Bank of Finland

BoF Economics Review

6 • 2022

The effects of age and cohort on household saving

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Abstract

According to the standard life cycle model, household saving rate should peak at the best working age and turn then to decline so that households dissolve their savings after retirement. This study examines, how age and birth cohort affect the saving behavior of the Finnish households. A synthetic panel data is used to estimate an empirical age-cohort-period model of income, consumption and saving rate of the households. The results suggest that the Fnnish households continue saving even in the old age and younger cohohorts tend to save more than the older ones. Thus, a projected aggregate saving rate of the Finnish economy will slightly increase during the next two decades.

Keywords: population aging, household saving, age-cohor-period models, synthetic cohort

JEL codes: E21, J11

1. Introduction

The share of elderly people on total household income has been increasing steadily as aging of the Finnish population has continued. Both the number of pensioners and the average level of pensions have increased. As their incomes have grown, the old age cohorts have also increased their share of total household consumption. In recent years, the age group of over 64-year-old has even consumed a larger share of their income than the Finnish households in average[1].

Changes in distribution of income and consumption between young and old is also likely to have consequences on the aggregate savings rate. The standard life cycle hypothesis (LCH) of consumption predicts a hump shaped pattern for the age profile of the saving rate of individuals. According to the LCH, households smooth their consumption over their life cycle by saving at middle age, which is their best working age, and dissolving their savings after retirement[2].

The lower saving rates of the elderly implies that the aggregate household savings rate should fall as the share of retirees of the population increases because of the population aging. In practice, the decisions of the elderly whether to save or decumulate their assets are also affected by other motives than those described by the LCH. The elderly may aim at leaving bequests to their children, or they continue saving for precautionary motives because of lifetime uncertainty and non-insurable health hazards. The net effect of all these factors on the aggregate savings rate remains an empirical question, however.

To make projections on the impact of the population aging on the aggregate savings rate, the effects of age on effects of income, consumption and saving behavior of individuals must be estimated. The age profiles may, however, change over time, which should be taken in account when estimating the age profiles from cross sections of data. The cross-sections consist of individuals from different generations that may differ in lifetime wealth, intertemporal preferences over consumption/saving or institutional environment (like social security or education).

The goal of this study is to estimate the independent effects of age and birth cohort of the household head on the saving of the Finnish households. The estimated age effects reveal whether the saving behavior of the Finnish households is in accordance with the predictions of the basic life cycle model of consumption. The cohort effects, in turn, tell of possible changes in overall saving behavior of the Finnish households over time.

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[1] See e.g. Mäki-Fränti (2018).
[2] In addition to the life cycle hypothesis, the potentially lower savings rate of the elderly can be motivated by the lesser need for precautionary savings, implied by the low volatility of pension income

The empirical model is estimated using cross sections from Finnish Consumer Survey data. As the state of business cycle may also have an independent effect on saving decision that can't be explained by age and cohort, we control for the effect of the survey period when estimating the model. Finally, based on the estimated model, we construct a projection on how the aggregate saving rate of the Finnish economy will develop in the coming years.

2. Previous studies

Existing literature provides evidence of hump shaped age pattern of saving, predicted by the LCH, for many countries. In some studies the results are, however, somewhat sensitive on whether the saving rate is estimated on household or individual level, and which other factors than cohort and period are controlled for. Previous studies based on synthetic cohorts and age-cohort-period framework include e.g. Attanasio (1993), Börsch & Supan (1994), Deaton & Paxson (2000), Demery & Duck (2004), Movshuk (2012) and Finley & Price (2014).

Attanasio (1993) found a hump shaped age profile for the saving of the U.S. households, peaking at the age of 60. Demery & Duck (2004) estimate age-cohort-period models for the UK with both household and individual level data, finding that the age profile of savings rate more closely follows the hump shape in the latter case. Finley & Price (2014) found more concave profile for Australian households, with the exception of a dip in the saving rates of the households at the age of 30-50. Vink (2014), in turn, estimates a hump shaped age profile of saving rate for the households in New Zealand. Movshuk (2012) examines the saving behavior of the Japanese households, also controlling for the effects of family structure. The results suggest that households with children are more motivated to maintain high saving rate up to the retirement than the households without them.

The previous studies provide mixed evidence on the direction of the cohort effects, that is, whether the younger generations tend to have higher or lower saving rates compared to the older generations at the same age. In some cases, like Attanasio (1993), which estimated cohort effects for the U.S. households, the cohort effects did not show any clear tendency on any direction. The results suggested, however, that those born between 1925-1939 had a dip in their saving rates in the 1980s, which accounted for the low savings rate among the working age population at that time. Börsch and Supan (1994), in turn, suggest that the savings rates of German households turned to decrease from the cohorts born in the 1940s onwards. Finley & Price (2014) found their cohort effects more difficult to interpret. Still, their results suggest that Australian baby boomer households saved more than the younger generations. Demery & Duck (2004) found no clear pattern for the cohort effects of saving rate in the UK.

Positive cohort effect is found, in contrast, in New Zealand, where Vink (2014) finds that household saving has been in increase in the cohorts of baby boomers or younger than them. Likewise, the profile for estimated cohort effects in Movshuk (2012) suggest that the cohorts born more recently than baby boomers tend to save more in Japan.

The saving behavior of the Finnish households has previously been studied with household level data by Riihelä (2006) and Kankaanranta (2019). Riihelä (2006) is a purely descriptive study on the age and cohort structure of income, consumption and savings of the Finnish households. The graphs of age profiles from different cross sections did not support the predictions of the LFH for saving in Finland. Instead, the saving rate was increasing in age during the research period of 1985 – 2001. During the great recession of the 1990s in Finland, the age profiles moved right so that the peak income and consumption was reached later in 1995-2001 than 1985-1990. The results also suggested that the cohorts born later saved less. At the same time, the younger cohorts had increased their saving more than the older ones, however.

Kankaanranta (2016) applied the age-cohort-period to examine the relationship between age and wealth accumulation of the Finnish households using data from four cross sections of the Finnish Wealth Survey, conducted between 1987 – 2004. All in all, the results suggest that the time-of-birth is an important determinant of wealth accumulation in Finland. In contrast with Riihelä's 2006) results, the age profiles of the cross sections of households have the hump shape suggested by the LCH. If the cohort effects are, however, controlled for, the Finnish households appear to continue accumulating their assets even in old age[3]. The cohort effects of wealth accumulation, in turn, show a concave pattern so that wealth grows from the generations born in 1923-27 to the generations born between 1948 and 1952, but turns then to decline.

3. Data

An ideal way to study the effects of age and birth year on consumption and savings would be to use longitudinal or panel data, which would allow tracking the same households over time. In this case, also the effects of other factors than age and cohort affecting the savings behavior could be controlled for more easily. The only household level dataset on household consumption and income that was available was Statistics Finlands' Household Budget Survey (HBS), however, and it is based on different set of households every year. Thus, the same households cannot be tracked over consecutive survey years.

[3] The saving behavior was, however, found to depend on the level of education so that households with tertiary education followed the hump-shaped age profile.

Our solution for capturing the time dimension in the saving behavior of households, was to use the HBS data to construct a pseudo panel data set. Instead of individual households, the observations of a synthetic panel consist of groups of households born and surveyed at given years. Although the sample of households representing the same birth cohort is different in every consecutive HBS survey, the means capture at least in average, the dynamics of the consumption (and saving) behaviour of the birth cohorts over time.

When constructing the pseudo panel, all households of the HBS in a a given survey year were first divided into groups that consisted of households with a reference person of the same birth year. Means of consumption, disposable income and savings were then computed for each of these birth cohort and survey year specific household groups. The means for households of the same birth cohort now constitute the cross section dimension of the synthetic panel, whereas the the time dimension is constituted by the different survey years. Our pseudo panel data constructed this way consists of totally 504 observations.[4]

The Household budget survey, the underlying data set of our synthetic panel, is a EU-harmonised cross-sectional survey of private households, whose permanent residence is located in Finland. The survey produces information on the consumption expenditure of Finnish households, and differences in consumption expenditure between different population groups. The information is collected with telephone interviews, from diaries completed by households, from receipt information and from administrative registry data.

The HBS was initiated in 1966, and up until 1995, it was conducted with five years intervals[5]. From then onwards, the length of the intervals between the surveys has been irregular, however. The latest survey data is from 2016. This study is based on eight cross sections of the households from the Household Budget Surveys from years 1985, 1990, 1995, 1998, 2001, 2006, 2012 and 2016. The sample size of the survey varies between 3551 and 8258 so that the largest samples were collected in the earliest surveys, while the most recent surveys have been based on smallest samples. The age of the household reference person in the samples ranges between 16 and 98 so that the household heads were born between years 1894 and 1997.

[4] Although the choice of using synthetic panel data is ultimately dictated by data availability issues, synthetic panel also have the advantage over longitudinal data that it is less sensitive on outlier observations.

[5] The households to the sample are selected to represent all Finnish households, but participation in the survey for those selected to the sample is voluntary. The sample of the survey of 2016, for instance, was based on two-stage stratified sampling. Totally 8216 households were initially selected to the gross sample, and 43% of them (3551 households) responded to the survey. For more detailed information on the HBS, see https://www.stat.fi/til/ktutk/2016/ktutk_2016_2020-04-20_laa_001_fi.html

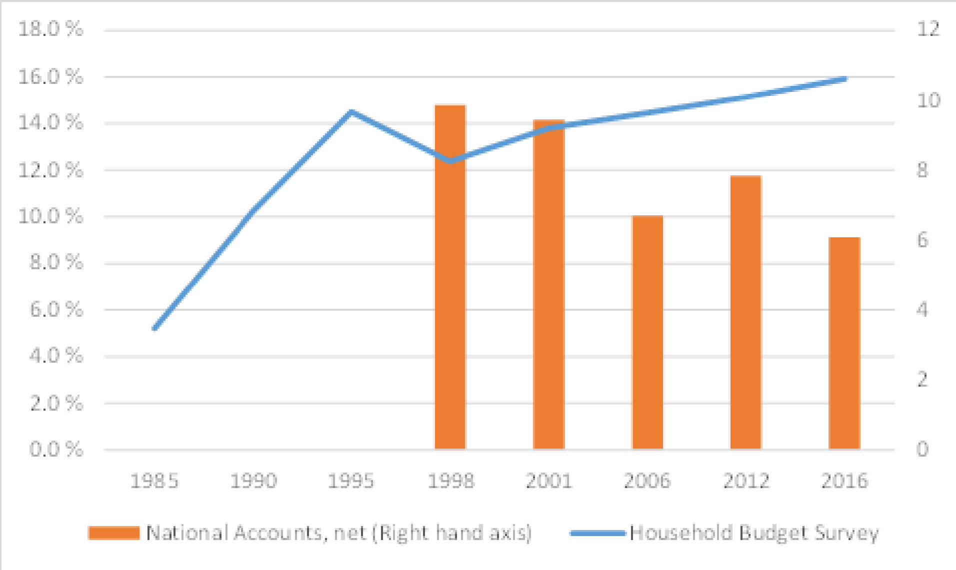
As the saving decisions are ultimately made by individuals, it would be optimal to use individual level data for constructing our synthetic panel data. The choice of using household rather than individual level data was, however, dictated by data availability, as consumer survey data for Finland was only available at household level.

The aggregate gross saving rates implied by household survey data typically deviates from the aggregate saving rates implied by national accounts data[6].

We compare developments of the two measures for the saving rate in Figure 1. The National Accounts (NA) saving rates were available from 1999 onwards. During this period, the HBS saving rate has generally been considerably higher than the NA saving rate. The two figures also have mainly developed to different directions during the period. The NA saving rate has wandered around 7 % between 2006 and 2016, whereas the HBS saving rate has been trending slightly upwards at the same time.

As the HBS data on disposable income is based on the same registers as the NA data, the differences in the saving rate measures are due to mismeasurement of consumption expenditure in the survey data. Thus, our estimation results are sensitive to the assumption that the measurement error for each age group has been of equal magnitude in each survey year.

Figure 1. Households saving rates based on Household Budget Survey and National Accounts



[6] Household consumption is calculated in a conceptually uniform manner in both the HBS and the NA. The main difference between the two measures is that the households in the latter also include population living in institutions, and the domestic consumption expenditure of foreigners living in Finland. The possible sample bias of the HBS is also corrected in the NA. During the years between the HBS surveys, the consumption expenditure in the NA are calculated based on numerous data sources from both demand- and supply sides of the economy.
Also the disposable income is measured the same way both in the HBS and the NA, as they both are based on registry based data, and also include imputed rents of owner occupied housing. See https://www.stat.fi/til/sekn/2020/04/sekn_2020_04_2021-03-15_tie_001_en.html

The consumption expenditure in the study is defined as the annual total consumption expenditure of the households. To calculate savings rates of the households, also data on disposable income is needed, and that data, based on registers of the tax authority, was also available in the HBS. The survey data is published in nominal terms, but for estimations it was transformed in 2016 prices by deflating the series with consumer price index.

The saving rate can be defined as an average of the saving rates of the individual household in a given cohort. To reduce the effects of outlier observations on results, the saving rates were, however, calculated as the average savings of the cohorts, divided by the average disposable income of the cohorts:

$s_{bt} = \frac{\sum_h s_{hbt}}{\sum_h Y_{hbt}}$, where

s_{hbt} =the savings of household h, born in year c, and observed in survey year t.
Y_{hbt} = the disposable income of household h, born in year c, and observed in survey year t.

The effects of outliers are particularly relevant for those households in the HBS that report very low (or even zero) disposable income. If the saving rates for these households would be calculated as average-of ratios, the low (or zero) values for nominator would imply extremely high (or nondefined) negative saving rates, making the cohort means biased upwards.

At the same time, the ratios of means are more influenced by higher income households than lower income households, and therefore may be uninformative about households at the median or lower parts of the saving distribution. Instead of means, the synthetic panel could consist of medians (or other quantiles) of the variables. Ratios of median would, however, be difficult to interpret. The median household by income is not necessarily the same household as the median household by consumption expenditure, so that median saving rate would be derived from two different households.

4. Age-period-cohort –model for savings rate

Our econometric model that allows identifying separate effects on saving rate for age, cohort and time follows the methodology presented in Vink (2014), originally developed by Deaton (1997). The empirical model can be motivated by a simple theoretical framework. The framework is based on the standard life cycle model of saving, which assumes that individuals (households) smooth their consumption over lifetime. The individuals tend to save during working age when their incomes are high, and these savings are used to compensate the lower income level during retirement. Thus, the lifetime profile of the saving rate of an individual follows the hump shaped pattern of the lifetime profile of individual’s earnings.

Whereas the age profile of consumption and saving can be explained by the intertemporal choices of the households, the independent effect of birth cohort on the saving decisions is explained, most importantly, by differences in lifetime wealth between the cohorts. The lifetime wealth, in turn, is ultimately determined by (both individual and the general level of) productivity. Because of the positive trend growth in labor productivity, the later a cohort enters the labor force, the higher its permanent income and wealth will be. Thus, wealth of the elderly people in a cross section of households surveyed in, say 2010, is likely to be considerably higher than in households surveyed in 1990. Consequently, the latter households may be more motivated to decumulate assets in old age only because of their lower wealth due to lower productivity. At the same time, the willingness of young households of any cohort to borrow is affected by expected lifetime wealth, which depends on their productivity.[7]

More formal theoretical framework for our empirical age-period-cohort model is provided by Deaton's (1997) formulation of the life cycle model. In Deaton's model, consumption expenditure of an individual is proportional to individual's lifetime wealth (W) of an individual, that is assumed to be known at birth. The factor of proportionality is determined by an individual's age. Thus, the level of consumption expenditure of an individual i born in year c and observed in year t, can be expressed as

1.) $$C_{i,c,t} = g_i\ (t-c)W_{ic},$$

where function g represents an individual's preferences over consumption and leisure.

Equation 1 can be interpreted in terms of a household, instead of an individual, by assuming that the lifetime wealth is known at the moment the household is formed, (instead it is known in year of birth of the individual), and assuming that function aggregates the preferences of an entire household. Equation x can be expressed in terms of synthetic cohorts by averaging over all individuals born in year c. Taking logs of this equation yields:

2.) $$\overline{lnC_{ct} = \overline{\ln g(t-c)}} + \overline{lnw_c}$$

In this form, our model implies that the consumption level of a synthetic cohort is directly determined by two components, that is, the age and the cohort of the household. Thus, the equation can be estimated by regressing the mean of the logs of the synthetic cohorts by a set of age and cohort dummy variables. The age dummies represent the time preferences of the households, whereas the cohort effects capture the effects of expected lifetime wealth.

[7] In addition to the level, also changes in productivity affects saving decisions, but the effect is ambiguous. In standar life cycle model, an increase in productivity growth will increase the lifetime wealth (and saving) particularly of younger age groups. To smooth lifetime consumption, the younger households increase saving.
In a more complicated set up with low current income but high lifetime wealth, the young households, however, borrow to finance current consumption. An increase in productivity (and lifetime wealth) results now in an increase in saving of the young households. See e.g .Deaton & Paxson (2000).

The saving behavior of households at different points of life cycle is also affected by the business cycle fluctuations and one-off events. These factors are taken in account by incorporating a set of survey year dummies into the model.

Thus, the following equations for household consumption and income for our pseudo panel data are estimated:

3.) $lnC_{bt} = D^a a_C + D^c \beta_C + D^t \gamma_c + \mu_C,$

4.) $lnY_{bt} = D^a a_Y + D^b \beta_Y + D^t \gamma_Y + \mu_Y,$

where D^a=age dummy, D^b=cohort dummy, $D^t = \text{survey year dummy}, \gamma_C, \gamma_Y$ =the effect of time trend on consumption C and income Y, a_C, a_Y=coefficients of age effects, β_C, β_Y=coefficients of cohort effects, μ_C, μ_Y = error terms.

A constant, as well as a variable for the mean number of children ar3 also included in the estimable equations.

The decomposition for the saving rate can be estimated likewise. Note, however, that the difference $lnY_{bt} - lnC_{bt}$-s a monotone increasing function of the saving-to-income ratio (Y-C)/Y. When the saving ratio is low, this difference is approximately equal to the saving ratio. Thus, the decomposition for the saving rate can be obtained by using the coefficient estimates for cohort, age and period dummies for income and consumption, as in Eq 5.

5.) $s_{bt} = lnY_{bt} - lnC_{bt} = D^a(a_Y - a_C) + D^b(\beta_Y - \beta_C) + (\gamma_Y - \gamma_C)(d_t^*) + \mu_C$

A major problem in estimating separate effects for age, cohort and survey year from the data is that there is an exact linear relationship between the three variables. For instance, survey year can be expressed as the sum of age and cohort, or age as survey year subtracted by cohort. Thus, any data generated by a model including all three variables is not separable from data generated by a model including only two of these variables. As age, cohort and time do not vary independently, it is not possible to identify their independent effects without making some restrictions to the estimable model.

Deaton and Paxson (1994) propose an identification scheme based on an assumption that the time variation in the dependent variable is divided into a trend and a cycle so that any trend growth in the dependent variable can be attributed to either cohort and age dummies, or alternatively, to the time trend. To be valid, this normalization requires that the data covers such a long time period that it includes both a trend and a cycle. As the cross sections in our synthetic panel covers a relatively long period of more than 30 years, which includes two major recessions, the first at the turn of the 1990s and the second after the financial crises in 2008, this precondition should be fulfilled.

The standard practice in previous studies has been to attribute the trend growth in savings to a combination of cohort and age effects. In this case, the year dummies capture the effects of macroeconomic shocks and cyclical variation, as well as any measurement errors. In terms of the estimable model, this normalization means that the year effects are assumed orthogonal to time trend and to average zero in the long run

6.) $\sum_t D^t\,(t-\bar{t}) = 0$ and $\sum_t D^t = 0$

To make the impact of possible outlier observations less significant, and to make the results easier to interpret, the age dummies in the model are formed for 5-year, and the cohort dummies for 10 year, rather than 1 year intervals. Thus, the youngest age group is <24 year old, followed by 12 ten-year age groups 25-29, 30-34,…,70-74, and finally, the oldest age group of >75 year old.

The cohort dummies, respectively, start from the households with head born before 1918, followed by cohorts born in 1919-1928, 1929-1938,…,1975- 1984, and finally, the households born after 1985.

5. Effects of age and cohort on saving rate

5.1. Age profiles of the saving rate by cohort

Before proceeding to the results of the empirical model, we make some descriptive analysis on the age and cohort profiles of single cross sections of the household surveys. Figures 2a to 2c depict household income, consumption and savings rate from our synthetic panel, against the age of household head. The age specific means of the variables are shown for four selected cross sections that cover our sample period with roughly 10 year-intervals. The vertical distances between the lines correspond now to the combined cohort and period effects, reflecting the impact of productivity growth and business cycle to earnings growth. Both income and consumption of households in all ages increased sharply during the 31-year interval, and the growth was particularly strong during the economic boom in 1995-2006. The increase has, however, been smaller for the youngest age group of 25-34, the productivity gains of the economy over time has benefitted more both the elderly and the households in their best working age.

Figure 2a. Age profiles of disposable income

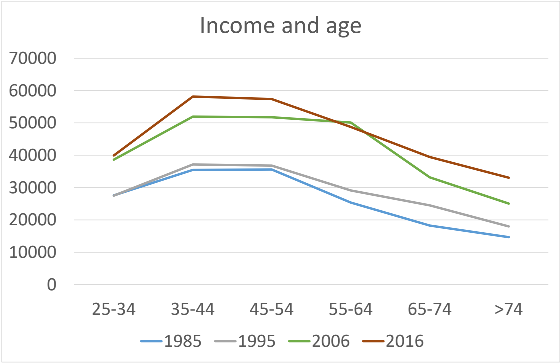


Figure 2b. Age profiles of household consumption

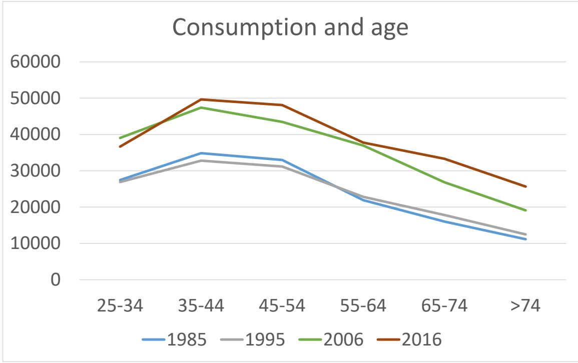


Figure 2c. Age profiles of household saving rate

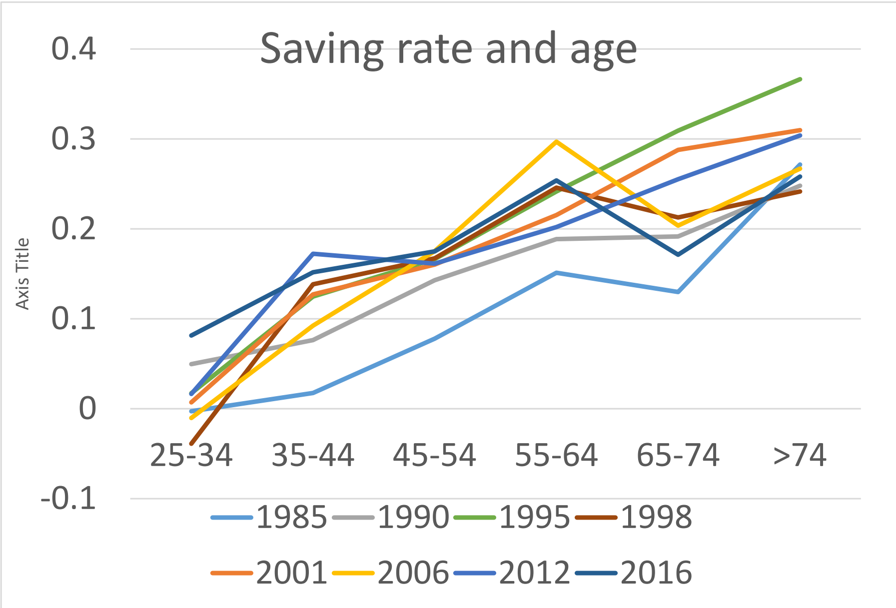
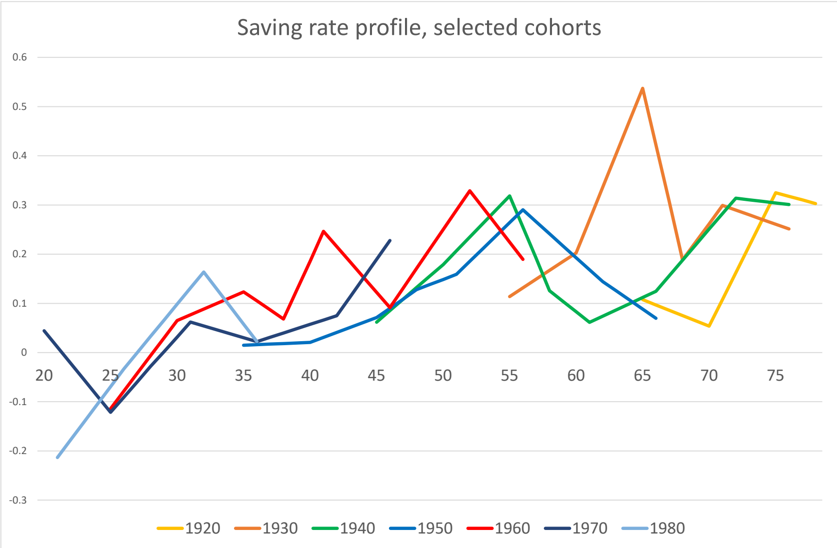


Figure 2c shows similar age profiles of saving rate for each eight cross sections. It is seen that there has occurred a general upward shift in the saving rates. The saving rate of the other age groups than the two oldest ones has increased by roughly 10 percentage points between years 1985 and 2016.

All profiles are generally increasing in age, so that the saving rates actually are highest among the households in the oldest age groups – in contrast with the predictions of the LCH. The age profiles are not uniformly shaped, however, as the age profiles of some cross sections show a drop at the age group of 65-74. The dissimilarities of the age patterns show that households belonging to different birth cohorts and observed at different points of time also differ on their saving behavior over their life cycle.

Figure 3 shows how saving rates of the same given cohorts have evolved along the life cycle[8]. The saving rates of synthetic cohorts selected with 10-year intervals are followed across our eight HBS surveys . Overall, the saving rates of the cohorts seem to vary quite a lot over years, and do not show such clear hump shape that the LCH suggests. The average saving rates of the cohorts tend to turn to decrease roughly at the age of 50 – 60 years old but turn then to increase again at later age. Moreover, the saving rates of the cohorts remain positive for the whole life cycle, except for the youngest cohorts, which show negative saving at the age under 30.

Figure 3. Saving rate by birth cohort of household head



5.2. Results from age-period-cohort –model

The regression results for age, cohort and period effects are presented separately for income, consumption and savings rate, which makes it easier to explain the observed patterns of the savings rate by the dynamics of income and consumption. The averages of the year-cohort cells in the pseudo panel are based on different number of observations, and the variances in the cells with fewer observations are typically higher. This is accounted for by using weighted least squares in the estimations, with the number of observations of each year-cohort cell as

[8] The line "1920", for instance, connects the average saving rate of households of age 65 in survey of 1985, to the average saving rate of households aged 70 in survey of 1990, then to average income of households aged 75 in 1995, etc. The youngest and the oldest cohorts emerge in the survey at different age, so that the cohorts born in 1920-1925, for instance, are presented in the first four surveys from 1985 to 1998, and respectively, cohorts of 1980-1985 in the last four surveys, conducted between 2001 and 2016.

weights. As the number of cohorts and survey years decrease towards both ends of the sample period, the corresponding age and cohort dummies still should be interpreted with care.[9]

The age effects for income, consumption and savings are presented in Figure 4. The reference point for the age dummies is the age group of 20-25, which was left out of the regression equation to avoid multicollinearity.

The disposable income of the households follows the typical development of earnings during a life cycle, so that the profile of age dummies has the expected hump shape. The income increases with age and work experience from the youngest age group of 26-30 onwards, reaching its peak at the age of 55-60, turning then to slow decrease.

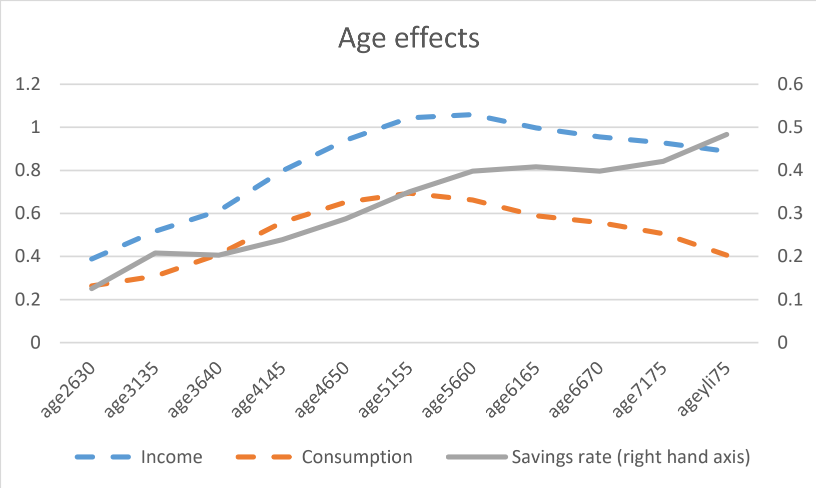
The life cycle framework implies that consumption decisions of the households are decoupled from the time path of income. Only in the case that households' time preferences for consumption accidentally coincide with the development of their earnings, should the profile of age dummies for consumption go hand in hand with the age dummies for income. If the households smooth their consumption over lifetime, however, the age profile of consumption should be flatter than that of income.

Overall, the age profile of consumption dummies in Fig. 4 is rather close to that of income dummies. The consumption expenditure reaches its peak at the age of 51-55, roughly at the same time as does the income. When moving to older age groups, the age profile of the consumption expenditure turns to decline with roughly the same slope than the age profile of income. It follows that there is no hump shape in the age profile of the saving rate, predicted by the life cycle model.

The estimated age effects for the saving rated do not suggest that households tend to dissolve their savings after retirement, as is suggested by the LCH. The age profile of the saving rate is mostly upward sloping, except the flat part from the age group of 56-60 to that of 66-70. Interestingly, the highest saving rates are shown be the oldest age group of >75 y.o.

[9] In all cases, the standard errors of the dummy coefficients took very low values. Thus, the error bands for the age, cohort and year effects were so narrow that they are almost impossible to separate from the point estimates themselves, so they were left out of the figures.

Figure 4. Estimates of the age dummies for income, consumption and saving rate



The lack of dissaving of the elderly, suggested by our results, may be partially explained by how the pensions are treated when calculating households' income using the micro data. Jappelli and Modigliani (1998) have pointed out that pension contributions should be considered as a part of households' savings and pension benefits as drawings from the pension wealth, that is, dissaving when the LCH is empirically tested. If household income is defined as disposable income, the pension contributions become treated as taxes and pension benefits as income transfers.

The pension system in Finland is mostly based on mandatory earnings related pensions so that households have less incentives for voluntary pension saving than households in e.g. the US or Germany. The Finnish earnings related pension system is a mix of pay-as-you-go (PAYG) system and pension funds, where both employees and employers make contributions. Households' pension contributions are treated like taxes, however, so that in line with Jappelli's and Modigliani's argument, they do not add the disposable income and savings of the households in the HBS data [10]. Thus, the argument of Jappelli and Modigliani also applies in Finland, so that the saving rates of the household cohorts in working age become under estimated.

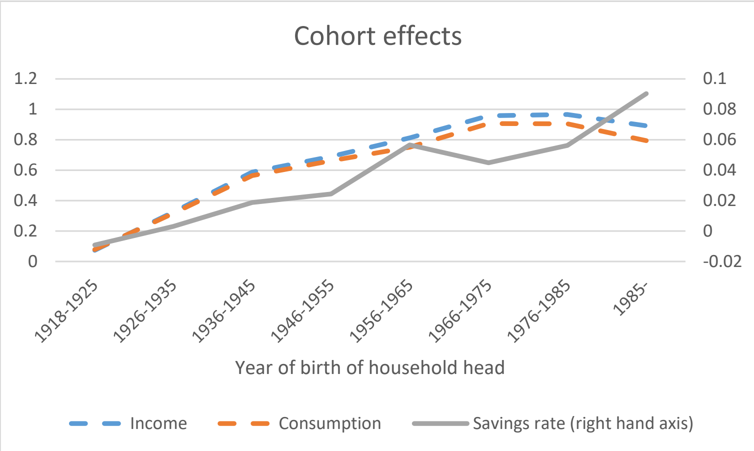
The estimates for the **cohort dummies** for disposable income, consumption expenditure and savings rate are shown in Figure 5. The reference year for the cohort effect is set to cohorts born in 1903-1917. The cohort profiles of income and consumption effects are very similar. Both profiles are increasing from the oldest cohorts born in the 1918-1925, up until the cohorts born in 1966-1975, and turn then to decrease. Thus, up to the cohorts born in the mid-1970s, all successive households enjoyed higher levels of income and consumption at the same age than their predecessors.

[10] In the sectoral National Accounts, the pension contribution fees becomes defined as public savings.

The cohort effects on income are generally considered to reflect changes in productivity. There has, however, been no major interruptions in the trend growth of labor productivity in Finland during the 1970s and the 1980s, except the temporary slowdown in the mid-1970s, due to the oil crises. Thus, the poor income growth of the cohorts of the late 1970s and 1980s is likely to be explained by other factors than productivity.

The Finnish household's willingness to save has been in continuous increase over time. The cohort profile of the savings rate is mostly upward sloping from the oldest to the youngest cohorts. The saving rates of the 10-year cohorts have been 1 to 2 percentage points higher than the saving rate of their predecessors. Only the households with their heads born in interval 1966-1975 saved less at the same age than the preceding 10-year cohort.

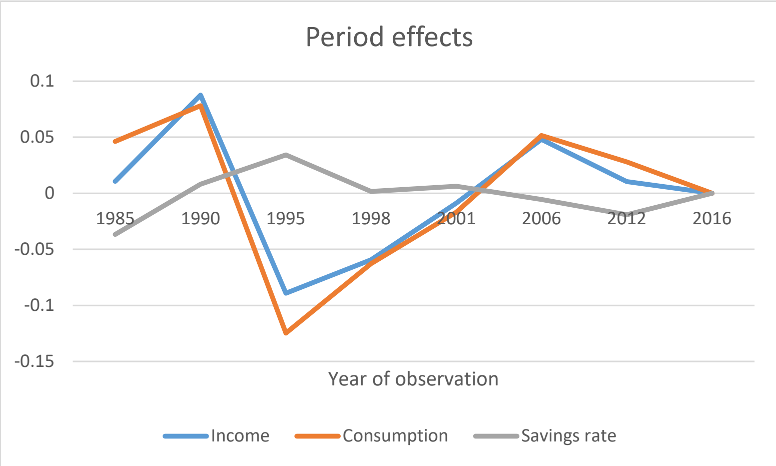
Figure 5. Estimates of the cohort dummies for income, consumption and saving rate



The estimates or the **period dummies** in Figure 6 capture the cyclical variation in income, consumption and savings. The period effects to income and consumption coincide rather well with the developments of the Finnish business cycle during the 30-year long sample period. The effects are, however, relatively small so that cyclical variation has played smaller role for the development of income and consumption of the households than age and cohort.

Both income and consumption increased during the economic expansion between 1985 and 1990 but dropped at the deep recession of the 1990s. Finland started to recover from the recession in the middle of 1990s, and a long period of rapid and stable economic growth lasted until the financial crisis in 2008. The boom years are reflected in Fig. 6 sas a continuous growth in the year dummies between 1995 and 2006. The financial crisis and the subsequent recession are also mirrored in the year dummies, as both disposable income and consumption turned to decrease after the 2006 survey.

Figure 6. Estimates of the period dummies for income, consumption and saving rate



Possible implications of households' age structure on their life time saving behavior were tested by including the average number of children of the synthetic cohorts as an explanatory variable into the model. The number of children of the households has a positive and statistivally significant effect on both income and consumption[11]. In the case *nr. of children* is left out of the model, it's impact becomes captured in the model by the age dummies, which now get somewhat greater values for the youngest age groups. (The cohort and period profiles are almost the same in the two models.)

The differences in the age profiles gradually disappear towards the older age groups so that age profiles coincide from the age group of 51-55 onwards, after the profiles have peaked. In the case of younger age groups, the effects of the the age structure on income and consumption offset each other so that the inclusion of the number of children into the model has no effect on the age profile of the saving rate.

6. A projection of the aggregate saving rate

The estimated age and cohort dummies can be used to make projections on the effects of population aging on aggregate saving rate of the economy. Because of the population aging, the proportion of older households of all households will gradually increase, and that of young households decrease, respectively. At the same time, the older birth cohorts become replaced by younger generations. As both age and cohort profiles of the saving rate are upward sloping, it follows that the aggregate saving rate is expected to increase over time.

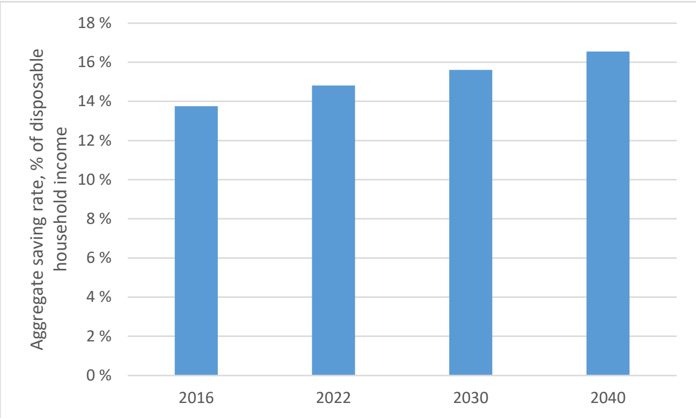
The saving rate projections are calculated as weighted averages of the estimated age and cohort dummies. As weights we used forecasts of income shares of the 5-year age groups, calculated separately for each projection year. When making forecasts for the income shares,

[11] The regression coefficient of the number of children takes a value of 0.20 in the model.

we assumed that the age structure of disposable income remains at its year 2016 level for the whole projection period. The mean incomes of each age group is then multiplied by the corresponding population share of the age group. The age group specific population forecasts are based on the population statistics and forecasts of Statistics Finland.

The projection period starts at 2016, for which Figure 7 reports the fitted value of the saving rate from our model. The period ends 2040, which is the last year for which Statistics Finland publishes its population forecast. The projection suggests that the saving rate of the Finnish economy will be in gradual increase over the next two decades. In 2016, the saving rate if slightly below 14 %, and by 2040, it has increased by roughly two percentage points, to 16 %. Thus, our projection of the saving rate contradicts the prediction of the life cycle hypothesis, which suggests that the population aging should lead to decrease in the aggregate savings.

Figure 7. Projections for the aggregate saving rate in 2016–2040



7. Conclusions

Rapidly aging population is leading to significant changes in intergenerational distribution of income in Finland as the share of elderly people of household total income increases. The standard life cycle hypothesis predicts that this should lead to a decrease in the aggregate household saving rate, as the retired people start to liquidate their savings. The purpose of this paper is to examine how age and birth year affect the saving behavior of the Finnish households. The estimated age and cohort effects are then used to make a projection for the aggregate saving rate of Finland until 2040.

According to the results, both income and consumption of the Finnish households peak when the household heads are in the age of 40-50 years, turning then to a gradual decline. The estimated age effects for the household saving rate do not support the predictions of the standard life cycle model, however. In contrast with the hypothesis, households continue to save even after retirement age, instead of dissolving their savings. The results also suggest that the cohorts born after the mid-1960s tend to save more at a given age than the cohorts born before the mid-1950s.

Put together, both age and cohort profiles of the saving rate imply that the aggregate saving rate of the Finnish households will increase by roughly 2 percentage points until 2040. Population aging implies that the income share of the elderly with their higher saving rate will keep rising. At the same time, households' willingness to save increase in all age groups, as younger cohorts are replacing older ones.

There are many potential reasons for the Finnish households' willingness to continue saving after retirement. The households may be willing to leave bequests, or the saving decisions may be affected by precautionary motives because of uncertainty over the expected lifetime and health. Also measurement errors may provide a partial explanation for our findings. The consumption expenditure is difficult to measure accurately with surveys. Moreover, the contributions that the working age households make to the mandatory earnings related pension system are not defined as private saving. Thus, the saving rates of the working age households in a way become under estimated.

The tendency of the later born cohorts to save more at any given age, could be explained e.g. by historical reasons. The austere consumption habits of the cohorts born before baby boomers can follow from the austere economic environment in which these cohorts lived their years. The cohorts from baby boomers onwards, in contrast, have experienced more robust economic growth and higher standard of living, which has made these cohorts more prone to consume in all phases of their life cycle. Exact testing of this hypothesis is, however, left for future research.

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