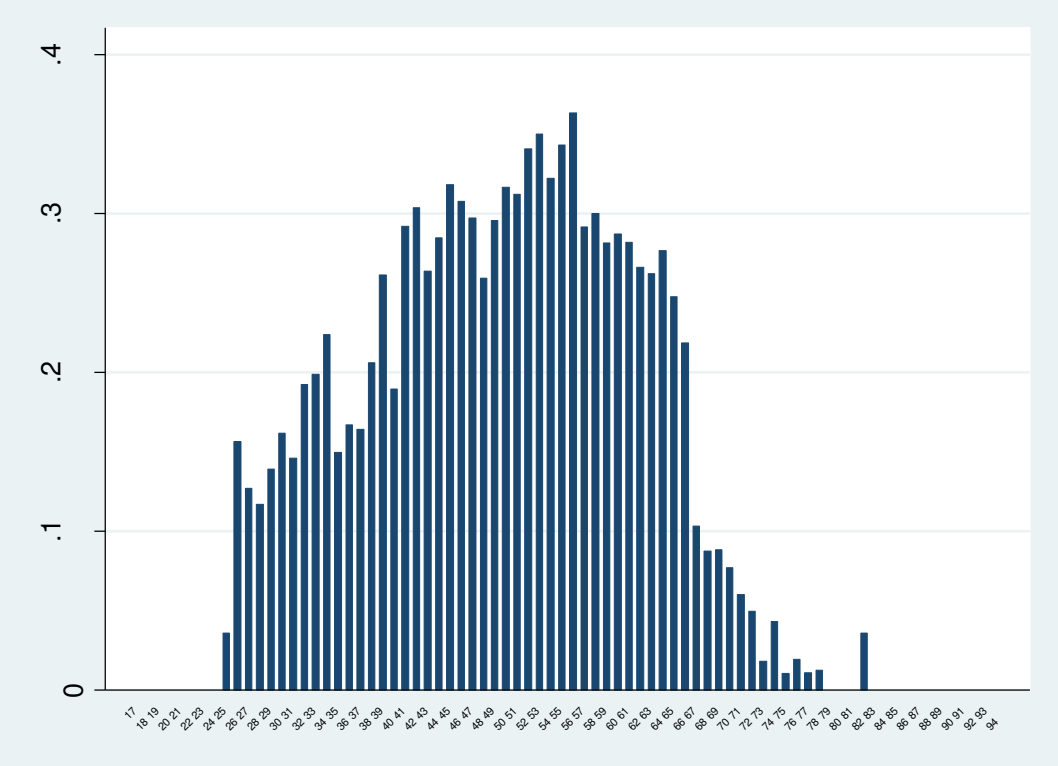

Table 1: Summary Statistics

	Number of observations	Percentage
Single-premium annuity insurance		
no	6,562	78.47
yes	1,800	21.53
Gender		
man	4,806	57.47
woman	3,556	42.53
Highest level of education completed		
kindergarten/primary education	298	3.56
VMBO (pre-vocational education	2,215	26.49
HAVO, VWO (pre-university education)	997	11.92
senior vocational training	1,592	19.04
vocational colleges	2,196	26.26
university education	1,064	12.72
General health condition		
Excellent	974	11.65
Good	5,619	67.2
Fair	1,380	16.5
Not so good	324	3.87
Poor	65	0.78
Partner		
no	1,938	23.18
yes	6,424	76.82
Number of children in the household		
0	5,650	67.57
1	798	9.54
2	1,318	15.76
3	516	6.17
4	58	0.69
5	21	0.25
6	1	0.01
Corporate pension		
yes	6,805	81.38
no	1,557	18.62
Single female		
no	7392	88.4
yes	970	11.6
Total observations	8362	
Longevity expectation		
low	4165	49.86
high	4189	50.14
Total observations	8354	
Bequest motive		
strategic bequest	127	2.47
altruistic	1,036	20.12

	Number of observations		Percentage
no bequest motive		3,985	77.41
Total observations		5,148	
Financial plan time-horizons			
next couple of months		2,606	33.5
next year	1,624		20.88
next couple of years		2,359	30.33
next 5 to 10 years		947	12.18
more than 10 years from now		242	3.11
Total observations		7,778	
Financial literacy			
not knowledgeable		1,199	16.56
more or less knowlegeable		4,276	59.05
knowledgeable		1,572	21.71
very knowledgeable		194	2.68
Financial advice source			
parents, friends or acquaitances		1,778	24.55
information from the newspaper		740	10.22
financial magazines, guides, books		733	10.12
brochures from my bank or mortgage adviser		644	8.89
advertisements on TV, in the papers, or in other media		199	2.75
professional financial advisers		1,972	27.23
financial computer programs		52	0.72
financial information on the Internet		1,123	15.51
Total observations		7241	
Risk averse			
low		3,903	52.42
high		3,543	47.58
Total observation		7446	

Table 2: Baseline model and single women model

	Baseline model		Alternative baseline model		Model 2	
	Coef.	**Z-value**	**Coef.**	**Z-value**	**Coef.**	**Z-value**
age	-0.0489***	(-5.99)	-0.0339***	(-4.23)	0.933***	(12.63)
age2	--	(.)	--	(.)	-0.00987***	(-13.05)
female	-1.633***	(-6.37)	-0.773***	(-3.16)	-2.075***	(-7.03)
Single female	--	(.)	--	(.)	0.655	(1.27)
Highest level of education completed						
kindergarten/primary education	--	(.)	--	(.)	--	(.)
VMBO (pre-vocational education)	0.980	(1.23)	1.234*	(1.65)	1.039	(1.27)
HAVO,VWO (pre-university)	1.567*	(1.91)	1.752**	(2.24)	2.024**	(2.38)
senior vocational training	1.319	(1.63)	1.331*	(1.75)	1.613*	(1.94)
vocational colleges	1.435*	(1.80)	1.405*	(1.87)	1.752**	(2.12)
university education	1.521*	(1.83)	1.199	(1.52)	2.198**	(2.53)
Self-reported general health condition						
Excellent	--	(.)	--	(.)	--	(.)
good	-0.274	(-1.24)	-0.216	(-1.03)	-0.258	(-1.15)
fair	-0.234	(-0.82)	-0.760***	(-2.75)	-0.209	(-0.72)
not so good	-1.057**	(-2.22)	-0.761*	(-1.71)	-1.117**	(-2.35)
poor	-4.624**	(-2.57)	-1.741*	(-1.74)	-4.794***	(-2.94)
ln(net total income)	0.915***	(5.69)	1.008***	(6.19)	0.685***	(4.32)
living with partner	0.108	(0.42)	-0.243	(-1.04)	0.585	(1.58)
Number of children	0.00503	(0.05)	-0.0335	(-0.33)	-0.380***	(-3.46)
entitled to corporate pension	-0.562**	(-2.32)	--	(.)	-0.509**	(-2.04)
Constant	-31.76***	(-12.61)	-12.91***	(-6.92)	-31.76***	(-12.61)
Total Observations	8362		7431		8362	

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

Table 3: longevity model, bequest model and financial plan time-horizons model

	Model 3		Model 4		Model 5	
	Coef.	**Z-value**	**Coef.**	**Z-value**	**Coef.**	**Z-value**
age	0.945***	(12.64)	0.943***	(9.12)	0.907***	(11.82)
age2	-0.00999***	(-13.05)	-0.0103***	(-10.01)	-0.00958***	(-12.27)
female	-1.936***	(-7.35)	-2.294***	(-6.38)	-1.825***	(-6.71)
Highest level of education completed						
kindergarten/primary education	--	(.)	--	(.)	--	(.)
VMBO (pre-vocational education)	0.965	(1.17)	1.040	(1.13)	0.794	(0.96)
HAVO,VWO (pre-university)	1.962**	(2.30)	1.988**	(2.06)	1.868**	(2.17)
senior vocational training	1.538*	(1.85)	1.657*	(1.77)	1.419*	(1.68)
vocational colleges	1.691**	(2.04)	2.238**	(2.41)	1.556*	(1.86)
university education	2.130**	(2.45)	2.941***	(2.92)	2.082**	(2.36)
Self-reported general health condition						
Excellent	--	(.)	--	(.)	--	(.)
good	-0.232	(-1.03)	0.0476	(0.17)	-0.221	(-0.95)
fair	-0.137	(-0.47)	0.334	(0.89)	-0.0911	(-0.30)
not so good	-1.032**	(-2.15)	0.131	(0.21)	-1.140**	(-2.30)
poor	-4.733***	(-2.86)	-2.944*	(-1.73)	-4.899***	(-3.01)
ln(net total income)	0.708***	(4.51)	0.585***	(2.96)	0.679***	(4.19)
living with partner	0.261	(0.98)	0.901**	(2.02)	0.322	(1.16)
Number of children	-0.369***	(-3.36)	-0.626***	(-4.27)	-0.332***	(-2.90)
entitled to corporate pension	-0.513**	(-2.05)	-0.648**	(-1.97)	0.635**	(2.44)
longevity expectation	0.298**	(1.98)	0.589***	(2.99)		

(Table continued)

Bequest motive						
no bequest motive			--	(.)		
strategic bequest			-1.294**	(-2.28)		
altruistic bequest			0.301	(1.26)		
financial plan time-horizons						
next couple of months					--	(.)
next year					0.00220	(0.01)
next couple of years					0.232	(1.36)
next 5 to 10 years					0.182	(0.82)
more than 10 years from now					0.645*	(1.72)
Constant	-32.10***	(-12.67)	-30.22***	(-8.66)	-32.05***	(-12.41)
Total Observations	8354		5148		7778	

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

Table 4: financial literacy and advice model & risk attitude model

	Model 6		Model 7		Model 7 (pension risk averse)	
	Coef.	**Z-value**	**Coef.**	**Z-value**	**Coef.**	**Z-value**
age	0.925***	(11.31)	0.932***	(11.84)	0.617***	(5.99)
age2	-0.00979***	(-11.74)	-0.00982***	(-12.25)	-0.00628***	(-5.62)
female	-1.943***	(-6.78)	-1.844***	(-6.52)	-1.913***	(-6.21)
Highest level of education completed						
kindergarten/primary education	--	(.)	--	(.)	--	(.)
VMBO (pre-vocational education)	0.576	(0.67)	0.972	(1.07)	0.684	(0.67)
HAVO,VWO (pre-university)	1.219	(1.37)	2.105**	(2.25)	1.478	(1.42)
senior vocational training	1.132	(1.30)	1.588*	(1.73)	0.949	(0.93)
vocational colleges	1.314	(1.52)	1.790**	(1.96)	1.255	(1.23)
university education	1.724*	(1.89)	2.279**	(2.38)	1.349	(1.27)
Self-reported general health condition						
Excellent	--	(.)	--	(.)	--	(.)
good	-0.296	(-1.21)	-0.186	(-0.79)	-0.193	(-0.71)
fair	-0.132	(-0.42)	-0.00848	(-0.03)	-0.121	(-0.34)
not so good	-0.740	(-1.44)	-1.020**	(-2.00)	-0.893	(-1.52)
poor	-4.637***	(-2.71)	-6.090**	(-2.55)	-3.688**	(-2.09)
ln(net total income)	0.828***	(4.76)	0.646***	(3.81)	0.838***	(4.22)
living with partner	0.368	(1.24)	0.206	(0.72)	0.0874	(0.28)
Number of children	-0.407***	(-3.37)	-0.319***	(-2.72)	-0.275**	(-2.14)

entitled to corporate pension	-0.590**	(-2.10)	0.576**	(2.17)	0.0692	(0.22)
financial literacy	-0.0351	(-0.19)				
financial advice source						
self decision	--	(.)				
trust others	-0.272	(-1.44)				
trust financial institution	-0.0229	(-0.12)				
Risk averse			-0.285*	(-1.85)	0.694***	(3.51)
Constant	-32.22***	(-11.50)	-32.22***	(-12.04)	-27.16***	(-8.82)
Total Observations	7241		7446		5139	

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

Appendix

Appendix 1

Baseline Logit Regression Model:

$$\text{logit}\,(\text{annuity demands}) = \ln\left(\frac{p}{1-p}\right) = \beta_0 + \beta_1 \text{age} + \beta_2 \text{female} + \beta_3 \text{edu} + \beta_4 \text{health} + \beta_5 \text{lninc} + \beta_6 \text{ partner} + \beta_7 \text{ number of children} + \beta_8 \text{corporate pension}$$

Model 2

$$\text{logit (annuity demands)} = \ln\left(\frac{p}{1-p}\right) = \beta_0 + \beta_1 \text{age} + \beta_2 \text{female} + \beta_3 \text{edu} + \beta_4 \text{health} + \beta_5 \text{lninc} + \beta_6 \text{ partner} + \beta_7 \text{ children} + \beta_8 \text{corporate pension} + \beta_9 \text{ age}^2 + \beta_{10} \text{ single female}$$

Model 3

$$\text{logit (annuity demands)} = \ln\left(\frac{p}{1-p}\right) = \beta_0 + \beta_1 \text{age} + \beta_2 \text{female} + \beta_3 \text{edu} + \beta_4 \text{health} + \beta_5 \text{lninc} + \beta_6 \text{ partner} + \beta_7 \text{ children} + \beta_8 \text{corporate pension} + \beta_9 \text{ age}^2 + \beta_{10} \text{ longevity expectation}$$

Model 4

$$\text{logit(annuity demands)} = \ln\left(\frac{p}{1-p}\right) = \beta_0 + \beta_1 \text{age} + \beta_2 \text{female} + \beta_3 \text{edu} + \beta_4 \text{health} + \beta_5 \text{lninc} + \beta_6 \text{ partner} + \beta_7 \text{ children} + \beta_8 \text{corporate pension} + \beta_9 \text{ age}^2 + \beta_{10} \text{ longevity expectation} + \beta_{11} \text{ bequest motive}$$

Model 5

$$\text{logit (annuity demands)}=\ln\left(\frac{p}{1-p}\right)=\beta_0+\beta_1\text{age}+\beta_2\text{female}+\beta_3\text{edu}+\beta_4\text{health}+\beta_5\ \text{lninc}+\beta_6\ \text{partner}+\beta_7\ \text{children}+\beta_8\text{corporate pension}+\beta_9\ \text{age}^2+\beta_{10}\ \text{financial plan horizon}$$

Model 6

$$\text{logit (annuity demands)}=\ln\left(\frac{p}{1-p}\right)=\beta_0+\beta_1\text{age}+\beta_2\text{female}+\beta_3\text{edu}+\beta_4\text{health}+\beta_5\ \text{lninc}+\beta_6\ \text{partner}+\beta_7\ \text{number of children}+\beta_8\text{corporate pension}+\beta_9\ \text{age}^2$$

$$+\beta_{10}\ \text{financial literacy}+\beta_{11}\text{financial advices}$$

Model 7

$$\text{logit (annuity demands)}=\ln\left(\frac{p}{1-p}\right)=\beta_0+\beta_1\text{age}+\beta_2\text{female}+\beta_3\text{edu}+\beta_4\text{health}+\beta_5\ \text{lninc}+\beta_6\ \text{partner}+\beta_7\ \text{number of children}+\beta_8\text{corporate pension}+\beta_9\ \text{age}^2+\beta_{10}\ \text{risk averse}$$

Appendix 2

Subjective Longevity Statistics

	chance of reaching 75		chance of reaching 80		chance of reaching 85		chance of reaching 90		chance of reaching 95		chance of reaching 100	
	Freq.	Cum. %	Freq.	Cum. %	Freq.	Cum. %	Freq.	Cum. %	Freq.	Cum. %	Freq.	Cum. %
0	39	0.62	131	1.84	47	3.31	106	10.01	127	21.67	73	43.71
1	25	1.01	165	4.15	40	6.13	107	20.11	95	37.88	46	71.26
2	83	2.32	320	8.64	84	12.05	127	32.11	81	51.71	9	76.65
3	164	4.91	494	15.57	129	21.14	148	46.08	68	63.31	12	83.83
4	203	8,12	646	24.64	135	30.66	112	56.66	64	74.23	8	88.62
5	1007	24,02	1342	43.46	318	53.07	197	75.26	78	87.54	12	95.81
6	664	34.51	1133	59.36	179	65.68	90	83.76	31	92.83	-	
7	1387	56.41	1365	78.51	218	81.04	99	93.11	20	96.25	5	98.80
8	1750	84.05	985	92.33	201	95.21	49	97.73	12	98.29	2	100
9	596	93.46	317	96.77	39	97.96	15	99.15	8	99.66	-	
10	414	100	230	100	29	100	9	100	2	100	-	
Mean	6.905717		5.747334		5.337562		3.860246		2.766212		1.45509	
Std. Dev.	1.857025		2.175025		2.264167		2.425704		2.350839		1.959551	
obs	6332		7128		1419		1059		586		167	

Appendix 3

1. Calculation of net total income

ntot= btot- ib + alik +beurs + studlen + otoel + ftoel + erf + hs +hg + min (0, winst) + min (alim, 0) + rente +og

where *btot* represents the total gross income.

btot =oon + vut + pens + wao + ww + wg +aow + aww + abw + waz + wajong + ioaw + alim + max(winst,0) +hprem + hwf.

The total gross income is unknown if one of the income components from *loon* through *alim* is unknown. If one of the other components (from *winst* through *hwf*) is unknown, it will be treated as zero in the calculation of the gross income.

TABLE: Overview of the variables that were used to calculate aggregated data on personal income

Variable	Description
NOHHOLD	Household index
NOMEM	Index of member of the household
WINST	Profits [gross]
OG	Real estate income/letting of rooms [gross]
HPREM	Premium for subsidized purchase of house [gross]
BEURS	Scholarship [net]
STUDLEN	Study loan [net]
ALIM	Alimony from spouse [gross]
ALIK	Alimony for children [net]
OTOEL	Parental support for studies [net]
FTOEL	Support from family [net]
RENTE	Interest/dividends/other income [gross]
ERF	Inheritance [net]
ZKP	Premium private medical insurance
HS	Rent subsidy [net]
HG	Allowance to adjust to new rent [net]
HWF	Rateable value of accommodation [gross]
HTR	Mortgage interest payments [gross]
LOON	Pay/salary [gross]
VUT	Early retirement benefits [gross]
WG	Reduced pay [gross]
PENS	Retirement pension/annuity [gross]
WW	Unemployment benefits [gross]
ZW	Illness benefits [bruto]
ZORG	Care support [bruto]
K_OP	Children support [bruto]
WAZ	Disability benefits for self-employed, their partner/ free-lancers/ clergymen etc. [gross]
WAJONG	Disability benefits for persons who were already disabled at the age of

	17 and therefore could not work [gross]
WAO	Disability pension [gross]
IOAW	Benefits for elderly and partly disabled unemployed/self-employed [gross]
ABW	Social assistance (US: welfare)/benefits for self-employed [gross]
AOW	General old-age pension (US: social security payments) [gross]
AWW	General widows" and orphans" pension [gross]
IB	Calculated income tax
BTOT	Total gross income
NTOT	Total net income
HEFKORT	Considered tax credit
BOX3TAX	Considered income tax box 3 (saving and investments)

2. Questions about risk attitude

In Questionnaire Economic and Psychological Concepts, respondents are required to answer following questions with a scale of 1-7 to represent the importance where 1 represents unimportant, 7 very important.

1) I think it is more important to have safe investments and guaranteed returns, than to take a risk to have a chance to get the highest possible returns.
2) I would never consider investments in shares because I find this too risky.
3) If I think an investment will be profitable, I am prepared to borrow money to make this investment.
4) I want to be certain that my investments are safe.
5) I get more and more convinced that I should take greater financial risks to improve my financial position
6) I am prepared to take the risk to lose money, when there is also a chance to gain money

Appendix 4

Another measurement of discounting rate is provided by following questions:

Please indicate what you do with money that is left over after having paid for food, rent, and other necessities -- on a scale from 1 to 7, where 1 means "I like to spend all my money immediately" and 7 means "I want to save as much as possible". So according to the rule of median split, we change it into a dummy variable which 0 represents low discount rate while 1 high discount rate.

Similar to the regression results using financial plan time-horizon, adding factor of discount rate, the corporate pension is positively linked with annuitization which is hard to interpret. But unlike theory predicts, discount rate here is not influential to annuitization decision. So in the main model we prefer to use financial plan time-horizon to interpret its effects on annuity demands.

	Coef.	**Z-value**
age	0.914***	(11.90)
age2	-0.00966***	(-12.35)
female	-1.829***	(-6.71)
Highest level of education completed		
kindergarten/primary education	0	(.)
VMBO (pre-vocational education)	0.791	(0.95)
HAVO,VWO (pre-university)	1.888**	(2.18)
senior vocational training	1.437*	(1.70)
vocational colleges	1.608*	(1.91)
university education	2.131**	(2.41)
Self-reported general health condition		
Excellent	0	(.)
good	-0.218	(-0.94)
fair	-0.0807	(-0.27)
not so good	-1.095**	(-2.22)
poor	-4.907***	(-3.00)
ln(net total income)	0.684***	(4.22)
living with partner	0.325	(1.17)
Number of children	-0.328***	(-2.85)
entitled to corporate pension	0.622**	(2.39)
discount rate	-0.206	(-1.37)
Constant	-32.09***	(-12.38)
Total Observations	7778	