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Measuring Risk Capacity

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DESIGN PAPER 219

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Abstract

Risk tolerance and risk capacity are key concepts in the implementation of adequate strategies in the new pension contract. Risk tolerance is a subjective measure of the psychological willingness to take risks, while risk capacity is the amount of risk that individuals can financially bear. In this paper we concentrate on risk capacity and the heterogeneity therein. We measure differences in risk capacity over the life cycle, using data from the DNB Household Survey from 2004 to 2019 on a representative sample of the Dutch population. Looking at different measures of income and 'discretionary wealth' (wealth not locked up in mandatory occupational pension schemes), we find that there are strong differences in risk capacity across age groups and that the age profile varies depending on the level of education. Although human capital decreases over the life cycle, the discretionary investment in risky assets increases with age up to the mid-50s. We also note significant heterogeneity in risk capacity in the population when controlling for age. This evidence should be taken into account by pension funds when making investment decisions.

Samenvatting

In het pensioenakkoord is afgesproken dat ouderen minder risico zullen krijgen toebedeeld dan jongeren. Een kernvraag is hoe het beleggingsbeleid onder de nieuwe Wet verbeterde premieregeling (WVP) of de toedeling van overrendementen (nieuwe pensioencontract) in te richten per groep deelnemers. Voor het formuleren van adequate beleggingsstrategieën is het voor pensioenfondsen belangrijk om inzicht te hebben in zowel risicotolerantie als risicocapaciteit. Risicotolerantie meet de bereidheid van individuen om risico te nemen terwijl risicocapaciteit aangeeft hoeveel financieel risico een individu kan nemen. In dit artikel maken we gebruik van gegevens van de DNB Household Survey om de (heterogeniteit in) risicocapaciteit te meten. We onderzoeken ook in hoeverre risicocapaciteit varieert over de levenscyclus. Risicocapaciteit hangt af van de contante waarde van het resterende arbeidsinkomen (menselijk kapitaal) en van het 'vrije' vermogen dat huishoudens zelf aanhouden, buiten de pensioenfondsen om. Bij het schatten van het menselijk kapitaal beschouwen we verschillende inkomensmaatstaven. We vinden dat risicocapaciteit daalt naarmate men ouder wordt. Verder verschilt de samenhang tussen leeftijd en risicocapaciteit per opleidingsniveau en is er sprake van een grote mate van heterogeniteit van risicocapaciteit binnen leeftijdsgroepen. Hoewel het menselijk kapitaal een dalende functie is van leeftijd, neemt de bereidheid van mensen om zelf te beleggen in aandelen en beleggingsfondsen toe met leeftijd.

1. Introduction

For pension funds, both risk tolerance and risk capacity are key concepts for the implementation of adequate investment strategies. Risk tolerance is a subjective measure of the psychological willingness to take risks, while risk capacity is the amount of risk that an individual can financially bear. In this paper we concentrate on the heterogeneity in risk capacity. In the Dutch Pension Agreement of June 2019, agreements were made about a new pension contract (see Ministry of Social Affairs and Employment, 2020). The objective is that pension participants can continue to achieve the same level of pension benefits as currently. Mandatory pension schemes will remain, and pension funds will continue to invest the contributions on a collective basis. In principle, pension benefits will depend substantially on the returns on contributions paid in and will therefore be more directly linked to volatility in the asset markets. However, excessive fluctuations in investment returns will be absorbed by means of an obligatory collective solidarity reserve that is built up with contributions and excess returns. Therefore, the new pension contract involves intergenerational risk-sharing.

The new Pension Agreement also states that, in their investment policy, pension funds should take less risk for older than for younger participants. A key question is how to implement the investment policy according to the Premium Schemes (Improvements) Act (in Dutch: *Wet Verbeterde Premieregeling* or WVP) or the allocation of excess returns (under the new pension contract) per group of pension participants. In the standard model, where no earnings uncertainty exists nor any other sources of income, the optimal strategy is to apply 'life cycle investing', meaning that the pension wealth of younger participants should be invested relatively more in 'risky assets' compared to those of older participants. That is because the present value of future labor income streams (human capital) is greater than that of older participants. In other words, younger people have more "risk capacity" than older people. Risk tolerance then determines how much extra investment risk a pension fund should take for the benefit of young people (see, for example, Bovenberg et al., 2007; Teulings and De Vries, 2006).

In this paper we measure differences in risk capacity which result from age differences, when taking into account not only income but also 'free' financial and real wealth (not locked up in mandatory occupational pension schemes). To measure risk capacity, we use data from the DNB Household Panel (DHS) from 2004 to 2019 on a representative sample of the Dutch population. The data include information on work, retirement, housing, mortgages, income, assets, loans, health, and economic

and psychological concepts. Importantly, the richness of the data also allows us to analyze the heterogeneity in risk capacity in the population, controlling for age.

The paper proceeds as follows. Section 2 introduces the theoretical framework, Section 3 describes the data that we use, and Section 4 presents the empirical strategy. The results for income, human capital, and wealth are presented in Sections 5, 6 and 7, respectively. In Section 8 we provide an overview of the overall risk capacity and its composition over the life cycle. Finally, Section 9 concludes.

2. Theoretical Framework

In this paper we assume that pension funds base their investment decisions on the standard life cycle portfolio choice model. According to this model, in which human capital is without risk (Cocco et al., 2005; Teulings and De Vries, 2006; Bovenberg et al., 2007), younger people should hold a larger share of their wealth in risky assets than older people. For each age t, the optimal fraction α_t of financial wealth S_t (including pension wealth), which is invested in risky assets I_t, is defined as

$$\alpha_t = \frac{I_t}{S_t} = \frac{\mu}{\gamma\sigma_\eta^2}\left(1 + \frac{HC_t}{S_t}\right) \tag{1}$$

where μ is the average real excess return on risky assets, σ_η^2 is the variance of the excess return, γ denotes the coefficient of relative risk aversion, and HC_t is human capital. Human capital is the present value of all future labour income streams. Note that labour income includes contributions to occupational pension funds but does not include pension benefits. Because the ratio of human capital to financial wealth varies with age, the optimal fraction α_t of financial wealth invested in risky assets will also be time varying. In the model we assume that there is only one risky asset. As human capital is higher for younger than for older people, while financial wealth is often small at younger ages, the model predicts that younger people should invest more in risky assets: they have more risk capacity. Risk capacity is also affected by the fact that part of the wealth (S_t^Z) is accumulated by the individuals themselves, who also decide on their own investments I_t^Z in risky assets. Pension funds can take this into account and invest a share $\tilde{\alpha}_t$ of the pension wealth $S_t - S_t^Z$ in risky assets $I_t - I_t^Z$. The optimal share of pension invested in risky assets is

$$\tilde{\alpha}_t = \frac{I_t - I_t^Z}{S_t - S_t^Z} = \frac{\mu}{\gamma\sigma_\eta^2}\left(1 + \frac{HC_t}{S_t}\right)\left(\frac{S_t}{S_t - S_t^Z}\right)\left(\frac{I_t - I_t^Z}{I_t}\right) \tag{2}$$

Again, it is important to note that, even if risk aversion is constant over time, the optimal investment in risky assets changes over time because risk capacity varies in time. Note that a pension fund can invest relatively more in risky assets than equation (1) suggests ($\tilde{\alpha}_t > \alpha_t$) if individuals themselves do not invest much in risky assets ($I_t^Z/S_t^Z < \alpha_t$). The goal of this paper is to provide insight into the level of risk capacity. In other words, we will provide information on the present value of future household income streams (i.e. human capital HC_t), and the level and composition of private wealth (S_t^Z and I_t^Z). We also consider income at the household rather than the individual level because a high income of a partner increases the risk capacity of

the individual. In our analysis we will take into account that human capital depends in large part on the shape of the age-income and age-wealth profiles, and that the relationship between age and income and wealth is known to vary with education level (see e.g. Kapteyn et al., 2005).

3. Data

We use data from the DNB Household Survey (DHS) by CentERdata, a representative online panel study among roughly 2,000 households in the Netherlands.[1] We pool data from the years 2004 to 2019 and aggregate individual data to household level. The DHS survey provides detailed accounts of the size and composition of income and wealth that can be used to determine risk capacity. As we pool data from different years, all nominal values for income and wealth are deflated using the Consumer Price Index (CPI), with 2015 as base year.

3.1 Income

We use three different measures of household income. The first measure is obtained by subtracting income taxes from gross income and adding inheritances received. Gross income is the sum of salaries, payments received from disability insurance (WAO, WAZ, Wajong), unemployment benefits (WW, ABW, IAOW, IAOZ), redundancy pay, public survivor benefits (ANW), alimony, profits (of self-employed persons), imputed rent (in Dutch: *huurwaardeforfait*). Imputed rent is calculated on basis of a formula applied by the Dutch tax authorities. For the second income measure, we add state retirement benefits (AOW) to the first measure. The idea is that the government provides a guaranteed income, which entails an increase in risk capacity. The third measure takes household income including AOW receipts and subtracts housing expenditures, i.e. rent and mortgage payments. Note that, according to the model presented in section 2, occupational pension income should not be included in the income measures as this is part of pension wealth and not human capital.

We equivalize household income by dividing each measure by the square root of household size (OECD, 2018a). As a two-person household does not require twice the income of a one-person household to achieve the same standard of living, adjusting the income variables in this way allows comparison across households of different size.

For the estimations concerning income, we restrict our sample to households where the household head is between 25 and 70 years of age. The reason for this is twofold. First, the number of observations of young households below the age of 25 and old households above the age of 70 is minimal; we are thus unable to produce precise predictions for these households. Second, the 25 to 70 age span captures the working lives of most households since most individuals will receive a permanent

1 See the website https://www.centerdata.eu/en/projects-by-centerdata/dnb-household-survey-dhs and Teppa and Vis (2012) for more information about the DHS survey.

Table 1: Descriptive statistics: Income (€)

	mean	SD	Q1	median	Q3	obs.	share positive
Household Income excl. AOW							
full sample	12765	16566	0	10074	22649	25908	61.6%
only positive	21660	15111	12442	19724	28372	15960	
Logs	9.66	1.05	9.43	9.89	10.3	15960	
Household Income incl. AOW							
full sample	13678	16087	0	11608	22822	25908	66.8%
only positive	20908	14936	11519	18700	27643	17327	
Logs	9.64	1.00	9.35	9.84	10.2	17327	
Household Income incl. AOW minus housing expenditures							
full sample	10570	15446	0	8475	19302	25908	63.5%
only positive	18390	13906	9564	16271	24159	16456	
Logs	9.51	0.959	9.17	9.7	10.1	16456	

Notes: Based on DHS data for the years 2004–2019 for households where the age of the head of the household is between 25 and 70. An equivalence scale has been applied to all income variables by dividing income by the square root of the household size.

contract around age 25, [2]while by age 70 most households have exited the labour force. Moreover, residual lifetime income after retirement is largely dependent on state retirement benefits, which pension funds can easily predict.

Outliers with equivalized household income value above €300,000 or below €–50,000 have been removed from the sample; this pertained to 16 to 47 observations, depending on the income definitions used. Note that when the logarithm of income is used, all households with non-positive income are excluded.

Table 1 reports descriptive statistics for all three income variables. For all measures, a substantial share of observations is zero, meaning that the household reported no income for a given year. The differences between income excluding and including AOW are minimal, as can be expected, given that only a small share of the sample receives these benefits.

3.2 Wealth

The 'discretionary' wealth variables (i.e. not locked up in mandatory occupational pension schemes) include financial wealth, real wealth, total wealth, net wealth, and risky assets. Financial wealth is the sum of checking and saving accounts, corporate savings accounts, deposit accounts, bonds, mutual funds[3], stocks directly held, put and call options, and the cash value of (single-premium) annuities and endowment

2 See https://www.cbs.nl/nl-nl/nieuws/2019/20/mijlpalen-twintigers-schuiven-op

3 The data does not allow us to make a distinction between stock mutual funds and funds which (partly) invest their money in bonds.

Table 2: Descriptive statistics: Wealth (€)

	mean	SD	Q1	Median	Q3	obs.	share positive
Financial Wealth							
full sample	43786	84237	3682	15467	45695	20651	94.2%
only positive	46619	85963	5150	17618	49364	19453	
logs	9.57	1.79	8.55	9.78	10.8	19453	
Real Wealth							
full sample	214897	183652	11070	214230	307500	17949	89.5%
only positive	240248	177809	140799	232012	323563	16055	
logs	11.6	1.83	11.9	12.4	12.7	16055	
Total Wealth							
full sample	264575	233347	46888	242790	367385	18028	98.0%
only positive	269960	232562	64975	246752	371694	17671	
logs	11.7	1.85	11.1	12.4	12.8	17671	
Debt							
full sample	86806	117423	0	31237	147742	18379	65.5%
only positive	132444	122444	35383	110736	191377	12046	
logs	11	1.81	10.5	11.6	12.2	12046	
Net Wealth							
full sample	167506	187551	15260	118331	262743	17831	89.6%
only positive	190169	184522	34543	149009	283205	15978	
logs	11.3	1.73	10.4	11.9	12.6	15978	
Risky Assets, incl. bonds							
full sample	7883	36128	0	0	0	20655	23.0%
only positive	34349	69133	3595	11253	32190	4740	
logs	9.04	2.44	8.19	9.33	10.4	4740	
Risky Assets, excl. bonds							
full sample	7138	33025	0	0	0	20662	22.1%
only positive	32271	64193	3496	10906	31130	4570	
logs	9	2.45	8.16	9.3	10.3	4570	

Notes: Based on DHS data for the years 2004–2019 for households where the age of the head of the household is between 25 and 80.

insurance policies. Real wealth is the sum of housing wealth (value of all real estate owned), the value of durable goods (cars, motorcycles, boats, and caravans), business equity, and stocks from a substantial holding. Total wealth is the sum of financial and real wealth. Net wealth is total wealth minus debt. Debt includes mortgages, checking accounts with a negative balance, student loans, personal loans, and credit balances on credit cards. Risky assets include mutual funds, stocks directly held, and put and call options.

Our sample for wealth variables is restricted to households aged 25 to 79. The reasoning is the same as for income variables, although we extend the upper age boundary of the sample since this provides additional information on households:

Table 3: Descriptive statistics: Household Characteristics

	mean	SD	Q1	median	Q3	obs.
Full Sample						
No. of children aged 0 to 6	.512	.924	0	0	1	25908
No. of children aged 7 to 12	.125	.425	0	0	0	25908
No. of children aged 13 to 17	.0539	.265	0	0	0	25908
No. of children aged 18+	.0209	.159	0	0	0	25908
No. of adults	1.74	.505	1	2	2	25908
Sample of households with positive income						
No. of children aged 0 to 6	.538	.94	0	0	1	15960
No. of children aged 7 to 12	.138	.446	0	0	0	15960
No. of children aged 13 to 17	.0584	.276	0	0	0	15960
No. of children aged 18+	.0217	.165	0	0	0	15960
No. of adults	1.74	.513	1	2	2	15960

Notes: Based on DHS data for the years 2004–2019 for households where the age of the head of the household is between 25 and 70. The sample of households with only positive income excludes households with zero income based on the first income measure.

decumulation of wealth after retirement. Unlike income, wealth levels are more difficult to predict from the pension fund's perspective as it cannot monitor the consumption of wealth as closely as it observes incomes.

Outlier correction is as follows. We exclude households with financial wealth above €1,000,000 (42 observations), real wealth above €1,000,000 (265 observations), total wealth above €1,500,000 (171 observations), total debt above €1,000,000 or below €−500,000 (41 observations), net wealth above €1,000,000 or below €−400,000 (453 observations), and total value of risky assets above €600,000 (40 observations if we include bonds and 28 observations if we exclude bonds).

Descriptive statistics of all wealth variables can be found in Table 2. Note that only less than 25 percent of households hold risky assets.

3.3 Background Characteristics

All individual-level characteristics, e.g. age, refer to the head of the household. The education level of the household is defined as the first reported education level of the head of the household so that this variable stays constant over time. Note that this adjustment has implications for only 1.56 percent of the sample. Tertiary education includes higher vocational (HBO) and university (WO) education; non-tertiary includes all other educational levels. Summary statistics of the background characteristics are presented in Table 3.

4. Empirical Strategy

4.1 Income

Our empirical strategy mirrors that of Kapteyn et al. (2005)[4] We estimate the model

$$\ln y_{ht} = \alpha_h + \sum_{k=1}^{K} \gamma_k s_k(age_{ht}) + \varepsilon_{ht} \quad (3)$$

using fixed-effects regressions, where y_{ht} denotes equivalized income of household h at time t, α_h is the household fixed effect, and age_{ht} is the age of the household head. The random error term ε_{ht} is assumed to be independently and identically distributed with a zero mean and variance σ_ε^2. The linear spline function $s_k(age_{ht})$ is configured to place a knot k ($k = 1, \ldots, K$) every five years and captures the development of income over the life cycle.

In Equation (3), the fixed effect α_h captures all heterogeneity between households. It contains time-invariant household characteristics, year-of-birth cohort effects, educational attainment, innate ability, and gender differences, among other things. Like Kapteyn et al. (2005), we will use the Mundlak-Chamberlain method to estimate the association between the fixed effect and some observable time invariant variables.[5]

It is well known that one cannot separately identify age, period, and time effects from longitudinal data. We address this identification problem by not including a full set of year dummies in equation (3). Basically, we assume that the coefficients corresponding to the time dummies add up to zero and are orthogonal to any (nonlinear) trend in age. These assumptions are slightly stronger than those made by Deaton and Paxson (1994), which are commonly made in the literature (see e.g. Chamon and Prasad, 2010; Zandberg, 2015). They assume that the time effects add up to zero and are orthogonal to a linear time trend.

We estimate the model separately for households where the head's highest level completed education is tertiary and for those with non-tertiary education. The age-income path is, therefore, allowed to differ for these two educational groups.

4 Zandberg (2012) and Zandberg (2015) also used the same empirical strategy to estimate age income profiles, applying 16 waves (1995-2010) of the DNB household survey. It should be realized that both studies estimate the age profile of net disposable household income, which includes first pillar and second pillar pension benefits. None of the income variables that we considered includes second pillar pension benefits. As a result, our (education-specific) income profiles differ quite a bit from those obtained by Zandberg (2012) and Zandberg (2015).

5 See Wooldridge (2010) and the legend of Table B1 for more details about the Mundlak-Chamberlain method.

As mentioned before, we consider only households where the head is aged between 25 and 70.

4.2 Human Capital

The value of a household's human capital is given by the discounted sum of all future income. To derive human capital for each household, we use the model in Equation (3); this predicts future values of equivalized household income. For a given year t, we estimate the expected income at year $\tau > t$ as follows:

$$E_t y_{ht} = \hat{\theta} \exp\left(\hat{\alpha}_h + \sum_{k=1}^{K} \hat{\gamma}_k s_k(age_{ht}) \right) \tag{4}$$

where $\hat{\theta}$ is the scaling factor of Duan's (1983) smearing estimate, set to be equal to the mean of ε_{ht}. The scaling factor is needed to obtain expected income in levels from the predicted value in logs. Human capital is then calculated as

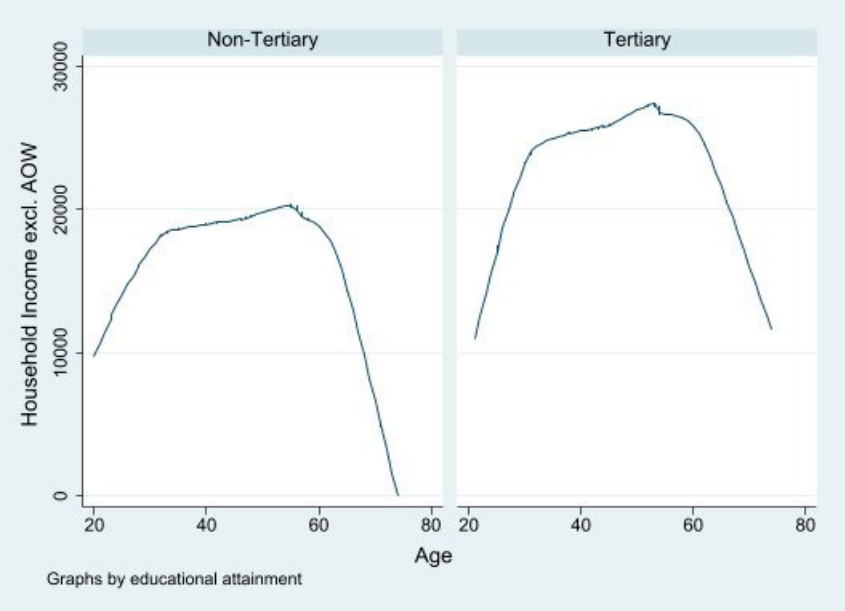
$$E_t Y_{ht} = \sum_{\tau=t}^{L} (1+r)^{t-\tau} E_t y_{ht} \tag{5}$$

where L is the year in which the head of the household becomes 70 and r is the real interest rate. In the calculations below, we assume that the real interest rate is equal to 1 percent. The estimation of human capital assumes that no income is earned after age 70.

5. Results: Income

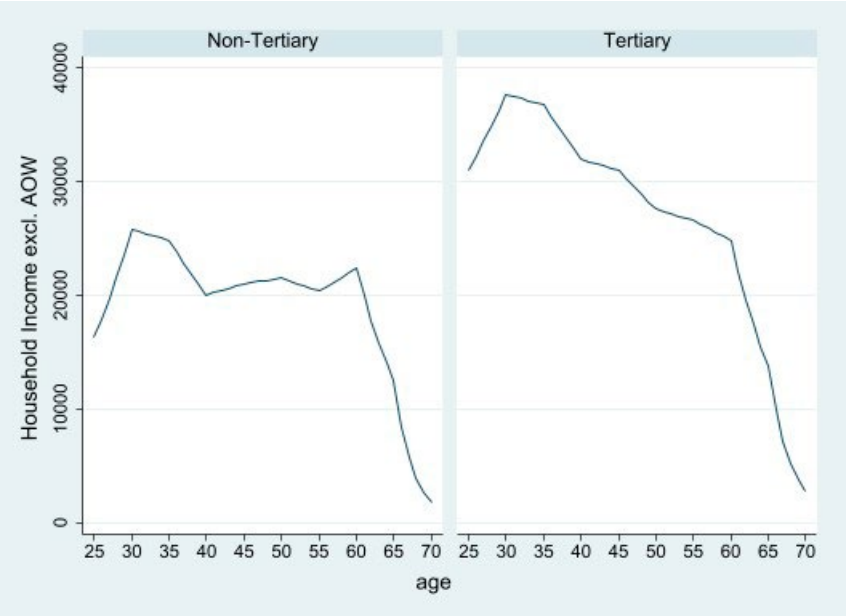
The cross-sectional age profile of equivalized household income (excluding AOW and occupational pensions) is hump-shaped, as shown in Figure 1. For both non-tertiary and tertiary-educated households, income peaks around age 58 with the peak being highest for tertiary-educated households. Income levels drop sharply as households enter retirement. According to Figure 1, a constant income assumption appears to hold relatively well between the ages of 30 and 60 but is too restrictive outside this interval. Relaxing this assumption will therefore provide more accurate measures of human capital. Income including AOW and income minus housing expenditures display similar patterns, although the drop in income is less steep for both and the peak of income is lower for the latter. Results are found in Figures A1 and A2, respectively. It should be stressed that in the construction of Figure 1 no attempt is made to disentangle age effects from cohort (generational) effects. To address this issue, we have run some fixed effects regressions (cf. equation 3). For both education levels, equivalized income increases up to age 30 and then decreases between age 30 and 40, when household size typically increases due to the arrival of children. This result might also

Figure 1: Household income (€, excl. AOW) by age and educational attainment (smoothed)



Notes: The figure plots equivalized household income (in euros), excluding AOW payments, as defined in Section 3.1, over age for households with non-tertiary and tertiary education, separately, using locally weighted scatterplot smoothing (lowess). Based on data from the DNB Household Survey (DHS) for the years 2004 to 2019.

Figure 2: Household income (€, excl. AOW) by age and educational attainment



Notes: The figure plots the predicted equivalized household income (in euros), excluding AOW payments, as defined in Section 3.1, over age for households with non-tertiary and tertiary education, separately. Prediction based on fixed-effects estimation with the log of income as a dependent variable and a linear age spline as regressor. Predicted income is obtained from predicted log of income using Duan's (1983) smearing estimate. Based on data from the DNB Household Survey (DHS) for the years 2004 to 2019.

be explained by the fact that female spouses reduce their labour force participation once they get children, as documented by Euwals et al. (2011) and Nientker and Alessie (2019). The plateau in the age-income profile between age 40 and 60 still applies for households with a non-tertiary education. However, it disappears for households with tertiary education when accounting for the household fixed effect, as shown in Figure 2. This provides more justification for a relaxation of the constant income assumption. Like in Figure 1, equivalized income decreases significantly after age 60. Findings are similar if we consider the second income definition (including AOW), see Figure A3 (see appendix A). However, we find a rather constant equivalized income between age 40 and 60 for both non-tertiary and tertiary education if we subtract housing expenditures from income (see Figure A4).

5.1 Heterogeneity

Equivalized income depends on household characteristics. Table B1 (see Appendix B) shows that households with a higher number of children aged 12 or below have lower household income, likely due to one of the parents working less to care for the children. Households with more adults appear to have less income, but this effect

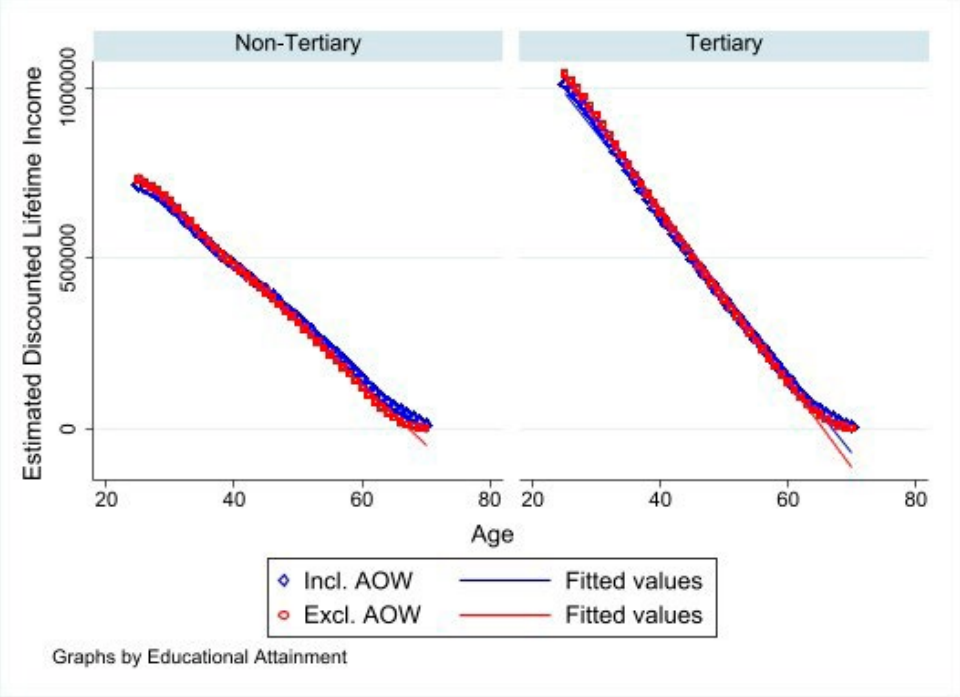
is driven by the equivalization of income, as we divide income by the square root of the number of adults. Female-headed households earn about 14 percent less than male-headed households. Households in the oldest cohorts, born before 1956, are predicted to earn more than the younger generations, conditional on age.
Overall, higher education is related to more household income. Occupational status also has an impact. Among households with tertiary education, the employed (either self-employed or contractual) and, to a lesser extent, retirees have substantially higher incomes. Retired households with non-tertiary education have lower incomes than workers and disabled persons when excluding AOW.

6. Results: Human Capital

The hump-shaped profile of income over the life cycle implies that the risk capacity from human capital does not decrease linearly with age. Instead, it displays slight concavity in the ages leading up the peak in income and convexity after age 60 (when income sharply decreases), given sufficiently low discount rates. (A high discount rate in itself introduces concavity into the development of age.)

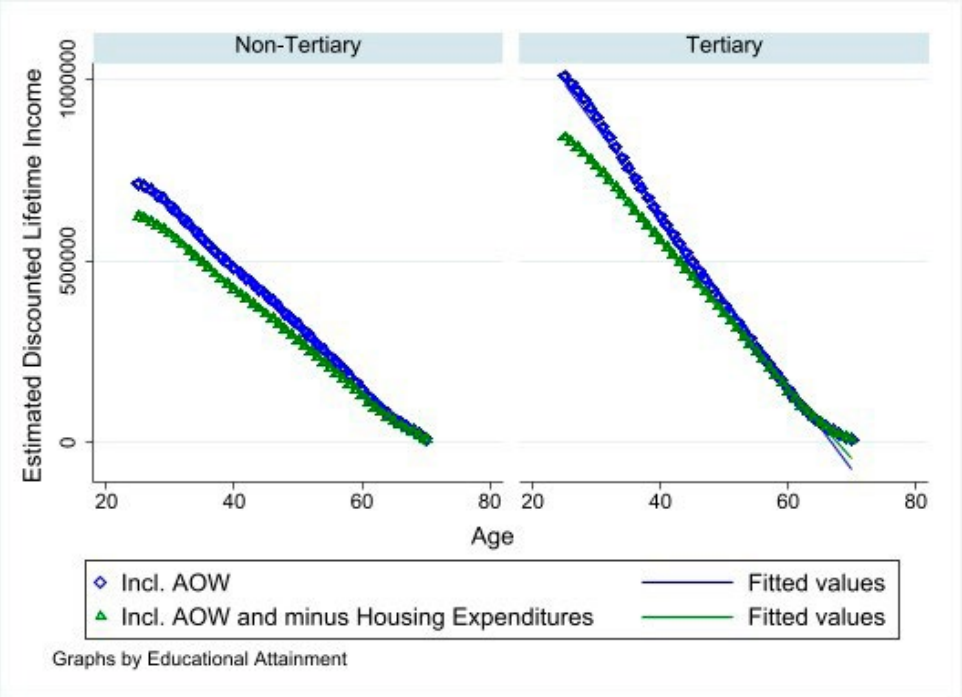
Figure 3 plots the development of human capital over the life cycle, based on household income excluding AOW payments (red line) and income including AOW payments (blue line). Given that the interest rate used is low (one percent) and is sufficiently low, the human capital profile indeed shows slight concavity up to age 30 and convexity after age 60. This implies that a constant income assumption together

Figure 3: Human capital (€, incl. AOW) by age and educational attainment



Notes: The figure plots the predicted discounted sum of lifetime equivalized household income (in euros), including and excluding AOW payments, separately, using the methods described in Section 4.2, over age for households with non-tertiary and tertiary education, separately. Predicted household income is based on fixed-effects estimation with the log of income as a dependent variable and a linear age spline as regressor. Predicted income is obtained from the predicted log of income using Duan's (1983) smearing estimate. Note that the figure does not include the discounted sum of AOW payments after age 70. Based on data from the DNB Household Survey (DHS) for the years 2004 to 2019.

Figure 4: Human capital minus housing expenditure (€, incl. AOW) by age and educational attainment



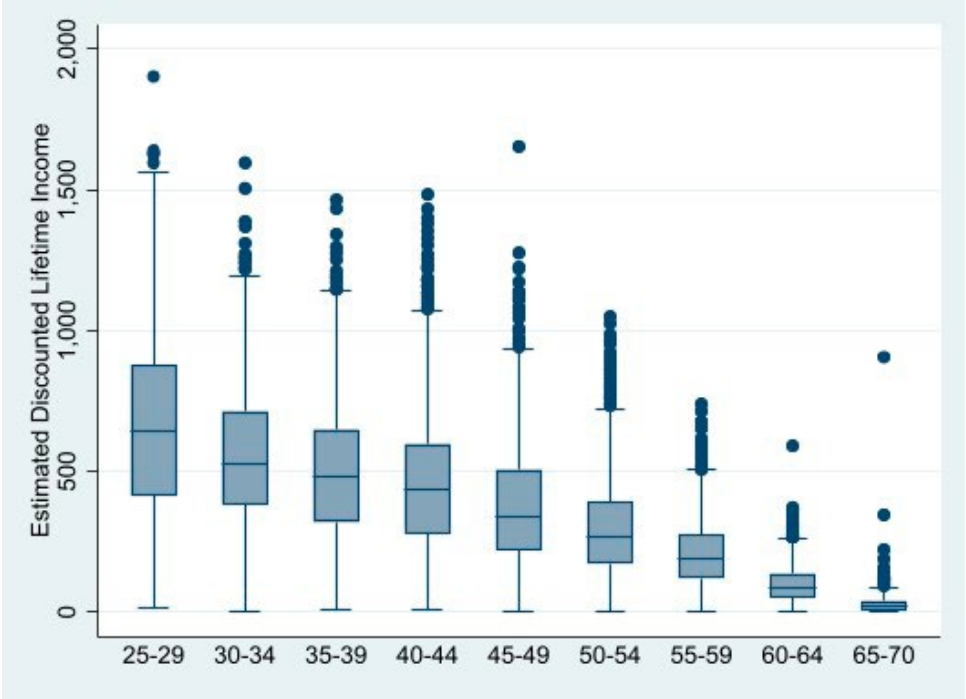
Notes: The figure plots the predicted discounted sum of lifetime equivalized household income (in euros), including AOW payments and minus housing expenditures, using the methods described in Section 4.2, over age for households with non- tertiary and tertiary education, separately. Predicted household income is based on fixed-effects estimation with the log of income as a dependent variable and a linear age spline as regressor. Predicted income is obtained from the predicted log of income using Duan's (1983) smearing estimate. Note that the figure does not include the discounted sum of AOW payments after age 70. Based on data from the DNB Household Survey (DHS) for the years 2004 to 2019.

with low interest rates, as used in Bovenberg et al. (2007), overestimates human capital in early and late life and underestimates it in between.

Human capital including AOW payments should reduce the convexity in late life due to the increase in income for households with members above the state pension age, thus making the drop in income less steep. Figure 3 shows that this prediction holds. Deducting housing expenditures from human capital produces a counter-clockwise spin around the point at age 70, where human capital is zero, as Figure 4 shows.

Differences in estimated human capital between households are enormous. In our estimations, the heterogeneity flows through the fixed effects of the income regressions. Figures 5 and 6 present box-plots of the predicted discounted sum of lifetime income (excluding AOW) including fixed effects (in thousands of euros), using the method described in Section 4.2, over age for households with non-tertiary and

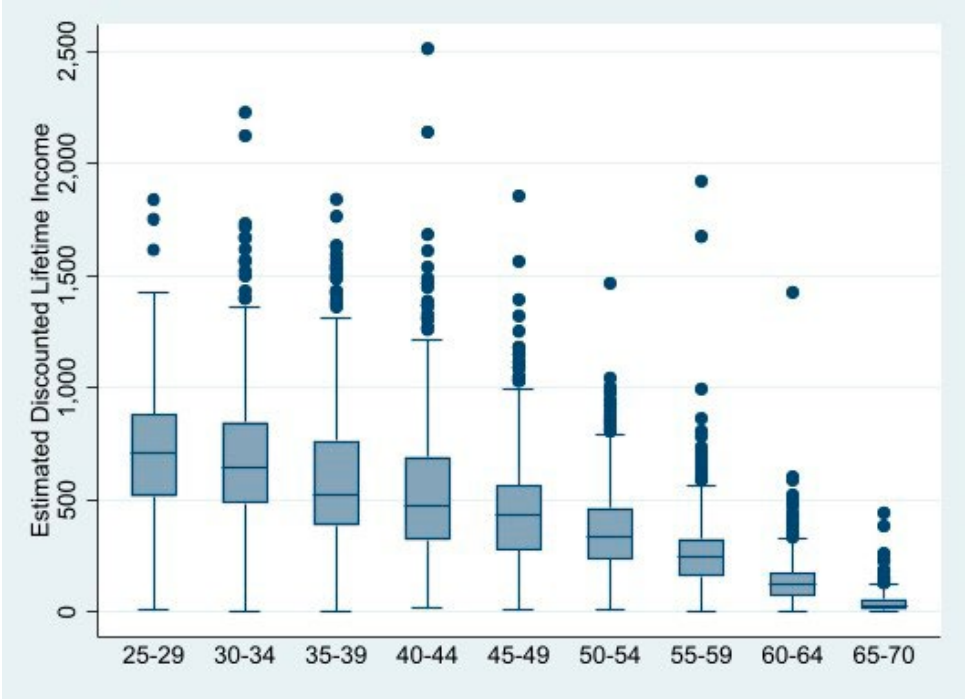
Figure 5: Human capital including fixed effects (1,000s €, excl. AOW) by age for households with non-tertiary education



Notes: This figure presents box-plots of the predicted discounted sum of lifetime income including fixed effects in thousands of euros, using the method described in Section 4.2, over age for households with non-tertiary education. Predicted household income is based on fixed-effects estimation with the log of income as a dependent variable and a linear age spline as regressors. Predicted income is obtained from predicted log of income using Duan's (1983) smearing estimate. Based on data from the DNB Household Survey (DHS) for the years 2004 to 2019.

tertiary education, respectively. The spread is not considerable for most households, but there are substantive outliers which have either a small or huge predicted fixed effect.

Figure 6: Human capital including fixed effects (1,000s €, excl. AOW) by age for households with tertiary education



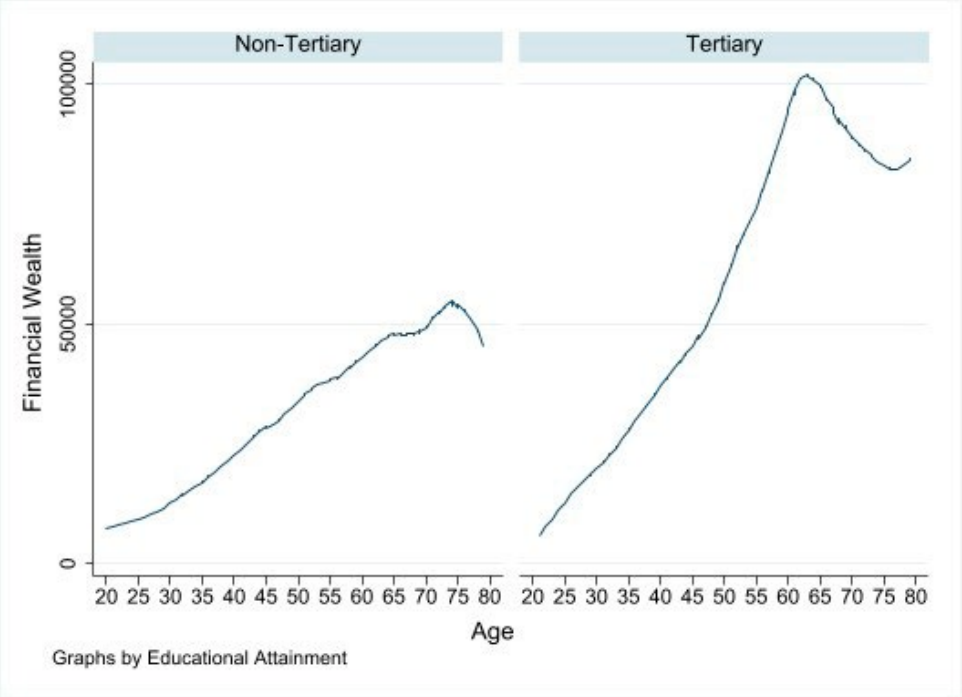
Notes: This figure presents box-plots of the predicted discounted sum of lifetime income including fixed effects (in thousands of euros), using the method described in Section 4.2, over age for households with tertiary education. Predicted household income is based on fixed-effects estimation, with the log of income as a dependent variable and a linear age spline as regressor. Predicted income is obtained from predicted log of income using Duan's (1983) smearing estimate. Based on data from the DNB Household Survey (DHS) for the years 2004 to 2019.

7. Results: Wealth

7.1 Financial Wealth

Figure 7 displays the path of free financial wealth over age, separately for households with tertiary and non-tertiary education. The raw data are smoothed using locally weighted scatterplot smoothing (lowess). For households with non-tertiary education, financial wealth increases almost linearly as the household ages. The accumulation of financial assets stops at a late age of 75, but there are not many households aged above 75 in our sample; the estimates are thus less precise for the oldest age group. For households with tertiary education, the accumulation of financial wealth is more rapid and displays some non-linearity. The peak of financial wealth holdings also comes sooner at around age 65, suggesting that households with higher education start to decumulate their financial wealth upon retirement, whereas households with non-tertiary education do so later, if at all.

Figure 7: Financial wealth (€) by age and educational attainment (smoothed)



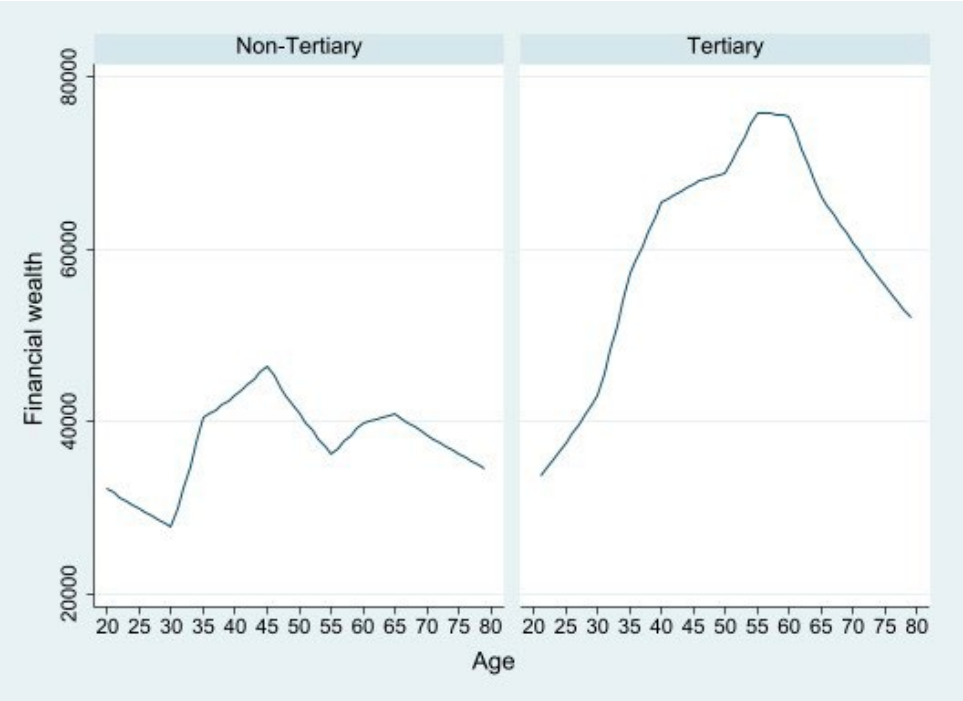
Notes: The figure plots financial wealth over age for households with non-tertiary and tertiary education, separately, using locally weighted scatterplot smoothing (lowess). Based on data from the DNB Household Survey (DHS) for the years 2004 to 2019.

In Figure 7 the role of cohort effects and other (time-invariant) control variables such as gender are not taken into account. We therefore estimate a multivariate regression model, very similar to the fixed effects model (3).[6] We use the same regression model for the other wealth variables. Figure 8 shows the age profile of financial wealth, which is obtained from this model. For households with non-tertiary education, financial wealth rises between age 30 and 35 and remains rather constant thereafter. The linearly increasing pattern of financial wealth in Figure 7 is, therefore, the result of differences in households with non-tertiary education. Later generations appear to accumulate less financial wealth than earlier generations (see also subsection 7.1.1). Note, however, that the results should be interpreted with caution as the estimates of the age profile are rather imprecise.

For households with tertiary education, the results are more in line with what Figure 7 would suggest. The general path of financial wealth is hump-shaped; there

6 The legend of Table B2 (see Appendix B) provides more details about this regression model. Zandberg (2012) has estimated the age profile of the ratio between financial wealth and permanent income.

Figure 8: Predicted financial wealth (€) by age and educational attainment



Notes: Figures plot the expected value of financial wealth in euros using the estimation approach discussed in Section 7.1. Based on data from the DNB Household Survey (DHS) for the years 2004 to 2019.

is a rapid accumulation of financial wealth early in life, which slows down subsequently. After retirement, financial wealth declines.

7.1.1 Heterogeneity

The regression models which are used to estimate the age-wealth profiles are also informative about the extent of heterogeneity in financial wealth holdings. The estimation results for households with non-tertiary education can be found in Column 1 of Table B2. Households with more adults hold more financial wealth, whereas female-headed households and households from younger cohorts hold substantially less financial wealth, after conditioning on age. More education, within the group with non-tertiary education, is associated with higher financial wealth holdings. Lastly, households where the head is disabled during an extended period have substantially lower financial wealth holdings, and retired households hold more financial wealth, even after including cohort dummies and conditioning on age. Self-employed households appear to hold similar amounts of financial wealth as the employed.
The results for households with tertiary education can be found in column 2 of Table B2. Qualitatively, the findings are similar to those for households with non-tertiary education. There are two main differences: the negative association of having a

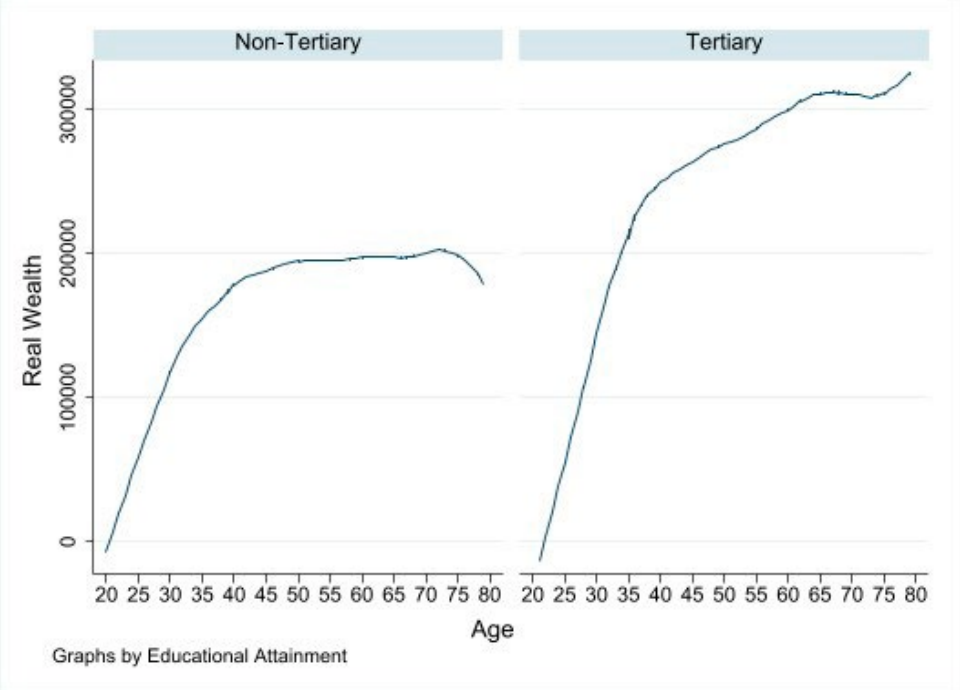
female household head is smaller for households with tertiary education, and a higher number of adults has a stronger positive effect. Generational differences are remarkably similar across non-tertiary and tertiary educated households.

7.2 Real Wealth

Figure 9 plots real wealth across age for each educational attainment group, using locally weighted scatterplot smoothing. For households with non-tertiary education, real wealth accumulation is rapid up to age 40 and slows down considerably after age 40. Given the limited number of households aged 75 or older, the slight drop in real wealth holdings late in life needs to be interpreted with caution. The development of real wealth over time suggests house purchasing between age 20 and 40 and few additional investments in real wealth after the age of 40. For households with tertiary education, real wealth accumulation is more persistent as households age. Accumulation is considerable up to age 40, but it also continues past that age. There is no indication of decumulation in this cross-sectional figure.

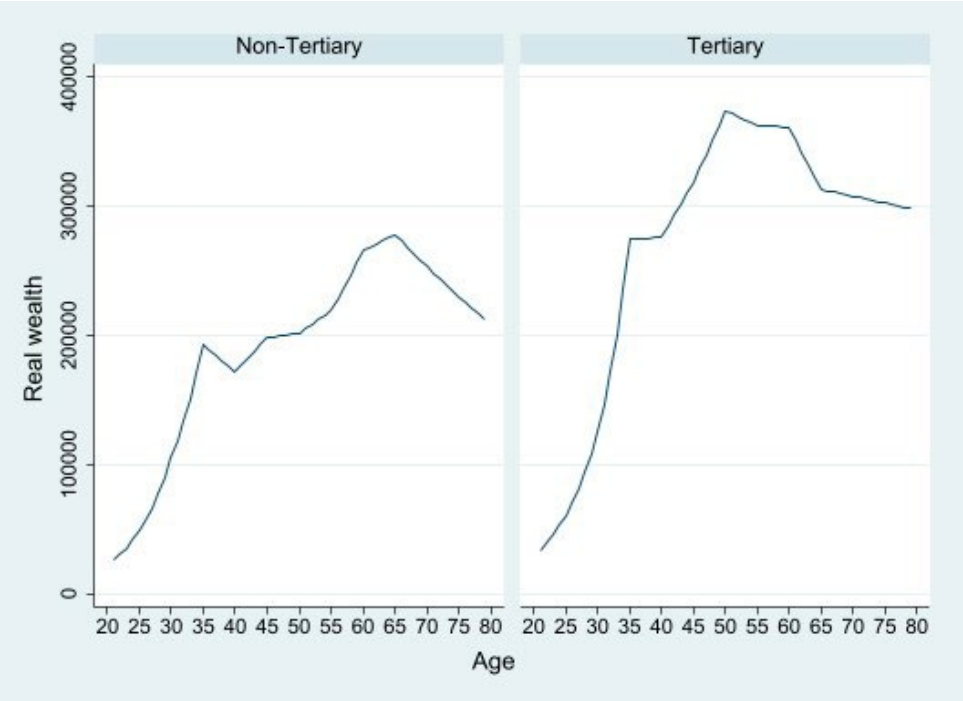
Figure 10 shows the regression results. For households with non-tertiary education, wealth increases up to age 65 and decreases thereafter. Same as for financial

Figure 9: Real wealth (€) by age and educational attainment (smoothed)



Notes: The figure plots real wealth over age for households with non-tertiary and tertiary education, separately, using locally weighted scatterplot smoothing (lowess). Based on data from the DNB Household Survey (DHS) for the years 2004 to 2019.

Figure 10: Predicted real wealth (€) by age and educational attainment



Notes: The figure plots expected value of real wealth (in euros) using the estimation approach discussed in Section 7.1. Based on data from the DNB Household Survey (DHS) for the years 2004 to 2019.

wealth, tertiary-educated households accumulate more rapidly before retirement. However, we do not see a significant decumulation of real wealth after retirement. This finding is also confirmed in other studies (see e.g. Van Ooijen et al., 2015)

7.2.1 Heterogeneity

We follow the same methods here as for financial wealth, with the results to be found in Columns 3 and 4 of Table B2. Column 3 shows the results for non-tertiary educated households, which indicate that female-headed households hold substantially less real wealth. There appear no generational effects, and higher education generally corresponds with more financial wealth holdings. Regarding occupational status, employment (including self-employment) is related to higher real wealth holdings, while disability corresponds with lower holdings. The employed and self-employed hold more real wealth than other households.

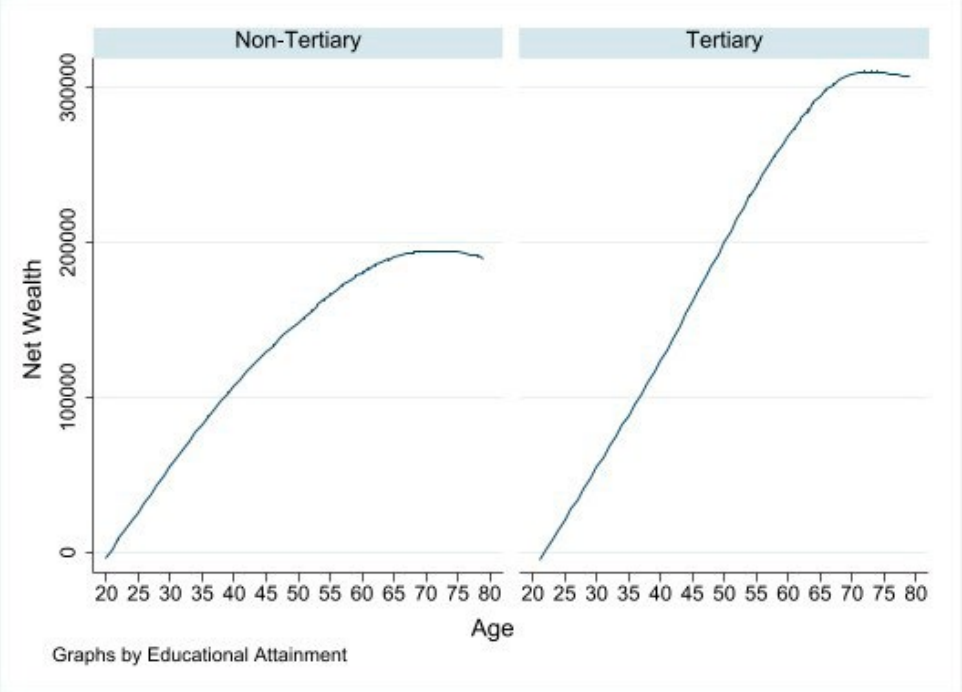
For households with tertiary education, we find no household gender differences and no generational effects, and no significant differences between non-employed, self-employed and disabled households. Contractually employed households hold more real wealth, as do retirees.

Columns 1 and 2 of Table B3 contain the results when looking at total wealth, i.e. the sum of financial and real wealth. Results are largely as expected, given the findings of Table B2.

7.3 Net Wealth

Figure 11 plots net wealth (total wealth minus total debts) in euros across age for each educational attainment group, using locally weighted scatterplot smoothing. Net wealth clearly increases as the household ages, for both educational attainment groups. It increases more rapidly and more persistently for households with tertiary education. For both groups, net wealth peaks around retirement, and there does not appear to be any decumulation during retirement in the cross-sectional figures. Figure 12 presents the age profiles following from the regression models. Compared to Figure 11, decumulation is visible during retirement for the non-tertiary educated households. Such a decline is not visible for households with tertiary education. Naturally, the peak of net wealth is higher than for non-tertiary-educated households.

Figure 11: Net wealth (€) by age and educational attainment (smoothed)



Notes: The figure plots net wealth over age for households with non-tertiary and tertiary education, separately, using locally weighted scatterplot smoothing (lowess). Based on data from the DNB Household Survey (DHS) for the years 2004 to 2019.

7.3.1 Heterogeneity

Columns 5 and 6 of Table B3 contain the results regarding heterogeneity in net wealth. Note that we have taken the log of net wealth, so only strictly positive net wealth holdings are contained in the estimation samples. Larger households have larger net wealth, and female-headed households hold less, although the latter effect is substantially smaller for tertiary-educated households. Contrary to real wealth, net wealth is subject to significant generational differences, with younger generations having less net wealth conditional on age. Employed, self-employed and retired households tend to hold substantially more net wealth than their non-employed and non-retired counterparts. All the above holds for both non-tertiary and tertiary educated households. Across these two groups, there is one noteworthy difference. Disability relates to substantially lower net wealth holdings for non-tertiary-educated households, but not for tertiary-educated households.

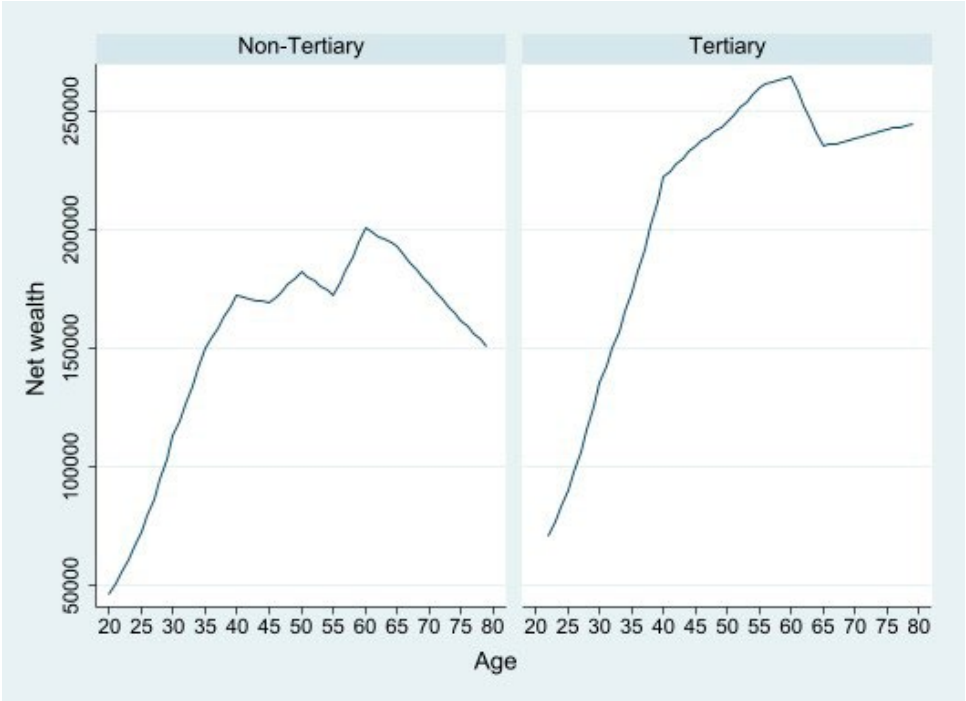
7.4 Risky Assets

7.4.1 Ownership

As many other studies have also found (see e.g. Haliassos and Bertaut, 1995), the portfolios of a majority of households is incomplete in the sense that they do not contain risky assets, as defined in Subsection 3.2. Figure 13 plots the smoothed ownership rates of risky assets (excluding bonds) across ages, separately for non-tertiary and tertiary-educated households. For both groups, ownership rates increase with age with a peak around 60. The peak is about 15 percentage points higher for tertiary-educated households (20 versus 35 percent). Ownership rates do not change after age 60.

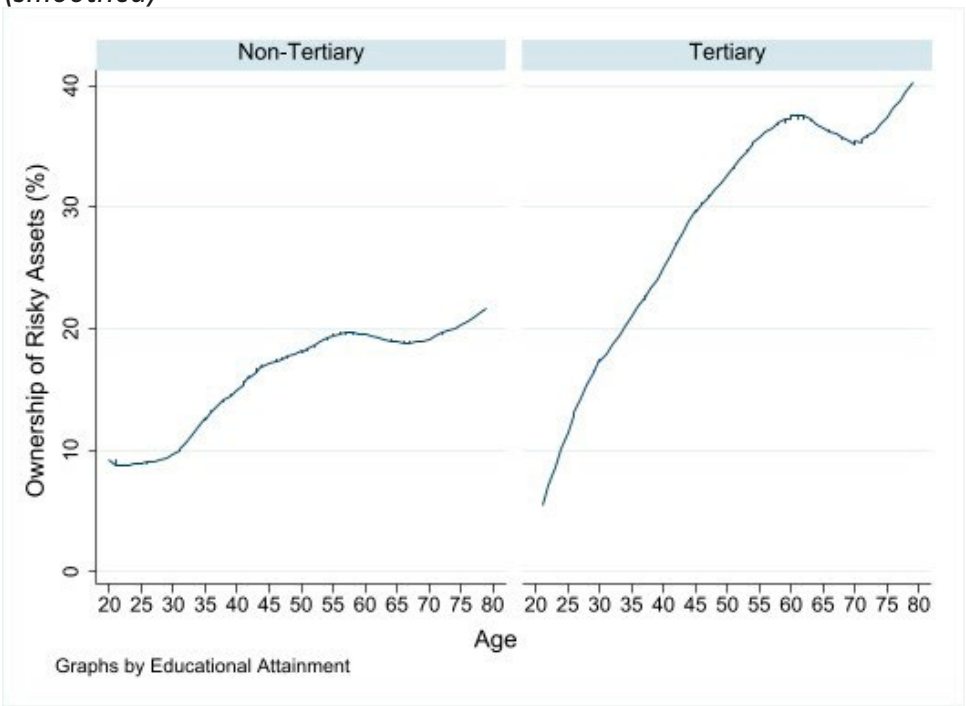
When modeling risky asset ownership, it is very important to take calendar year effects into account so as to capture the impact of the financial crisis. We therefore adjust the regression model, which we used to estimate the age profile of financial, real, and net wealth, in the following way: we replace the cohort dummies by a full set of year dummies. This meant removal of the cohort dummies because age, period, and cohort effects cannot otherwise be disentangled. Figure 14 displays the estimated age profile. The regression-based age profiles are more or less similar to the cross-sectional profiles presented in Figure 13. The peak ownership of risky assets is around age 60 for both education levels. Notably, ownership of risky assets is relatively high among the older age groups compared to the young ones.

Figure 12: Predicted net wealth (€) by age and educational attainment



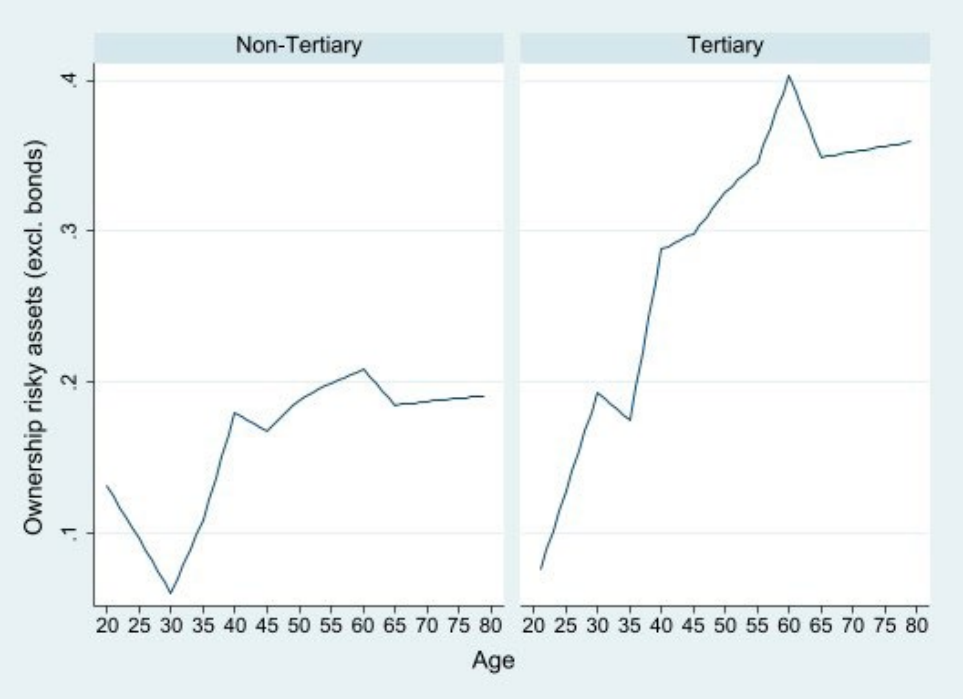
Notes: The figure plots the expected value of net wealth (in euros) using the estimation approach discussed in Section 7.1. Based on data from the DNB Household Survey (DHS) for the years 2004 to 2019.

Figure 13: Ownership of risky assets (excl. bonds) by age and educational attainment (smoothed)



Notes: The figure plots risky assets ownership rates over age for households with non-tertiary and tertiary education, separately, using locally weighted scatterplot smoothing (lowess). Based on data from the DNB Household Survey (DHS) for the years 2004 to 2019.

Figure 14: Probability of ownership of risky assets (excl. bonds) by age and educational attainment



Notes: The figure plots probability of risky assets ownership based on regression models described in the text. Based on data from the DNB Household Survey (DHS) for the years 2004 to 2019.

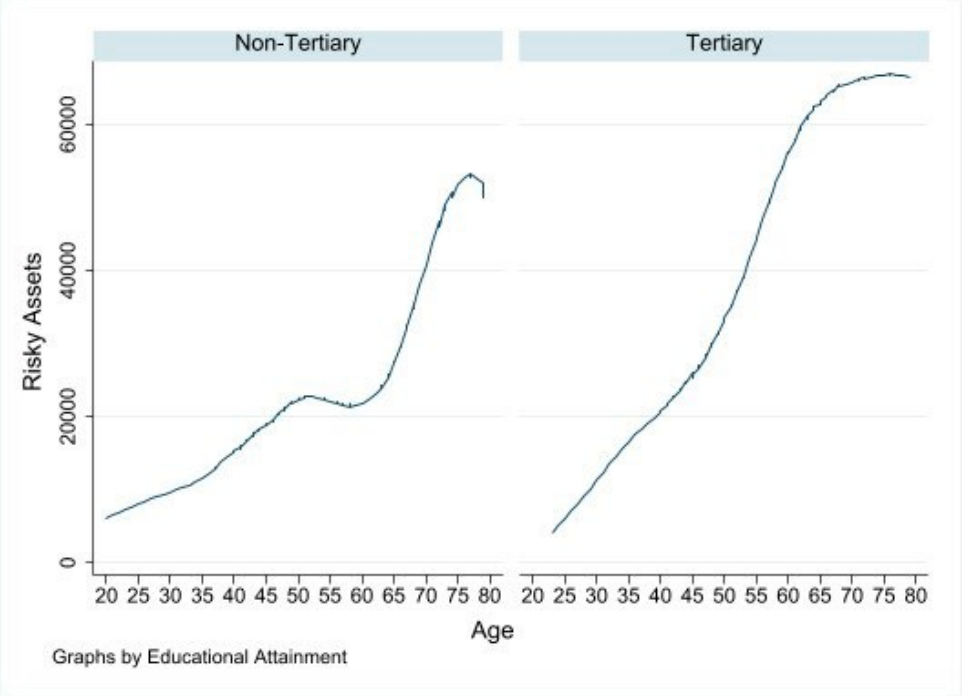
7.4.2 Size of Risky Assets Holdings

For households that hold risky assets, the amount invested therein increases over the life cycle, as Figures 15 and 16 show. The raw data and the fixed effects estimation show more or less similar patterns. However, when conditioning on fixed effects, households with tertiary education appear to accumulate risky assets more than those without tertiary education, which is less visible in the raw data. The steady increase in risky assets holdings with age is directly opposite to what the theory laid out in Section 2 predicts. Instead of younger households – who have more total wealth – holding more risky assets, the volume of risky assets actually increases with age.

7.4.3 Heterogeneity

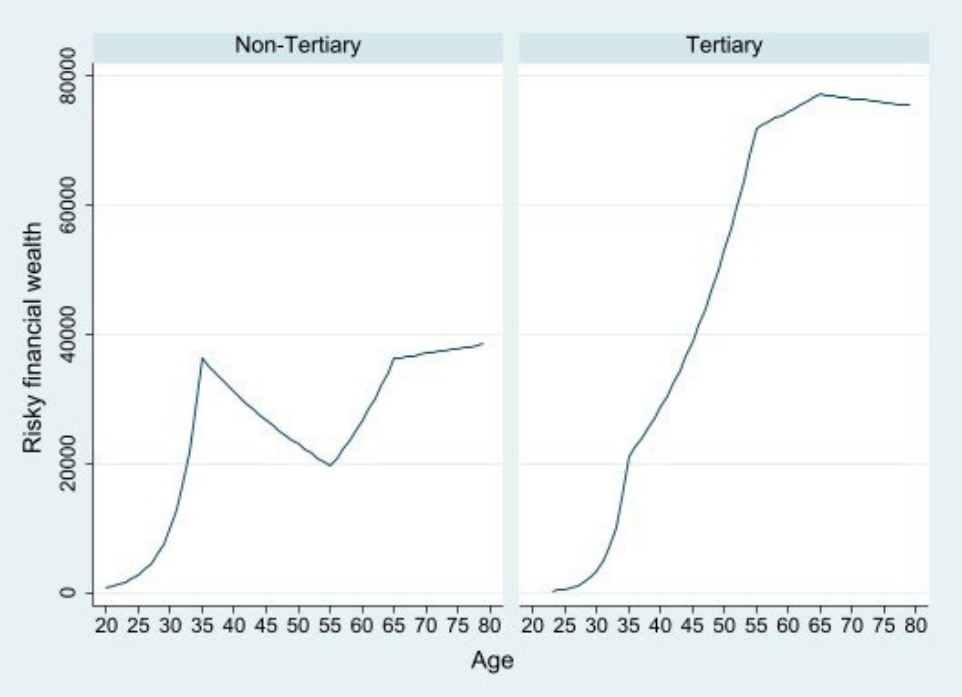
Table B4 in Appendix B contains an assessment of the heterogeneity in the amount of risky assets conditional upon ownership (columns 1 and 2), ownership rates (columns 3 and 4), and risky assets as a share of total financial wealth (columns 5 and 6). For risky-asset-owning households without tertiary education, the employees, retired and disabled hold less risky assets than the self-employed. Heterogeneity in risky

Figure 15: Risky assets (€) conditional upon ownership by age and educational attainment (smoothed)



Notes: The figure plots total risky assets excluding bonds over age for households with non-tertiary and tertiary education, separately, using locally weighted scatterplot smoothing (lowess). Based on data from the DNB Household Survey (DHS) for the years 2004 to 2019.

Figure 16: Predicted risky assets (€, excl. bonds) conditional on ownership by age and educational attainment



Notes: The figure plots the expected value of risky assets in euros using the estimation approach discussed in Section 7.1. Based on data from the DNB Household Survey (DHS) for the years 2004 to 2019.

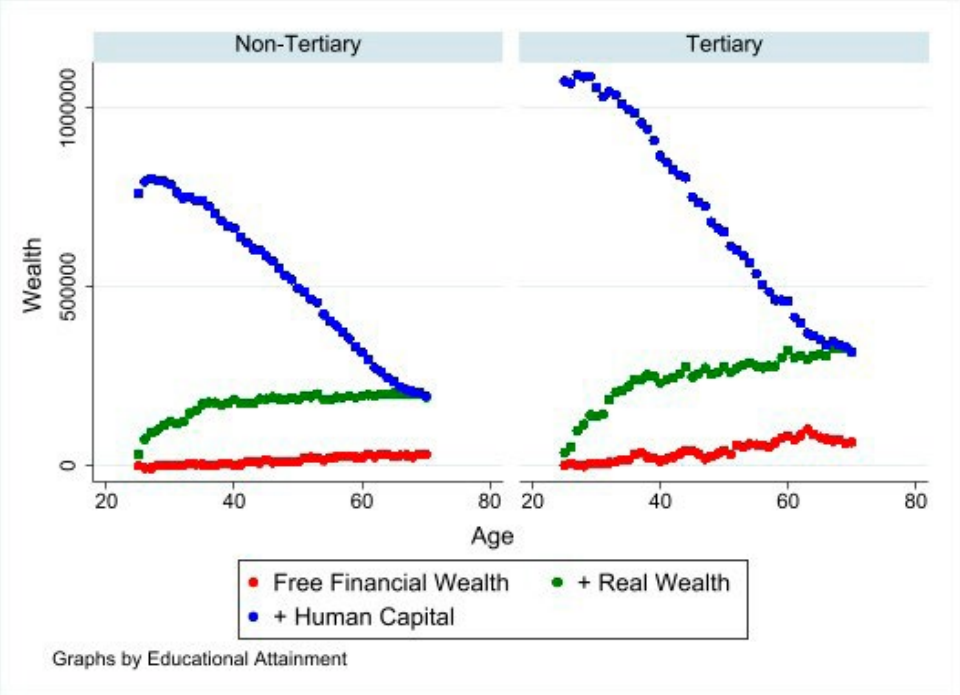
asset holdings among households with tertiary education cannot be explained by demographic and socio- economic variables (cf. column 2).

Columns 3 and 4 of Table B4 contain the estimations with ownership of risky assets as the dependent variable. Women are substantially less likely to hold risky assets. Ownership is also positively associated with education level.

8. Risk capacity: an overall view

To assess overall risk capacity, we plot in Figure 17 mean free financial wealth, mean real wealth and predicted human capital (without AOW) over the life cycle, on a cumulative basis.[7] For both non-tertiary and tertiary-educated households, free financial wealth steadily increases with age, as earlier findings suggested. The rise is steeper for the higher-educated group of households. From the age of 25 to 35, households acquire real wealth largely by means of home ownership. Here too, the rise is steeper for tertiary-educated households. Cumulatively, real and financial wealth acquisition occurs throughout the life cycle, at least up to the latest point in our data. Adding human capital to this sum shows the overall risk capacity profile over the life cycle. The gap between the risk capacity of tertiary-educated and non-tertiary-educated households decreases with age, both in relative and absolute terms; it is much narrower at age 70 than at age 25.

Figure 17: Risk capacity by age and educational attainment



Notes: The figure plots the overall risk capacity and its composition in euros. Human capital is based on the income definition which excludes AOW. Based on data from the DNB Household Survey (DHS) for the years 2004 to 2019.

7 It should be admitted that we do not provide a complete picture of overall risk capacity as the DHS does not contain information on how much pension wealth is built up and invested in other funds from previous employers.

9. Conclusion

In this paper we present risk capacity over the life cycle. To measure risk capacity, we look not only at income but also at 'free' (risky) financial and real assets, and at net worth. For all measures, we find that there are substantial differences in risk capacity across different age groups and that the age profile is strikingly different for individuals with low and high education. Although human capital decreases over the life cycle, household investment in risky assets increases with age up to the mid-50s. Nonetheless, the majority of the population does not privately invest in risky assets. This applies at all ages.

We also look at the heterogeneity in risk capacity in the population, controlling for age. In general, we find that the most vulnerable groups are households with a female head, those with lower education, and those not in employment.

Our findings provide useful input for pension funds when making their investment decisions. However, for several reasons it is still difficult to determine which exact implications our research has for the investment policy of pension funds. First, pension funds should also take into account how risk-tolerant their participants are. Second, we did not attempt to assess the risk of human capital, nor the appropriate discount rate for future income. Third, it should be realized that our measure of risk capacity is incomplete because DHS does not provide any information on pension wealth built up in other pension funds from previous employers. Fourth, the distribution of risk capacity may differ dramatically across pension funds. Given the limited size of our dataset we could not investigate this issue in more detail.

To address these issues, administrative panel datasets from Statistics Netherlands should be used in future research. These datasets provide accurate information about the size and composition of gross income and about private wealth, which would allow estimation of the risk of human capital.[8] Moreover, one could then also infer how many people have built up pensions in one or more pension funds. Since the name of the pension funds is also known and given the large size of the datasets, information by pension fund can then be provided on the distribution of human capital and of private and pension wealth and on the heterogeneity therein. Moreover, one can then check whether the shape of the age-income and age-wealth profiles varies with pension fund membership.

8 The paper by De Nardi et al. (2021) provides useful input to estimate this risk.

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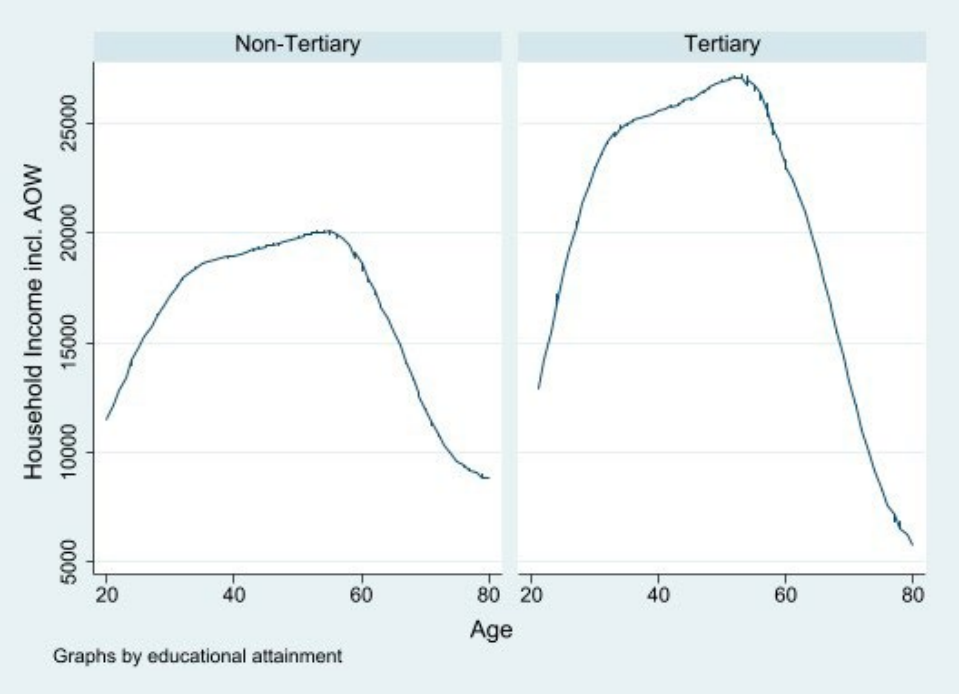
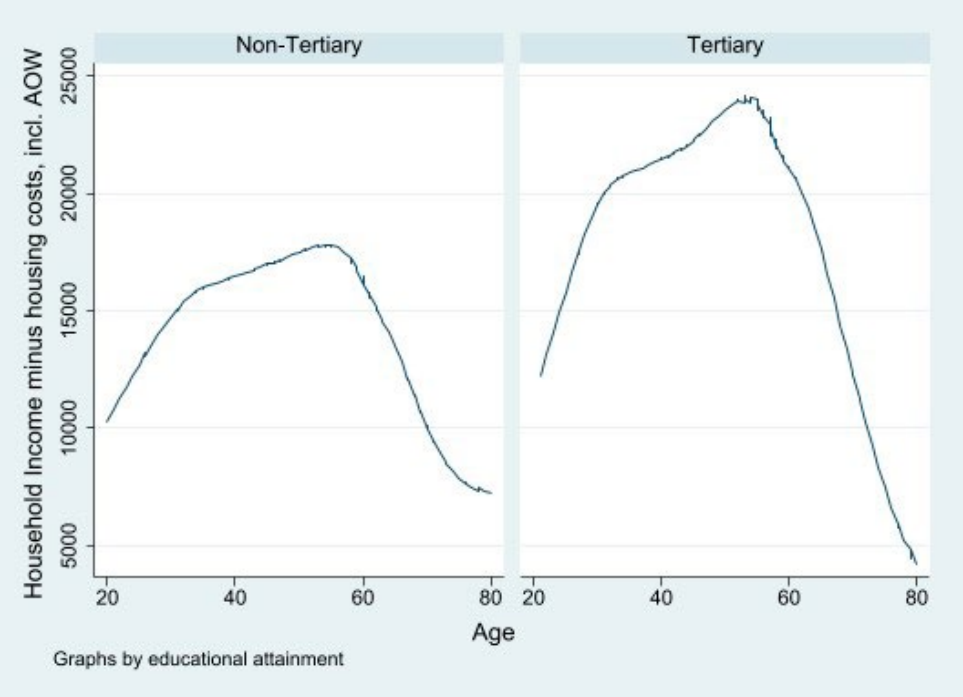
A Additional Figures

Figure A1: Household income (in €, incl. AOW) by age and educational attainment (smoothed)



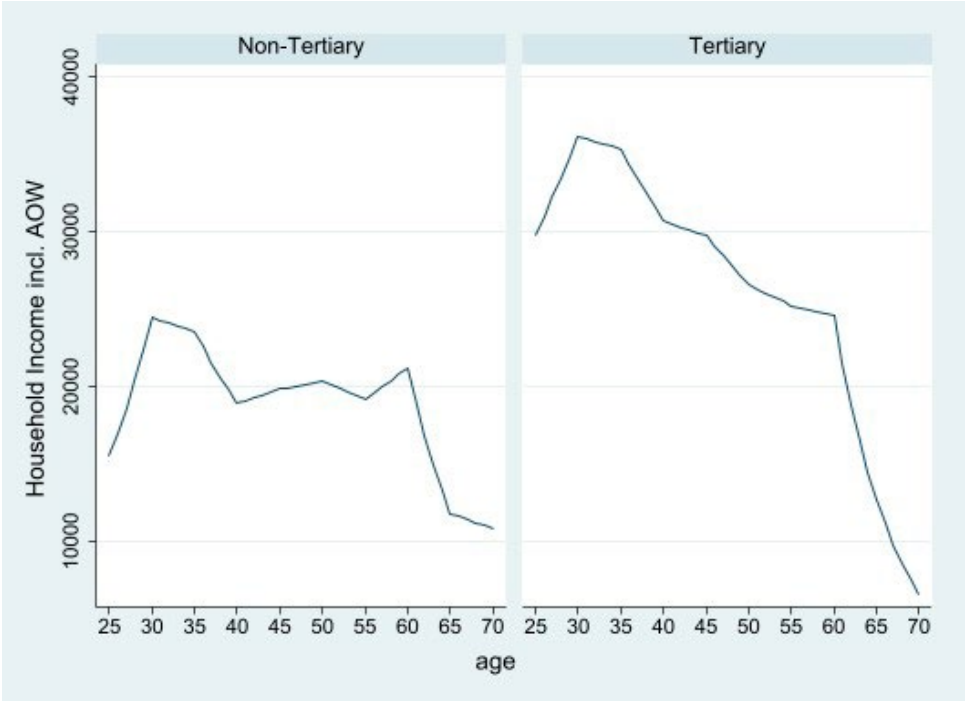
Notes: The figure plots equivalized household income (in euros), including AOW payments, as defined in Section 3.1, over age for households with non-tertiary and tertiary education, separately, using locally weighted scatterplot smoothing (lowess). Based on data from the DNB Household Survey (DHS) for the years 2004 to 2019.

Figure A2: Household income minus housing expenditure (in €, incl. AOW) by age and educational attainment (smoothed)



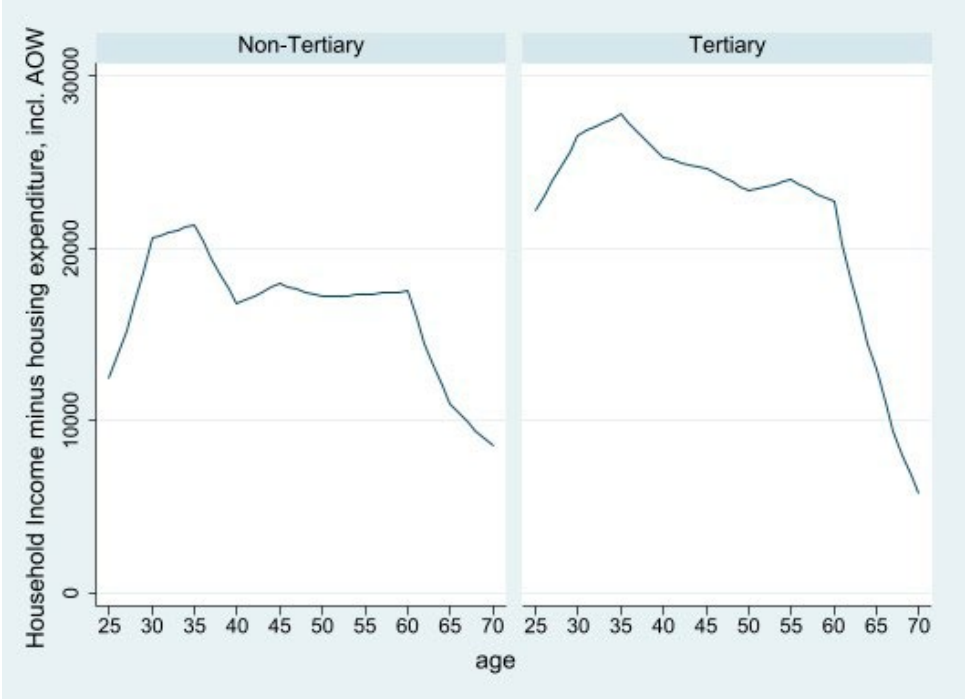
Notes: The figure plots equivalized household income less housing expenditures in euros, including AOW payments, as defined in Section 3.1, over age for households with non-tertiary and tertiary education, separately, using locally weighted scatterplot smoothing (lowess). Based on data from the DNB Household Survey (DHS) for the years 2004 to 2019.

Figure A3: Household income (in €, incl. AOW) by age and educational attainment



Notes: The figure plots predicted equivalized household income in euros, including AOW payments, as defined in Section 3.1, over age for households with non-tertiary and tertiary education, separately. Prediction based on fixed-effects estimation with the log of income as a dependent variable and a linear age spline as regressor. Predicted income is obtained from predicted log of income using Duan's (1983) smearing estimate. Based on data from the DNB Household Survey (DHS) for the years 2004 to 2019.

Figure A4: Household income minus housing expenditure (in €, excl. AOW) by age and educational attainment



Notes: The figure plots predicted equivalized household income in euros, including AOW payments and minus housing expenditure, as defined in Section 3.1, over age for households with non-tertiary and tertiary education, separately. Prediction based on fixed-effects estimation with the log of income as a dependent variable and a linear age spline as regressor. Predicted income is obtained from predicted log of income using Duan's (1983) smearing estimate. Based on data from the DNB Household Survey (DHS) for the years 2004 to 2019.

B Heterogeneity Tables

Table B1: Heterogeneity in household income by educational status

	Excl. AOW (ln)		Incl. AOW (ln)		Incl. AOW (ln) minus Hous. Exp. (ln)	
	Non-tertiary	Tertiary	Non-tertiary	Tertiary	Non-tertiary	Tertiary
Number of children aged 0-6	-0.160***	-0.114***	-0.158***	-0.113***	-0.195***	-0.107***
	(0.040)	(0.033)	(0.039)	(0.033)	(0.070)	(0.028)
Number of children aged 7-12	-0.122*	-0.201***	-0.121*	-0.130*	-0.160**	-0.065
	(0.073)	(0.059)	(0.073)	(0.078)	(0.077)	(0.072)
Number of children aged 13-17	-0.147	-0.118	-0.158*	-0.155**	-0.159**	-0.201***
	(0.094)	(0.077)	(0.085)	(0.070)	(0.077)	(0.069)
Number of children aged 18+	0.090	0.027	0.053	0.367**	0.167	0.068
	(0.147)	(0.202)	(0.122)	(0.161)	(0.120)	(0.127)
Number of adults in household	-0.070	-0.117*	-0.098*	-0.139**	-0.088**	-0.191***
	(0.054)	(0.066)	(0.050)	(0.059)	(0.043)	(0.066)
Female head of household	-0.172***	-0.125***	-0.139***	-0.126***	-0.174***	-0.145***
	(0.043)	(0.035)	(0.040)	(0.035)	(0.038)	(0.035)
Cohort (base is born before 1956)						
Born between 1956 and 1964	-0.239***	-0.233***	-0.250***	-0.258***	-0.203***	-0.195***
	(0.058)	(0.077)	(0.057)	(0.077)	(0.051)	(0.072)
Born between 1965 and 1973	-0.276***	-0.440***	-0.288***	-0.460***	-0.290***	-0.391***
	(0.076)	(0.102)	(0.076)	(0.102)	(0.071)	(0.100)
Born after 1973	-0.381***	-0.454***	-0.393***	-0.471***	-0.376***	-0.411***
	(0.089)	(0.105)	(0.088)	(0.105)	(0.084)	(0.107)
Educational attainment (base is kindergarten and primary school)						
VMBO (pre-vocational education	0.131		0.154		0.134	
	(0.114)		(0.098)		(0.092)	
HAVO, VWO (pre-university education)	0.345***		0.280***		0.263***	
	(0.119)		(0.104)		(0.096)	
Senior vocational training	0.250**		0.240**		0.217**	
	(0.114)		(0.099)		(0.093)	
University education		0.212***		0.174***		0.164***
		(0.035)		(0.034)		(0.035)
Occupational Status (base is other)						
Employed	0.785***	0.997***	0.713***	0.956***	0.633***	0.872***
	(0.102)	(0.130)	(0.093)	(0.120)	(0.078)	(0.133)
ZZP(self-employed)	0.280*	0.655***	0.213	0.638***	0.111	0.531***
	(0.144)	(0.153)	(0.136)	(0.140)	(0.125)	(0.152)
Retired	0.075	0.478**	0.079	0.299**	0.003	0.196
	(0.141)	(0.190)	(0.100)	(0.149)	(0.086)	(0.170)
Disabled	0.262**	0.185	0.199**	0.143	-0.011	0.112
	(0.105)	(0.201)	(0.097)	(0.204)	(0.093)	(0.188)
Number of observations	9246	7027	10116	7555	9356	6929
Number of households	2619	1964	2786	2042	2655	1916
Adjusted R-squared	0.179	0.163	0.119	0.212	0.150	0.203
F-test Mundlak variables (p-value)	0.741	0.425	0.595	0.271	0.312	0.461

Notes: Based on DHS data for the years 2004-2019 for households where the age of the head of the household is between 25 and 70. Results display pooled OLS regressions of the dependent variable specified in the column titles on the listed regressors, their household-specific mean (Mundlak-Chamberlain device), and a fully specified linear age spline with a knot every five years. Results for the latter two are omitted. For the female, cohort, education, and occupational status dummies, only the household-specific means are included. The *F* -test on the final row is exclusively on Mundlak terms, for which the non-meaned variable is also in the regression, i.e. the children-by-age-category variables and the number of adults. Clustered standard errors in parentheses. *, ** and *** indicate significance at the 10, 5 and 1 percent level, respectively.

Table B2: Heterogeneity in financial and real wealth by educational status

	Financial Wealth (ln)		Real Wealth (ln)	
	Non-tertiary	Tertiary	Non-tertiary	Tertiary
Number of children aged 0-6 in HH	-0.086	-0.072	0.009	0.132*
	(0.067)	(0.053)	(0.056)	(0.071)
Number of children aged 7-12 in HH	0.293***	0.179*	0.151*	-0.029
	(0.094)	(0.107)	(0.083)	(0.161)
Number of children aged 13-17 in HH	0.261***	0.109	0.092	0.023
	(0.096)	(0.118)	(0.061)	(0.100)
Number of children aged 18+ in HH	0.051	-0.142	0.224***	0.045
	(0.152)	(0.181)	(0.078)	(0.083)
Number of adults in household	0.143*	0.280***	0.341***	0.515***
	(0.081)	(0.079)	(0.080)	(0.149)
Female head of household	-0.438***	-0.260***	-0.451***	-0.146
	(0.094)	(0.099)	(0.143)	(0.106)
Cohort (base is born before 1956)				
1956-1965	-0.144	-0.269	0.129	-0.006
	(0.149)	(0.181)	(0.168)	(0.172)
1965-1973	-0.622***	-0.634***	-0.120	-0.001
	(0.180)	(0.236)	(0.216)	(0.201)
1973-1994	-0.812***	-0.753***	-0.083	-0.039
	(0.206)	(0.257)	(0.249)	(0.224)
Educational attainment, base: kindergarten and primary school				
VMBO (pre-vocational education	0.362*		0.241	
	(0.192)		(0.245)	
HAVO, VWO (pre-university education)	0.813***		0.699***	
	(0.202)		(0.253)	
senior vocational training	0.621***		0.484**	
	(0.194)		(0.245)	
university education		0.520***		0.180**
		(0.083)		(0.084)
Occupational Status (base is other)				
Employed	0.424**	1.043***	0.486**	0.766**
	(0.165)	(0.367)	(0.242)	(0.365)
ZZP (self-employed)	0.696***	0.974**	0.907***	0.530
	(0.231)	(0.409)	(0.291)	(0.395)
Retired	0.672***	1.088***	0.276	0.939**
	(0.188)	(0.363)	(0.257)	(0.369)
Disabled	-0.355	0.356	-1.347***	0.227
	(0.228)	(0.492)	(0.348)	(0.535)
Number of observations	13505	9586	11242	8024
Number of households	3092	2127	2519	1731
Adjusted R-squared	0.106	0.135	0.145	0.142
F-test Mundlak variables (p-value)	0.001	0.146	0.001	0.487

Notes: Based on DHS data for the years 2004-2019 for households where the age of the head of the household is between 25 and 80. Results display pooled OLS regressions of the dependent variable specified in the column titles on the listed regressors, their household-specific mean (Mundlak-Chamberlain device), and a fully specified linear age spline with a knot every five years. Results for the latter two are omitted. For the female, cohort, education, and occupational status dummies, only the household-specific means are included. The *F* -test on the final row is exclusively on Mundlak terms for which the non-meaned variable is also in the regression, i.e. the children-by-age-category variables and the number of adults. Clustered standard errors in parentheses.
*, ** and *** indicate significance at the 10, 5 and 1 percent level, respectively.

Table B3: Heterogeneity in total wealth, total debt and net wealth

uneven columns: non-tertiary even columns: tertiary	Total Wealth (log) (1)	 (2)	Total Debt (log) (3)	 (4)	Net Wealth (log) (5)	 (6)
Number of children						
Aged 6 and below	0.016	0.128**	−0.001	−0.038	0.004	0.117*
	(0.053)	(0.063)	(0.076)	(0.055)	(0.067)	(0.069)
Aged between 7 and 12	0.124**	0.187	0.098	0.008	0.139**	0.243*
	(0.060)	(0.141)	(0.095)	(0.089)	(0.070)	(0.141)
Aged between 13 and 17	0.169***	0.076	0.051	0.120	0.155**	−0.049
	(0.063)	(0.096)	(0.174)	(0.136)	(0.068)	(0.072)
Aged 18 and over	0.049	−0.084	0.141	−0.357	0.004	−0.083
	(0.135)	(0.087)	(0.176)	(0.226)	(0.140)	(0.082)
Number of adults	0.443***	0.600***	0.365***	0.201*	0.318***	0.554***
	(0.079)	(0.128)	(0.113)	(0.118)	(0.069)	(0.109)
Female head of household	−0.543***	−0.214**	−0.520***	−0.095	−0.475***	−0.178*
	(0.118)	(0.102)	(0.136)	(0.099)	(0.115)	(0.100)
Cohort (base is born before 1956)						
Born between 1956 and 1964	−0.135	−0.198	0.023	−0.100	−0.165	−0.209
	(0.154)	(0.171)	(0.158)	(0.173)	(0.153)	(0.167)
Born between 1965 and 1973	−0.539***	−0.337*	−0.127	0.241	−0.607***	−0.721***
	(0.204)	(0.189)	(0.188)	(0.195)	(0.194)	(0.195)
Born after 1973	−0.556**	−0.397*	0.005	0.381*	−0.848***	−0.857***
	(0.236)	(0.216)	(0.252)	(0.210)	(0.231)	(0.228)
Educational attainment (base is kindergarten and primary school)						
VMBO (pre-vocational education)	0.461**		0.338		0.410**	
	(0.221)		(0.267)		(0.208)	
HAVO, VWO (pre-university education)	0.868***		0.736***		0.775***	
	(0.228)		(0.274)		(0.215)	
Senior vocational training	0.745***		0.512*		0.660***	
	(0.221)		(0.271)		(0.208)	
University educated (base is HBO)		0.259***		0.313***		0.239***
		(0.073)		(0.077)		(0.073)
Occupational status (base is other)						
Employed	1.040***	1.306***	1.111***	0.731***	0.615***	0.933***
	(0.213)	(0.357)	(0.266)	(0.276)	(0.207)	(0.355)
ZZP (self-employed)	1.473***	1.088***	1.392***	0.336	1.101***	0.722*
	(0.270)	(0.395)	(0.328)	(0.375)	(0.263)	(0.394)
Retired	0.917***	1.324***	1.071***	0.846***	0.708***	1.073***
	(0.236)	(0.352)	(0.277)	(0.277)	(0.231)	(0.352)
Disabled	−0.751**	0.271	−0.368	0.157	−0.671**	0.324
	(0.293)	(0.511)	(0.327)	(0.411)	(0.284)	(0.476)
Constant	4.432***	3.188**	6.530***	3.395***	5.979***	6.927***
	(0.928)	(1.249)	(1.054)	(1.173)	(0.940)	(1.367)
Observations	12,531	8,718	7,845	6,272	11,511	7,827
Number of households	2,825	1,886	2,064	1,558	2,622	1,728
Adjusted $R2$	0.236	0.246	0.119	0.109	0.201	0.243
F-test on Mundlak variables (p-value)	4.37 (.001)	1.19 (.309)	1.04 (.392)	1.66 (.142)	4.60 (.000)	1.60 (.156)

Notes: Based on DHS data for the years 2004–2019 for households where the age of the head of the household is between 25 and 70. Results display pooled OLS regressions of the dependent variable specified in the column titles on the listed regressors, their household-specific mean (Mundlak-Chamberlain device), and a fully specified age spline with a knot every five years. Results for the latter two are omitted. For the female, cohort, education, and occupational status dummies, only the household-specific means are included. The F-test on the final row is exclusively on Mundlak terms, for which the non-meaned variable is also in the regression, i.e. the children-by-age-category variables and the number of adults. Clustered standard errors in parentheses. *, ** and *** indicate significance at the 10, 5 and 1 percent level, respectively.

Table B4: Heterogeneity in risky assets (excl. bonds)

	Risky assets (ln) among owners		Ownership		Risky assets/Fin. Wealth (%)	
	Non-tertiary	Tertiary	Non-tertiary	Tertiary	Non-tertiary	Tertiary
Number of children in household						
Number of children aged 0-6	-0.204	0.042	-0.004	-0.009	-3.766	6.261*
	(0.188)	(0.175)	(0.016)	(0.014)	(2.552)	(3.601)
Number of children aged 7-12	-0.345***	-0.069	0.020	0.042	-2.472	-4.012
	(0.104)	(0.132)	(0.027)	(0.040)	(2.236)	(2.613)
Number of children aged 13-17	0.300	-0.175	0.037	0.129***	1.426	-4.787
	(0.188)	(0.140)	(0.032)	(0.046)	(2.159)	(3.571)
Number of children aged 18+	0.290	-0.381*	-0.021	-0.046	5.141	-3.567
	(0.300)	(0.215)	(0.044)	(0.032)	(4.748)	(5.386)
Number of adults in household	-0.183	0.034	-0.002	0.006	-9.546***	-0.514
	(0.181)	(0.150)	(0.016)	(0.015)	(2.680)	(3.094)
Female head of household	0.031	-0.096	-0.065***	-0.098***	2.996	-0.358
	(0.237)	(0.194)	(0.020)	(0.025)	(2.960)	(2.724)
Cohort (base is born before 1956)						
1956-1965	0.365	0.026			1.296	0.529
	(0.335)	(0.389)			(4.242)	(4.137)
1965-1973	0.328	0.056			0.975	-4.899
	(0.488)	(0.545)			(4.852)	(5.252)
1973-1994	0.279	-0.305			1.444	-8.937
	(0.715)	(0.687)			(6.849)	(6.236)
Educational attainment, base: kindergarten and primary school						
VMBO (pre-vocational education	-0.348		0.010		-3.935	
	(0.520)		(0.036)		(3.733)	
HAVO, VWO (pre-university education)	0.003		0.143***		-3.383	
	(0.533)		(0.043)		(3.985)	
Senior vocational training	-0.236		0.067*		-1.349	
	(0.536)		(0.039)		(3.910)	
University education		0.235		0.109***		0.197
		(0.177)		(0.025)		(2.099)
Occupational status (base is other)						
Employed	-0.617**	0.456	0.028	0.058	-6.565	6.834
	(0.305)	(0.580)	(0.029)	(0.061)	(4.854)	(6.747)
ZZP	0.074	1.009	0.048	0.033	-8.651	9.929
	(0.443)	(0.623)	(0.044)	(0.074)	(7.082)	(7.769)
Retired	-1.104***	1.041	0.069*	0.036	-9.388*	9.365
	(0.326)	(0.716)	(0.038)	(0.074)	(5.484)	(7.165)
Disabled	-0.861*	0.626	-0.029	-0.094	-8.235	3.097
	(0.448)	(0.671)	(0.040)	(0.083)	(5.690)	(9.442)
Number of observations	2530	3018	14501	9931	2466	2963
Number of households	678	792	3255	2184	668	784
Adjusted R-squared	0.063	0.100	0.043	0.064	0.032	0.042
F-test Mundlak variables (p-value)	0.067	0.482	0.721	0.317	0.002	0.243

Notes: Based on DHS data for the years 2004-2019 for households where the age of the head of the household is between 25 and 80. Results display pooled OLS regressions of the dependent variable specified in the column titles on the listed regressors, their household-specific mean (Mundlak-Chamberlain device), and a fully specified age spline with a knot every five years. Results for the latter two are omitted. For the female, cohort, education, and occupational status dummies, only the household-specific means are included. For the regressions explaining ownership, we replaced the cohort dummies by a full set of year dummies as explained in subsection 7.4.1. The *F*-test on the final row is exclusively on Mundlak terms for which the non-meaned variable is also in the regression, 'I.e. the children-by-age-category variables and the number of adults. Clustered standard errors in parentheses. *, ** and *** indicate significance at the 10, 5 and 1 percent level, respectively.

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