SONDERFORSCHUNGSBEREICH 504
Rationalitätskonzepte,
Entscheidungsverhalten und
ökonomische Modellierung

No. 99-28

Tax incentives, bequest motives and the demand for life insurance: evidence from Germany

Walliser, Jan*
and Winter, Joachim**

February 1998

Financial Support from the Deutsche Forschungsgemeinschaft, SFB 504 at the University of Mannheim, is gratefully acknowledged.

*International Monetary Fund, email:

**Sonderforschungsbereich 504, Universität Mannheim, email: winter@rumms.uni-mannheim.de

Universität Mannheim
L 13,15
68131 Mannheim

Preliminary version; comments are much appreciated.

Tax incentives, bequest motives and the demand for life insurance: Evidence from Germany*

Jan Walliser

Congressional Budget Office, Washington D.C.

Joachim K. Winter**

University of Mannheim

First draft: February 1998
This version: June 1998

Abstract: Life insurance, in particular whole life insurance, plays an important role for private saving in Germany. Whole life insurance combines the insurance against uncertain death with a savings plan. Accordingly, a stylized model of life-cycle behavior would predict that whole life insurance purchases respond to both bequest motives and the tax advantages of life insurance compared with other forms of saving. Using data from the German Consumer Expenditure Survey (EVS), the paper shows that tax advantages and bequest motives indeed have an important impact on life insurance demand in Germany, if the empirical specification explicitly recognizes the censoring of life insurance face values.

Keywords: savings, life insurance, bequests

JEL classification: D91

---

* We are grateful to Ralf Rodepeter and Reinhold Schnabel for sharing their definitions of EVS variables, and to Melanie Lührmann for dedicated research assistence. Axel Börsch-Supan and seminar participants at the University of Mannheim provided helpful comments on an earlier version of this paper. Winter acknowledges financial support from Deutsche Forschungsgemeinschaft (Sonderforschungsbereich 504 at the University of Mannheim). The views expressed in this paper do not necessarily reflect the position of the Congressional Budget Office.

** Corresponding author.
Address: Sonderforschungsbereich 504, Universität Mannheim, D-68131 Mannheim
E-mail: winter@rumms.uni-mannheim.de

1 Introduction

Life insurance, in particular whole life insurance plays an important role in German capital markets. Allianz Leben, the largest German life insurance company, commands assets of DM 118 billion and owns minority shares in several large corporations. Allianz alone generated life-insurance contributions of about DM 12 billion in 1996 (Allianz, 1996). On the flipside of the market, 60.5 percent of households own life insurance policies (authors' estimate; see Table 2 below). Out of total household saving of DM 289.2 billion in 1996, 86.8 billion or 30.0 percent were saved in insurance policies (Deutsche Bundesbank, 1997). Figure 1 shows that saving through insurance policies accounts for a substantial fraction of the private sector's total saving, although its relative importance has declined over the 1960–96 period. On the other hand, the importance of life insurance payments as part of old age income has increased over that last decades. In 1980, life insurance payments were 10.3 percent of total social security pensions. This share has increased to 21.5 percent in 1996 (see Figure 2).

`Insert Figure 1 about here.`

`Insert Figure 2 about here.`

Who are the owners of life insurance policies? Do richer and more heavily taxed people hold a disproportionate share of their wealth in life insurance policies? Do people with more dependents tend to purchase larger life insurance coverage? Answering these questions offers first insights into the importance of bequest motives and tax incentives for German life insurance demand. The latest German Consumer Expenditure Survey, the *Einkommens- und Verbrauchsstichprobe* (EVS) – collected in 1993 – presents a unique opportunity to address these and other issues because it provides information on the cash value of whole life insurance in combination with socio-economic and demographic variables for the first time. In this study, we present empirical results on life-insurance demand using microdata from the EVS 1993.[1]

[1] Wähling *et al.* (1993) investigate the motives for (whole) life insurance demand in Germany using survey data from 1990 and 1992. They find that bequest motives and saving for retirement are the two most important factors in life insurance demand.

We motivate our empirical analysis with a stylized three-period model of life-cycle savings decisions that captures the salient features of the German tax and pension system. We model life insurance as a combination of term life insurance and a savings plan, and derive bequests using a "joy-of-giving" motive. This model is in the tradition of Yaari (1965) and Fischer (1973). Babbel and Ohtsuka (1989) build a three-period model with uncertainty about future rates of return and health status that allows for simultaneous purchase of term life insurance and whole life insurance, overcoming the problem that whole life insurance is usually dominated by a combination of term life insurance and a savings plan. However, their model is inherently difficult to solve even with sophisticated numerical methods. Moreover, Babbel and Ohtsuka do neither capture the tax preferences of life insurance nor consider the effect of public pension programs on life insurance demand.

There are a number of empirical studies of life-insurance demand that are related to this paper. Bernheim (1991) uses estimates of the demand for life insurance to assess the strength of bequest motives. In particular, he finds that a significant fraction of total saving is motivated by the desire to leave bequests. Browne and Kim (1993) present evidence on life insurance demand accross 45 countries. They find that the main determinants of cross-country variations in the demand for life insurance are the dependency ratio (i. e., the number of dependents per potential life insurance consumer), national income, government spending on social security, inflation, and the price of insurance. Finally, Brunsbach and Lang (1998) analyze the rates of return of life insurance contracts generated by the German tax system. They conclude that the tax incentives afforded life insurance savings in Germany do not significantly increase savings.[2] However, while their study carefully quantifies the tax advantage of life insurance saving, it assumes that the cross-sectional data are also capturing lifetime tax advantages and are thus closely related to the observable life insurance demand. That assumption could overstate the actual differences in tax advantages because income varies over the life cycle.

[2] The microdata they use are taken from the 1988 wave of the EVS, the same dataset we use for estimation. However, this paper uses the more recent 1993 wave; see Section 3.

The paper proceeds by discussing some key theoretical predictions from a formal model of life insurance demand in section 2. The third section discusses the data set and some preliminary empirical findings. Section 4 presents some regression results, and the last section concludes the paper.

2 A life-cycle model with whole life insurance

2.1 The model

A number of papers in the economics literature model the demand for *term* life insurance. Term insurance pays a benefit if the insured dies before a certain date. The first model for term life insurance in a continuous time setting is Yaari (1965). Fischer (1973) develops a life-cycle model of term life insurance demand in discrete time and discusses the allocation of insurance purchases over the life cycle. Less common is the modeling of whole life insurance. In that case, the insurance company covers death for the whole life of the insured and thus faces a liability for sure at some point. Whole life insurance requires the build-up of insurance reserves because the insured typically pays premiums only during working life but may die at a later date. The premiums must therefore also finance the accumulation of reserves sufficient to meet expected later obligations. Many whole life insurance contracts enable the insured to take out those reserves (the cash value or surrender value) some time before death, and therefore resemble some combination of term life insurance with a savings plan.

Following the standard approach, this paper derives life insurance demand in a model with a "joy-of-giving" bequest motive (one exception is Lewis, 1989). The model has three periods and three types of assets, life insurance, bonds, and public pensions. Life insurance is modeled as a combination of term life insurance and a savings plan, and the specification incorporates the salient features of the German tax and pension system.

In the three-period model, the timing convention used is as follows: consumption streams in the three periods are indexed by 0, 1, and 2, and end-of-period bequests are indexed by 1, 2, 3, respectively. A consumer can use his income to purchase life insurance

L or save an amount S of bonds. Bonds earn a rate of return r and the return is subject to a capital income tax of τ^C. Moreover, individuals must contribute to a public pension system with a payroll tax τ^S and they receive pensions in old age. The pension system has an internal rate of return of g.

More formally, consider the following expected utility function in consumption, c, and bequests, b:

$$W(c,b) = \sum_{t=0}^{2} \frac{1}{1-\gamma} \left(\frac{1}{1+\delta}\right)^t [c_t^{1-\gamma} + \eta_{t+1} b_{t+1}^{1-\gamma}(1-\pi_{t+1})] \prod_{s=1}^{t} \pi_s, \tag{1}$$

where δ represents the pure rate of time preference, γ is the risk aversion parameter of the constant relative risk aversion utility function, η is the weight on bequests and π_t is the probability to survive at the beginning of period t. Since death at the end of period 2 is certain, $\pi_3 = 0$.

To simplify notation, let $1 + r = R$, $1 + r(1 - \tau^C) = R^C$, and $1 + g = G$. The utility maximization is then subject to the following budget constraints in the first two periods ($t = 0, 1$):

$$c_t = w_t(1-\tau^S) - Z_t L_{t+1} - S_{t+1} + S_t R^C + \alpha L_t \tag{2}$$

$$b_{t+1} = S_{t+1} R + L_{t+1}. \tag{3}$$

Here, w stands for labor earnings. α is the exogenous savings portion of the life insurance contract – if the policy holder survives, a fraction of the insurance sum (the cash value) can be withdrawn. Note also that in case of death the estate receives the full rate of return on bonds, implicitly assuming that there are no estate taxes to be paid.

Consumers retire in their third period of life and receive a public pension. Since life ends with certainty after period 2, there is no role for life insurance in the last period. Consequently, the budget constraints are as follows:

$$c_2 = \tau^S(w_0 G^2 + w_1 G) - S_{t+1} + S_t R^C + \alpha L_t \tag{4}$$

$$b_3 = S_3 R. \tag{5}$$

The first order conditions imply the following relationship between consumption in different periods and consumption and bequest for $t = 1, 2$:

$$\frac{c_t}{c_{t-1}} = \left[\frac{1 - Z_{t-1}}{\frac{\pi_t}{1+\delta}(R^C - \alpha R)} \right]^{-\frac{1}{\gamma}} \tag{6}$$

and

$$\frac{c_t}{b_t} = \left[\frac{(1 - \pi_t)\eta_t(1 - Z_{t-1}R)}{\frac{\pi_t}{1+\delta}(R^C Z_{t-1} - \alpha)} \right]^{-\frac{1}{\gamma}} \tag{7}$$

Bequests at the end of period 2 are simply:

$$b_3 = c_2(R\eta_3)^{\frac{1}{\gamma}} \tag{8}$$

Using equations (6), (7) and (8), the consumer's maximization problem can be solved recursively. However, the algebraic solution is fairly complicated and therefore provides few immediate insights (see the Appendix). Instead, we demonstrate the sensitivity of life insurance demand with respect to key variables for a couple of numerical examples below. In general, people buy life insurance for three reasons in our model: first, life insurance enhances bequeathable wealth and is therefore valuable especially at younger ages when savings are still small. Second, life insurance has a tax advantage over other savings. Third, if the consumer considers public pension coverage as too generous he can deannuitize by purchasing life insurance.[3]

2.2 Numerical examples

The driving forces behind the demand for whole life insurance can be most easily indentified by varying some key parameters of the model. First, life insurance demand and savings are calculated under baseline assumptions. In particular, assume that each period lasts 20 years and that the annual interest rate is 3 percent, hence $R = 1.81$. Moreover, let $R^C = 1.61$, in line with an annual capital income tax of 20 percent. Furthermore, assume an annual pure rate of time preference of 1 percent ($\delta = 0.22$), a rate of return on pension contributions

[3] Yaari (1965) discusses why in perfect markets purchasing life insurance is equivalent to purchasing a negative annuity.

of 1 percent ($G = 1.22$), and a pension contribution rate of 20 percent ($\tau^S = 0.2$). Wages are normalized to 1 in the first period and 50 percent higher in the second period. We use $\pi_1 = 0.95$ and $\pi_2 = 0.90$, in line with life-table probabilities to live to from age 20 to age 40 and from age 40 to age 60, respectively. The values for the bequest weights, η_t, are the average values for ages 20 to 40, 40 to 60, and 60 to 80, respectively, from Fischer (1973), Table A2. The risk aversion parameter γ is set to 2. In addition, $\alpha = 0.22$, because if people were not able to surrender their life insurance at the end of the first period, $\alpha = 0.22$ would about generate a cash value equivalent to the insurance value L at the beginning of the last period of life (period 2).[4] Finally, insurance is assumed to be fair, thus $Z_{t-1} = \frac{(1-\pi_t)}{R} + \frac{\alpha\pi_t}{R}$.

Table 1 exhibits life insurance demand and savings for the initial parameter choice and a variety of parameter variations. In the baseline characterization, life insurance demand is strong in the first period but substantially weaker in the second period. The household insures 180 percent of its earnings between ages 20 and 40 but only around 37 percent of second period earnings. Saving other than life insurance is initially negative but turns positive in periods 1 and 2.

`Insert Table 1 about here.`

The experiments with $\alpha = 0$ demonstrate that more than 40 percent of life insurance demand in the baseline can be attributed to the savings portion of insurance. If $\alpha = 0$, life insurance is simply term life insurance as in Fischer (1973). Comparing rows 2 and 3 of Table 1 shows also that under term life insurance, the capital income tax influences only the allocation of consumption over the life cycle but has little immediate effect on life insurance demand, especially in the first period of life.

[4] An insurer would build reserves sufficient to meet the obligations of an insurance contract L_1 that continues in period 1 ($L_1 = L_2$). Thus, people pay a premium in period 0 and period 1 to build reserves sufficient to meet expected payments at the end of period 2, and the insurance company needs to set $\alpha = 0.22 = \frac{1}{(R^2\pi_1\pi_2 + R\pi_2)}$. $\alpha = 0.22$ implies that about 19 percent of the insurance premium in period 1 covers the risk of death, and the remaining 81 percent contribute to the accumulation of reserves. Brunsbach and Lang (1998) estimate that for a 30-year contract between 10 and 20 percent of the life insurance premium cover the risk of death.

Once life insurance incorporates a savings plan, taxes can have a quite dramatic effect on life insurance demand and saving behavior as is revealed by row 4 of Table 1. Without capital income tax, life insurance is less tax advantaged than under baseline assumptions, and life insurance demand in the first period is significantly smaller.

In row 5, the sensitivity of life insurance demand with respect to the savings portion of whole life insurance is explored. Brunsbach and Lang (1998) report that many life insurance holders can expect to receive a distribution of life insurance company profits such that they can cash out substantially more than the face value of insurance at age 65. An α of 0.28 corresponds to an approximate cash out value of 125 percent of the face value at age 60. Increasing that value can dramatically shift savings into life insurance: with increasing α life insurance becomes more of a tax-advantaged savings plan and it is worthwile to hold negative wealth in bonds while investing heavily in whole life insurance.

Row 6 of Table 1 shows the effect of public pensions on life insurance demand. Because a smaller portion of resources is annuitized once government pensions are eliminated, it is more attractive to purchase annuities (buy negative life insurance) and hence life insurance demand falls quite dramatically in the second period of life. Put differently, without a government pension, the consumer must accumulate more savings – indeed the amount of savings exceeds what the individual would like to bequeath and thus it becomes favorable to own negative life insurance (purchase annuities). However, consumers also seek to take advantage of the tax preference for life insurance savings. For that reason, life insurance demand in the first period of life falls much less.

The last two rows of Table 1 demonstrate that life insurance – whether life insurance cum savings or term life insurance – remains quite sensitive to the strength of bequest motives. The reason is straightforward: with increasing weight on bequests, the consumer seeks to increase the life insurance coverage in case of early death but also wants to save more to increase bequests that may occur at later points of the life cycle.

To conclude this section, let us state some qualitative and testable predictions of our model for life insurance: first, life insurance demand should rise with the tax advantage of life insurance savings, that is with the wedge between the rate of return on other savings and savings through life insurance. Moreover, observations of positive life insurance purchases can coincide with borrowing in the capital market. Second, life insurance demand should be smaller for people whose public pension is smaller relative to their earnings. Third, whole life insurance demand is very sensitive to the strength of bequest motives.[5]

3 Empirical results from the EVS 1993

This section presents empirical results on life-insurance demand in Germany. The microdata in this paper are taken from the 1993 wave of the *Einkommens- und Verbrauchsstichprobe* (EVS), a dataset that is roughly comparable to the U.S. Consumer Expenditure Survey (CEX).[6] The data appendix contains details on the construction of all variables used in our empirical analysis. The sample excludes households headed by foreigners because their portfolio structure is different from that of German households – for reasons that include differences in labor market participation, the distribution of human capital and income, and saving for return migration. These differences are not the subject of this paper (but might be of independent interest).

Table 2 contains details of the sample. About 60.5 percent of households hold at least one life insurance policy, and for slightly more than half of German households, life insurance is the only significant form of insurance.

`Insert Table 2 about here.`

One of the main conclusions from theoretical life-cycle models is that households with more dependents (children) should purchase larger life insurance coverage if they value bequests behavior. In Table 3, life-insurance demand is stratified by the number of children and wealth. Clearly, households with no dependents differ significantly from those with one and

[5] If we set the weight on bequests to zero, the tax advantaged savings available through whole life insurance are sufficient to generate small positive life insurance demand.

[6] Earlier waves of the EVS were conducted in 1978, 1983, and 1988. Note that as a whole, the EVS is not a panel study but rather consists of repeated cross-sections.

more children: whereas only about a quarter of households own life-insurance policies in the former group, the number of policy holders is in excess of three quarters for households with children. To the extent that higher-income households are subject to higher taxation and have more children, one would also expect that wealthier people are more likely to have life insurance. The data confirms that expectation: based on the percentages reported in Table 3, life-insurance demand increases with a household's position in the wealth distribution.

`Insert Table 3 about here.`

Table 4 displays sample means for key financial variables. The mean gross labor income in our sample is roughly DM 63,250, the mean net labor income (after taxes and transfers) is about DM 46,750. The mean asset balance is about one quarter million DM. Face and cash values of households' life insurance policies and annual premium payments (computed for the sub-sample with one or more life insurance policies) are also reported in Table 4. On average, life insurance cash values represent about 14 percent of assets, and premium payments comprise about 3.5 percent of gross income on average.

`Insert Table 4 about here.`

Table 5 exhibits the face values of life insurance policies stratified by the number of the household head's children and by income quintile. The mean of the life-insurance policies' face values increases with the number of children, again consistent with the presence of a bequest motive. Regarding wealth, the face-value means increase with the position in the wealth distribution, reflecting higher lifetime earnings and possibly tax incentives.

`Insert Table 5 about here.`

Finally, we show age profiles for a number of key variables. As with all empirical evidence reported in this paper, note that as we use just a single cross-section of data, age and cohort effects cannot be separately identified.[7] Figure 3 shows assets, and Figure 4 shows net labor income for age classes 20 through 85. Older households tend to own less

[7] Schnabel (1998) provides evidence on life-cycle asset accumulation based on pseudo-cohorts from four EVS waves 1978, 1983, 1988, and 1993.

wealth, a reflection of both cohort and life cycle effects. Average labor income in the sample exhibits a strong life cycle pattern, driven by labor force participation rates and changes in productivity with age.

`Insert Figure 3 about here.`

`Insert Figure 4 about here.`

Age profiles for life insurance variables (annual premium payments, and face and cash values, respectively) are depicted in Figures 5 and 6.

`Insert Figure 5 about here.`

`Insert Figure 6 about here.`

The cross section of life insurance premium payments displays a hump shape similar to income. That hump shape reflects the change in income over the life cycle, the increase in the number of insurance holders between ages 20 and 40, and the tendency to cash out insurance policies in old age with concomitant lower premium payments. The pattern is also consistent with life cycle insurance demand as derived from the model in section 2.

Life insurance face values are higher for middle aged than for young people in the 1993 cross section, consistent with the observation that middle aged households are more likely to hold and insurance policy. Life insurance face values are significantly lower at higher ages, again reflecting both life cycle and cohort effects. Cash values also are higher at higher ages, which in this case signifies the accumulation of life insurance savings over time. Due to the design of whole life insurance in Germany, median cash values and face values are quite similar for people over 60 years of age: most contracts are designed such that the insured can cash out a balance equivalent to at least the insurance face value at retirement. Therefore, both the median face value and the median cash value are much lower for people over 65 than for people in their mid-50s, illustrating once again the strong savings component of whole life insurance in Germany.

4 Reduced-form estimation of life-insurance demand

This section presents different estimations of life insurance demand functions. The first regression is a simple probit where the dependent variable takes the value 1 if the household holds one or more life insurance policies, and a value of 0 otherwise. The results are contained in Table 6. The independent variables in the probit are consistent with the determinants of life insurance demand derived in the theoretical model of Section 2.[8] In particular, the model includes linear and non-linear terms of age, net labor income and assets to proxy for lifetime income. Furthermore, marital status and number of children capture bequest motives, and the average tax rate proxies for the possible tax advantage of life insurance savings. The model also incorporates indicator variables for civil servants and the self-employed to reflect specific characteristics of the German tax and public pension system: civil servants with tenure do not have to contribute to their pensions and also receive fairly generous survivor benefits; the self-employed are generally exempt from contributing to the public pension system but must provide for their own retirement income and survivor's benefits.

Because many households cash out their whole life insurance policies at retirement, many households without life insurance policies are elderly. In order to test whether that fact has a significant impact on the regression results, Table 6 presents regression output for all ages and for a subsample of households with a head of less than 65 years of age.

`Insert Table 6 about here.`

The results of this simple regression model are generally consistent with the predictions of the theoretical model presented in Section 2.[9] The likelihood of owning a life insurance policy depends in a non-linear way on age for both the full sample and the subsample of households with heads under age 65. The age coefficients again capture both life cycle and cohort effects and imply that people between 40 and 45 are most likely to own a life insurance

[8] Chuma (1994) uses a similar set of variables is in an empirical analysis of life-insurance demand in Japan.

[9] Recall that "life-insurance demand" here refers to the (conditional) probability that a household has at least one life-insurance policy.

policy after controlling for income and other characteristics. Similarly, the probability of owning a life insurance policy depends in a non-linear way on net income.

Consistent with the existence of a bequest motive, married people and families with children are more likely to purchase life insurance in both the full sample and the subsample. Moreover, a higher average tax rate (after controlling for net income and assets) significantly raises the likelihood of life insurance ownership, which seems to confirm the theoretical prediction that tax advantages raise demand for whole life insurance.

Finally, the probit estimation shows that the self-employed have a greater tendency to purchase life insurance after controlling for assets and income. As pointed out earlier, the self-employed must finance their own pensions and survivor benefits. The tax advantage and the higher demand for survivor coverage therefore appear to outweigh the higher demand for pensions (negative demand for life insurance) among the self-employed.

Do the independent variables of the probit regression explain the face value of life insurance, that is the size of the insurance for those who purchase life insurance? Table 7, reports the results of an OLS regression of life insurance face values.

`Insert Table 7 about here.`

West Germans are less likely to own an insurance policy than East Germans (see the probit regression) but those West Germans who own a policy have about DM 15,000 larger face values, even after controlling for the income differences between East and West Germany.

In contrast to the probit regression, where age effects are hump shaped, the age variables in the OLS regression largely pick up the falling branch of the life insurance face values (see also Figure 6). Moreover, marital status does not significantly contribute to explaining the face value of life insurance. However, the number of children continues to be (marginally) significant in the full sample. On average, an additional child raises the face value by about DM 1,300. Home ownership significantly lowers the face value of insurance demand, consistent with theoretical predictions: buying a home offers similar advantages as whole life insurance, because home owners receive tax preferences and a home constitutes a bequeathable asset that provides a consumption stream to survivors.

The average tax rate is either not significant (full sample) or has the wrong sign (subsample of non-elderly), and thus there is no direct evidence for increasing face values with rising tax burden in the OLS regression. However, there is some indirect evidence regarding the evidence to save for old-age through insurance policies. The indicator variables for the self-employed and civil servants are strongly significant. The self employed have on average life insurance policies that are DM 72,400 larger than those of other Germans, whereas civil servants on average have policies with DM 10,300 smaller face values. That difference can likely be attributed to the fact that the self-employed must save for their own retirement income and provide for their own survivor benefits, while the opposite is true for civil servants.

The regression results reported above implicitly assume that all possible values of life insurance demand are observable. However, as discussed previously, people who prefer to annuitize their wealth implicitly demand negative life insurance. Thus, by looking simply at life insurance demand without correcting for annuity demand, our observations are censored at zero. In other word, someone who purchases a private pension (buys negative life insurance) but does not buy life insurance would simply be recorded with a zero demand although his demand is negative. That problem is particularly relevant for the elderly among whom many receive public pensions but do not hold any life insurance policies. In order to overcome the problem of censoring, we run a Tobit regression of life insurance face values that is reported in Table 8.

`Insert Table 8 about here.`

Correcting for censoring changes the results of the previous OLS regression quite dramatically. The age variables now produce a hump shape with a maximum at about age 35. Both marital status and the number of children now are significantly positive, pointing at considerable bequest motives behind the demand for life insurance. Home ownership continues to have a significantly negative influence on the face value of insurance. Moreover, the average tax rate variable now exhibits the expected sign and is also highly significant. Additionally, the indicator for maximum taxable earnings under the public pension system now has a negative sign and is significant. That result indicates that – after controlling for self-employment status – being outside the public pension system or contributing a lower portion of income than others tends to lower insurance demand (raise the demand for pension coverage). In other words, as theory would predict, the incentives work in opposite directions: on the one hand, lower public pension coverage should raise demand for annuities (lower demand for life insurance) as is indicated by the negative coefficient of the "large income" dummy, on the other hand a smaller or non-existent public pension necessitates higher pension savings and more insurance coverage for survivors, which is how we interpret the large positive coefficient of the self-employed. Interestingly, with the exception of the "West Germany" indicator neither the sign nor the size of the coefficient depends on including the elderly in the sample.

To conclude, the regression results presented in this section are largely consistent with both a significant impact of tax incentives and bequest motives on life insurance demand in Germany. While those effects can be detected in a Probit model of insurance purchases and a Tobit model of life insurance face values, they are much weaker or non-existent in a simple OLS model. Given that life insurance face values are censored at zero, however, the Tobit model seems more appropriate than than OLS. Nonetheless, the Tobit results should be interpreted with some caution as they rely on the specific assumptions of the Tobit model.[10]

5 Conclusions

Whole life insurance plays an important role in household saving. In a stylized model both bequest motives and tax incentives are driving forces of whole life insurance demand. While a bequest motive could be satisfied by term life insurance, sheltering savings from income taxes is only possible in whole life policies. The empirical evidence presented is consistent with

[10] We have restricted our attention to the standard Tobit estimator for censored data in the current version of this paper, but we wish to stress that there are alternative methods which do not require strong normality assumptions, e. g., the least absolute deviations estimator by Powell (1984). We are currently working on a pseudo-panel version of the censored regression model which is based on the trimmed LAD estimator by Honoré (1992), and we plan to apply this model to all four waves of the EVS in future work. (For a review of these and other methods, see Honoré and Kyriazidou (1998).)

those theoretical predictions. In particular, a Tobit model that corrects for the censoring of observed life insurance face values finds strong positive effects of marital status, the number of children and the tax burden on insurance demand.

Future research could probe the importance of bequest motives and tax preferences further by constructing a time series using all EVS waves currently available. Given the considerable changes in German tax laws over time (for example, the premium tax rose from 10 to 15 percent between 1989 and 1996) there should be sufficient variation to identify the importance of tax incentives for life insurance demand. Exploiting several waves of the EVS could also support the separation of life-cycle and cohort effects on insurance demand.

Technical appendix

The solution for first period consumption c_0 can be derived as follows:

$$
\begin{aligned}
c_0 = &\\
&\left[\left(1+\frac{1}{R}(R\eta_3)^{\frac{1}{\gamma}}\right)\left[\frac{(R^C-R\alpha)^2\frac{\pi_1\pi_2}{1+\delta}}{(1-Z_0R)(1-Z_1R)}\right]^{\frac{1}{\gamma}}+\right.\\
&\left(\frac{R^C-\alpha R}{1-Z_1R}Z_1-\alpha\right)\left(\frac{(1-\pi_2)\eta_2\frac{\pi_1}{1+\delta}(R^C-\alpha R)^2}{(Z_1R^C-\alpha)(1-Z_0R)}\right)^{\frac{1}{\gamma}}+\\
&\left(\frac{R^C-\alpha R}{1-Z_1R}\right)\left(\left(\frac{(R^C-\alpha R)\frac{\pi_1}{1+\delta}}{1-Z_0R}\right)^{\frac{1}{\gamma}}+\right.\\
&\left.\left(\frac{R^C-\alpha R}{1-Z_1R}Z_1-\alpha\right)\left(\frac{(1-\pi_1)\eta_1(R^C-\alpha R)}{Z_0R^C-\alpha}\right)^{\frac{1}{\gamma}}\right)+\\
&\left.\frac{(R^C-\alpha R)^2}{(1-Z_0R)(1-Z_1R)}\right]^{-1}\times\\
&\left[\frac{(R^C-\alpha R)^2}{(1-Z_0R)(1-Z_1R)}w_0(1-\tau^S)+\right.\\
&\left.\frac{R^C-\alpha R}{1-Z_1R}w_1(1-\tau^S)+\tau^S(w_0G^2+w_1G)\right]
\end{aligned}
$$

The solution for c_0 in combination with equations (6), (7) and (8) immediately implies values for c_1, c_2, b_1, b_2, b_3 and thus, by applying the budget constraints, also for L_1 and L_2.

Data appendix

The *Einkommens- und Verbrauchsstichprobe* (EVS) is based on a quinquennial survey conducted by the *Statistisches Bundesamt*, the German Federal Statistical Office. It is roughly comparable to the U.S. Consumer Expenditure Survey (CEX). The EVS is designed to cover about 0.3 percent of the household population. It is, however, top-coded: it excludes (approximately) the top 2 percent of the income distribution (households with a monthly net income in excess of DM 35,000 are excluded). In 1993, East Germany was covered for the first time. We include East German households in our sample, but we exclude households headed by foreigners. To ensure the sample is representative for the population, we used the sample weights supplied by the Federal Statistical Office in all calculations.

Demographic variables All demographic variables are taken from the EVS.

Income Our income variable is disposable labor income, defined as the sum of gross labor and other non-asset income (e. g., from self employment) less income taxes and social security contributions plus public transfers plus the net balance of private transfers. Not that our income measure does not include any asset income (such as interest received, dividends, and the rental value of owner-occupied houses), as is standard in life-cycle analysis.

Assets The asset variable is the sum of money holdings in accounts, stocks and bonds, real estate assets, and the cash value of existing insurance policies.

Taxes The tax variable contains the sum of labor and capital income taxes.

Life insurance variables The 1993 wave of the EVS contains figures for total annual premium payments and both face and cash values of existing life insurance policies. We used those values to construct our life insurance variables. In addition, thesample contains face and cash values of some other types of insurance such as insurance for burial costs, insurance for education expensesof dependents and bridal insurance, and we used the cash values of these insurance policies in our asset variable, in addition to the cash value of life insurance policies.

References

Allianz (1996): *Geschäftsbericht 1996.* Berlin and München: Allianz Lebensversicherungs-Aktiengesellschaft.

Babbel, D. F. and E. Ohtsuka (1989): Aspects of optimal multiperiod life insurance. *Journal of Risk and Insurance*, 56(3), 460–481.

Bernheim, B. D. (1991): How strong are bequest motives? Evidence based on estimates of the demand for life insurance and annuities. *Journal of Political Economy*, 99(5), 899–927.

Browne, M. J. and K. Kim (1993): An international analysis of life insurance demand. *Journal of Risk and Insurance*, 60(4), 616–634.

Brunsbach, S. and O. Lang (1998): Steuervorteile und die Rendite des Lebensversicherungssparens. *Jahrbücher für Nationalökonomie und Statistik*, 217(2), 185–213.

Chuma, H. (1994): Intended bequest motives, savings and life insurance demand. In T. Tachibanaki (Ed.), *Savings and Bequests*, 15–38. Ann Arbor, MI: University of Michigan Press.

Deutsche Bundesbank (1997): Die gesamtwirtschaftlichen Finanzierungsströme im Jahr 1996. *Monatsberichte der Deutschen Bundesbank*, May, 17–41.

Fischer, S. (1973): A life cycle model of life insurance purchases. *International Economic Review*, 14(1), 132–152.

Gesamtverband der deutschen Versicherungswirtschaft (1997): *Statistisches Taschenbuch der Versicherungswirtschaft 1997.* Karlsruhe: Verlag der Versicherungswirtschaft.

Honoré, B. E. (1992): Trimmed LAD and least squares estimation of truncated and censored regression models with fixed effects. *Econometrica*, 60(3), 533–565.

Honoré, B. E. and E. Kyriazidou (1998): Estimation of Tobit-type models with indiviudal specific effects. Unpublished manuscript, Princeton University and University of Chicago.

Lewis, F. D. (1989): Dependents and the demand for life insurance. *American Economic Review*, 79(3), 452–467.

Powell, J. L. (1984): Least absolute deviations estimation for the censored regression model. *Journal of Econometrics*, 25, 303–325.

Schnabel, R. (1998): Wealth and savings in Germany: A cohort analysis. Unpublished manuscript, Universität Mannheim.

Wähling, S., J. Trumpfheller, and J.-M. von der Schulenburg (1993): Die Nachfragemotive nach Kapitallebensversicherungen und ihre Struktur. *Versicherungswirtschaft*, No. 3, 173–180.

Yaari, M. E. (1965): Uncertain lifetime, life insurance and the theory of the consumer. *Review of Economic Studies*, 32(1), 137–150.

Table 1: Life insurance demand and savings

Experiment	L_1	L_2	S_1	S_2	S_3
Baseline	1.80	0.56	-0.16	0.46	0.65
$\alpha = 0, \tau^C = 0$	0.60	0.13	0.11	0.58	0.72
$\alpha = 0$	0.65	0.13	0.10	0.56	0.66
$\tau^C = 0$	0.78	0.18	0.02	0.55	0.72
$\alpha = 0.28$	6.36	0.86	-1.02	0.38	0.64
$\tau^S = 0$	1.63	-0.47	0.01	1.09	0.70
double bequest weights	2.37	0.94	-0.20	0.51	0.86
double bequest weights, $\alpha = 0$	0.86	0.33	0.13	0.65	0.87

Source: authors' calculations.

Table 2: Sample characteristics

	households	percent
EVS total	40230	
German household head	39612	100.0
West Germany	31173	78.7
No life insurance	15625	39.5
Life insurance only	20253	51.1
Life insurance and other forms of insurance	3734	9.4

Source: Einkommens- und Verbrauchsstichprobe (EVS) 1993; authors' calculations.

Table 3: Life-insurance demand vs. children and wealth

		observations	LI holders[a]	percent
Full sample		39612	23987	60.5
Number of children	0	21207	9833	46.4
	1	7668	5683	74.1
	2	7336	5792	78.9
	3	2663	2098	78.8
	4	585	462	79.0
	5+	153	119	77.8
Assets quintile	1	7922	3459	43.7
	2	7922	4736	59.8
	3	7922	5198	65.6
	2	7922	5104	64.4
	5	7924	5490	69.3

Source: Einkommens- und Verbrauchsstichprobe (EVS) 1993; authors' calculations.
[a] Households with one or more life insurance policies.

Table 4: Descriptive statistics for financial variables

	observations	mean	st.dev.
Gross income	39612	63250.7	44662.2
Net labor income	39612	46746.0	29675.3
Asset balance	39612	212059.2	325478.0
Face value of insurance policies[a]	23987	62467.0	82534.1
Cash value of insurance policies[a]	23987	29611.8	65546.4
Annual premium payments[a]	23987	2243.7	3313.1

Source: Einkommens- und Verbrauchsstichprobe (EVS) 1993; authors' calculations.

[a] Life-insurance holders only.

Table 5: Face value of life-insurance policies vs. children and wealth

		observations	mean	st.dev.
Full sample		23987	62467.0	82534.1
Number of children	0	9833	48516.4	66176.3
	1	5683	66766.7	86897.3
	2	5792	81508.0	95175.0
	3	2098	92773.4	109985.7
	4	462	88716.1	97586.1
	5+	119	80580.8	115787.1
Asset quintile	1	3459	37406.0	50427.5
	2	4736	43288.3	52195.0
	3	5198	64457.3	70215.7
	2	5104	62597.5	67847.7
	5	5490	104471.6	128670.8

Source: Einkommens- und Verbrauchsstichprobe (EVS) 1993; authors' calculations.

Table 6: Probit regression of life insurance demand

		All age groups			Under 65 years only		
		estimate	st. error	p-value	estimate	st. error	p-value
West Germany	D	-0.2264	0.0226	0.000	-0.1905	0.0243	0.000
Age		0.0901	0.0046	0.000	0.0803	0.0076	0.000
Age^2		-0.0010	0.0000	0.000	-0.0009	0.0000	0.000
Sex	D	0.0444	0.0229	0.053	0.0568	0.0241	0.019
Married	D	0.5980	0.0526	0.000	0.7034	0.0586	0.000
Number of children		0.0746	0.0108	0.000	0.0480	0.0113	0.000
Home owner	D	0.0020	0.0225	0.929	0.0314	0.0267	0.239
Asset balance		0.0002	0.0000	0.000	0.0003	0.0000	0.000
Net labor income		0.0166	0.0018	0.000	0.0170	0.0018	0.000
Net labor income^2		-0.0000	0.0000	0.014	-0.0000	0.0000	0.012
Net labor income^3		5.43e-08	4.92e-08	0.270	5.42e-08	4.59e-08	0.238
Net labor income $\times$ married		-0.0061	0.0010	0.001	-0.0073	0.0011	0.000
Average tax rate		1.4049	0.0993	0.000	1.2723	0.1031	0.000
Large income[a]	D	-0.0230	0.0285	0.420	-0.0429	0.0306	0.162
Self employed	D	0.4373	0.0415	0.000	0.4304	0.0441	0.000
Civil servant	D	0.0730	0.0256	0.004	0.0408	0.0261	0.119
Constant		-2.4208	0.1096	0.000	-2.2708	0.1549	0.000
Number of observations		39612			32081		
Log likelihood		-21013.2			-18022.8		
Pseudo R^2		0.2308			0.1221		
$\chi^2(16)$		5518.7			2915.7		

Source: Einkommens- und Verbrauchsstichprobe (EVS) 1993; authors' calculations.

Notes: The dependent variable takes the value 1 if the household holds one or more life insurance policies, and is 0 otherwise. Asset balance and net labor income are measured in units of DM 1000. Robust standard errors.

[a] The large income dummy variable takes the value 1 if gross income is in excess of DM 86.400, the 1993 maximum taxable earnings for the public pension system (*Beitragsbemessungsgrenze*).

Table 7: OLS regression of life insurance face values

		All age groups			Under 65 years only		
		estimate	st. error	p-value	estimate	st. error	p-value
West Germany	D	15.7587	0.9827	0.000	16.7922	1.0596	0.000
Age		-1.9689	0.2317	0.000	0.3675	0.3920	0.348
Age^2		0.0071	0.0023	0.003	-0.0213	0.0045	0.000
Sex	D	0.1901	1.3442	0.888	1.1874	1.4120	0.400
Married	D	4.4867	6.3041	0.477	7.1560	6.7743	0.291
Number of children		1.2776	0.6311	0.043	-0.4552	0.6794	0.503
Home owner	D	-5.7407	1.4911	0.000	-5.7367	1.6214	0.000
Asset balance		0.0394	0.0040	0.000	0.0422	0.0044	0.000
Net labor income		0.5515	0.1465	0.000	0.6162	0.1403	0.000
Net labor $income^2$		0.0030	0.0013	0.028	0.0028	0.0012	0.022
Net labor $income^3$		-6.20e-06	3.96e-06	0.118	-5.82e-06	3.70e-06	0.116
Net labor income × married		-0.0810	0.1368	0.554	-0.1085	0.1453	0.455
Average tax rate		-9.5066	6.5319	0.146	-14.5970	6.9217	0.035
Large income[a]	D	-1.5747	2.2563	0.485	-2.7115	2.3332	0.245
Self employed	D	72.3754	3.4620	0.000	72.1611	3.5180	0.000
Civil servant	D	-10.3261	1.4855	0.000	-11.8301	1.5265	0.000
Constant		73.1455	6.4279	0.000	25.8394	8.6863	0.003
Number of observations		23929			22317		
R^2		0.3389			0.3289		
F(16,·)		364.51			299.56		

Source: Einkommens- und Verbrauchsstichprobe (EVS) 1993; authors' calculations.

Notes: The dependent variable is the sum of the face values of all life insurance policies held, excluding zero observations. Face values, asset balance and net labor income are measured in units of DM 1000. Robust standard errors.

[a] The large income dummy variable takes the value 1 if gross income is in excess of DM 86.400, the 1993 maximum taxable earnings of the public pension system (*Beitragsbemessungsgrenze*).

Table 8: Tobit regression of life insurance face values

		All age groups			Under 65 years only		
		estimate	st. error	p-value	estimate	st. error	p-value
West Germany	D	0.7927	1.1955	0.507	3.8146	1.2607	0.002
Age		3.8479	0.2365	0.000	4.0610	0.4069	0.000
Age^2		-0.0564	0.0024	0.000	-0.0597	0.0046	0.000
Sex	D	2.3406	1.2468	0.060	3.0536	1.3000	0.019
Married	D	35.1342	2.4347	0.000	40.1107	2.6125	0.000
Number of children		3.7845	0.5741	0.000	1.8641	0.6087	0.002
Home owner	D	-3.9929	1.2180	0.001	-2.5490	1.3017	0.050
Asset balance		0.0377	0.0018	0.000	0.0461	0.0019	0.000
Net labor income		1.2504	0.0651	0.000	1.3349	0.0682	0.000
Net labor income^2		0.0002	0.0005	0.649	7.58e-06	0.0005	0.989
Net labor income^3		-1.46e-06	1.38e-06	0.291	-1.12e-06	1.37e-06	0.412
Net labor income × married		-0.4067	0.0457	0.000	-0.4601	0.0478	0.000
Average tax rate		57.3180	4.8800	0.000	50.1906	5.0188	0.000
Large income[a]	D	-4.0712	1.6958	0.016	-6.0068	1.7474	0.001
Self employed	D	77.8294	2.0105	0.000	78.4872	2.0404	0.000
Civil servant	D	-4.9038	2.1182	0.021	-7.2022	2.0965	0.001
Constant		-131.1412	5.5493	0.000	-140.1352	8.2622	0.000
σ		81.1408	0.4085		82.7119	0.4180	
Number of observations		39612			32081		
Log likelihood		-133456.9			-130818.6		
Pseudo R^2		0.062			0.039		
$\chi^2(16)$		17706.2			10879.3		

Source: Einkommens- und Verbrauchsstichprobe (EVS) 1993; authors' calculations.

Notes: The dependent variable is the sum of the face values of all life insurance policies held, including zero observations. Face values, asset balance and net labor income are measured in units of DM 1000.

[a] The large income dummy variable takes the value 1 if gross income is in excess of DM 86.400, the 1993 maximum taxable earnings of the public pension system (*Beitragsbemessungsgrenze*).

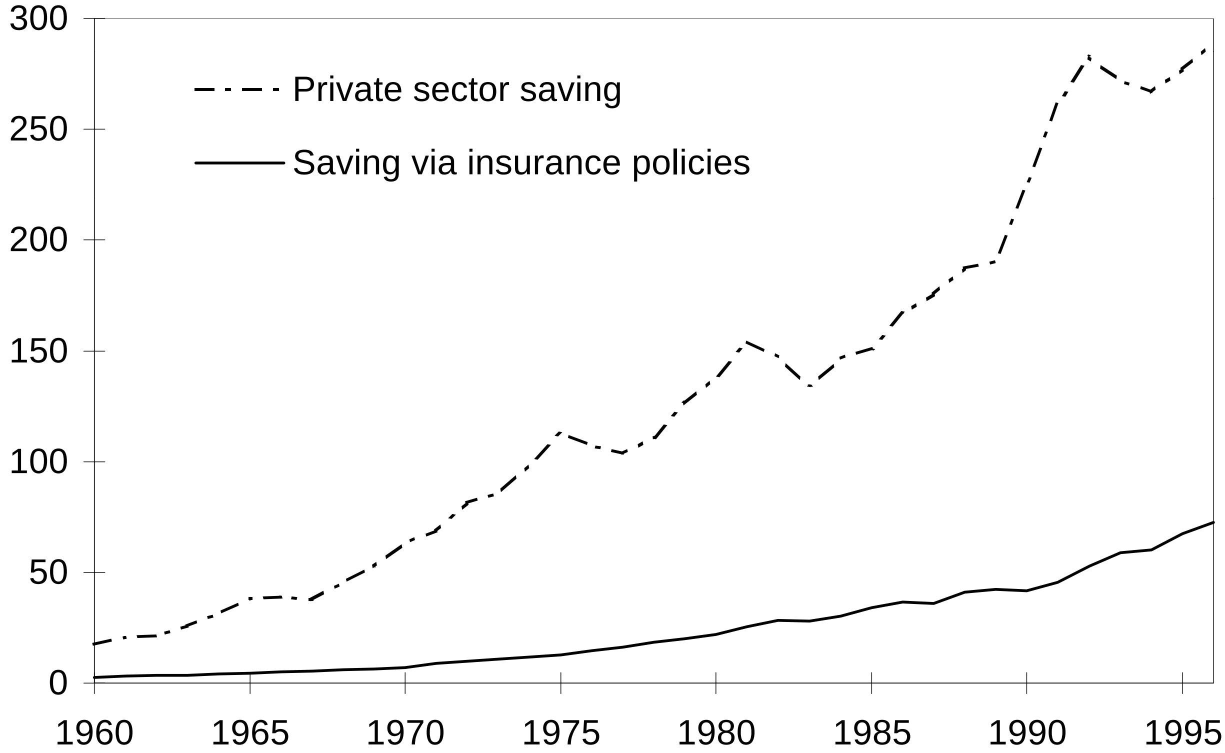

Figure 1: Total saving and insurance saving, 1960–96

Source: Deutsche Bundesbank, *Gesamtwirtschaftliche Finanzierungsrechnung*, various issues.

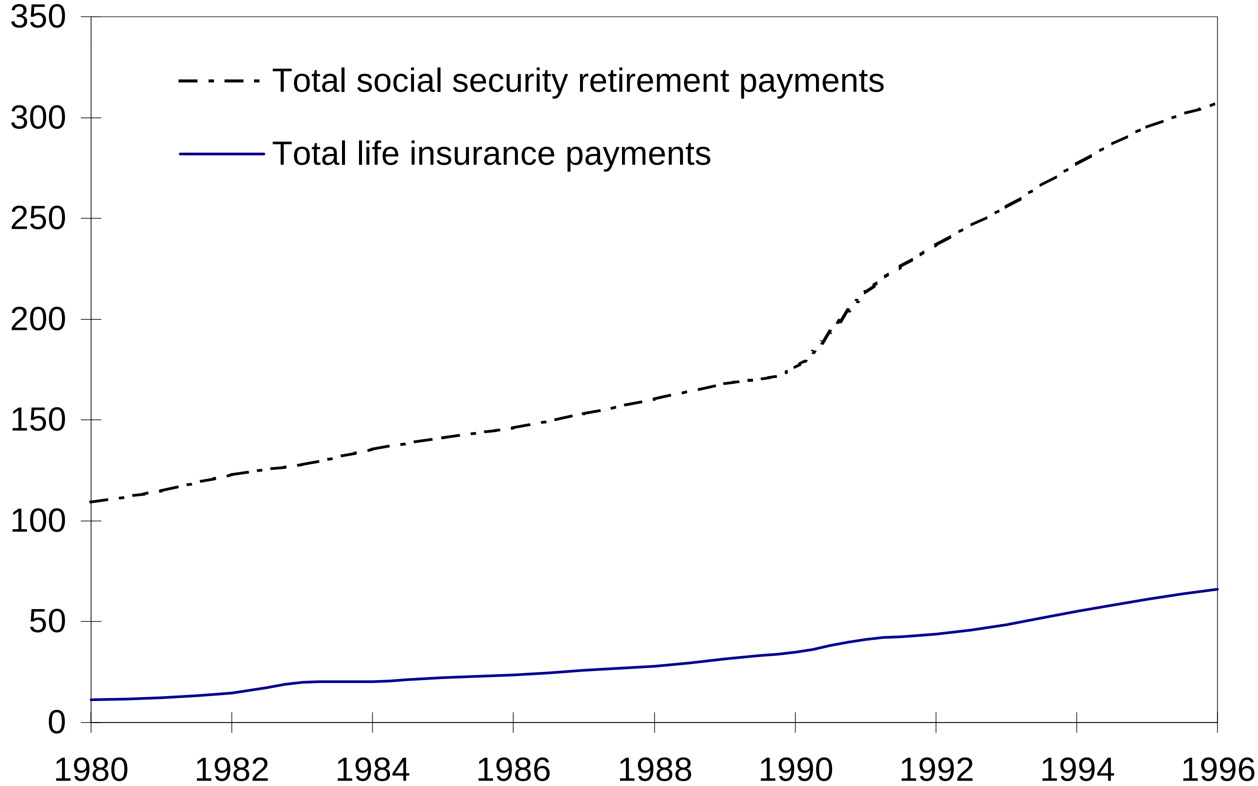

Figure 2: Social security pensions and life insurance payments, 1980–96

Source: Gesamtverband der deutschen Versicherungswirtschaft (1997).

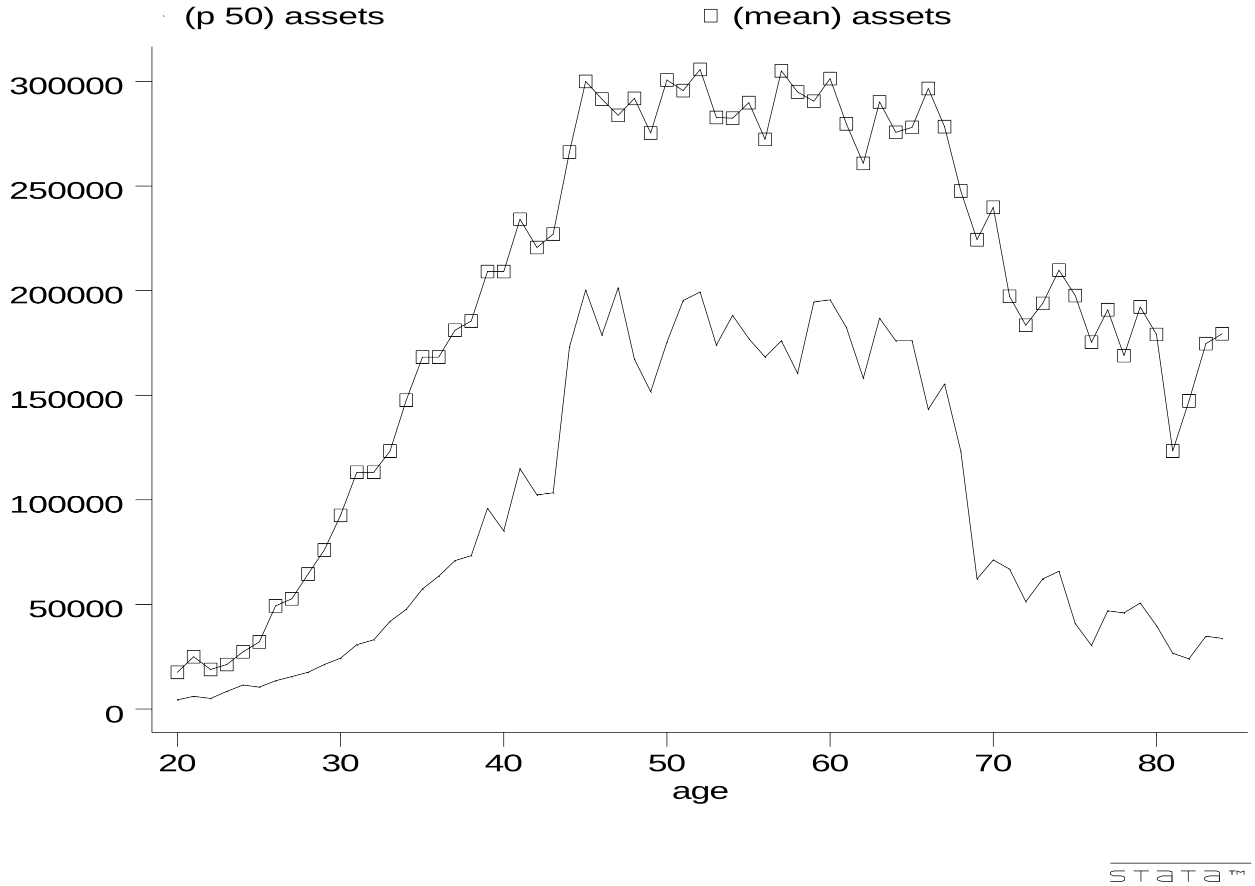

Figure 3: Mean assets by age group

Source: Einkommens- und Verbrauchsstichprobe (EVS) 1993; authors' calculations.

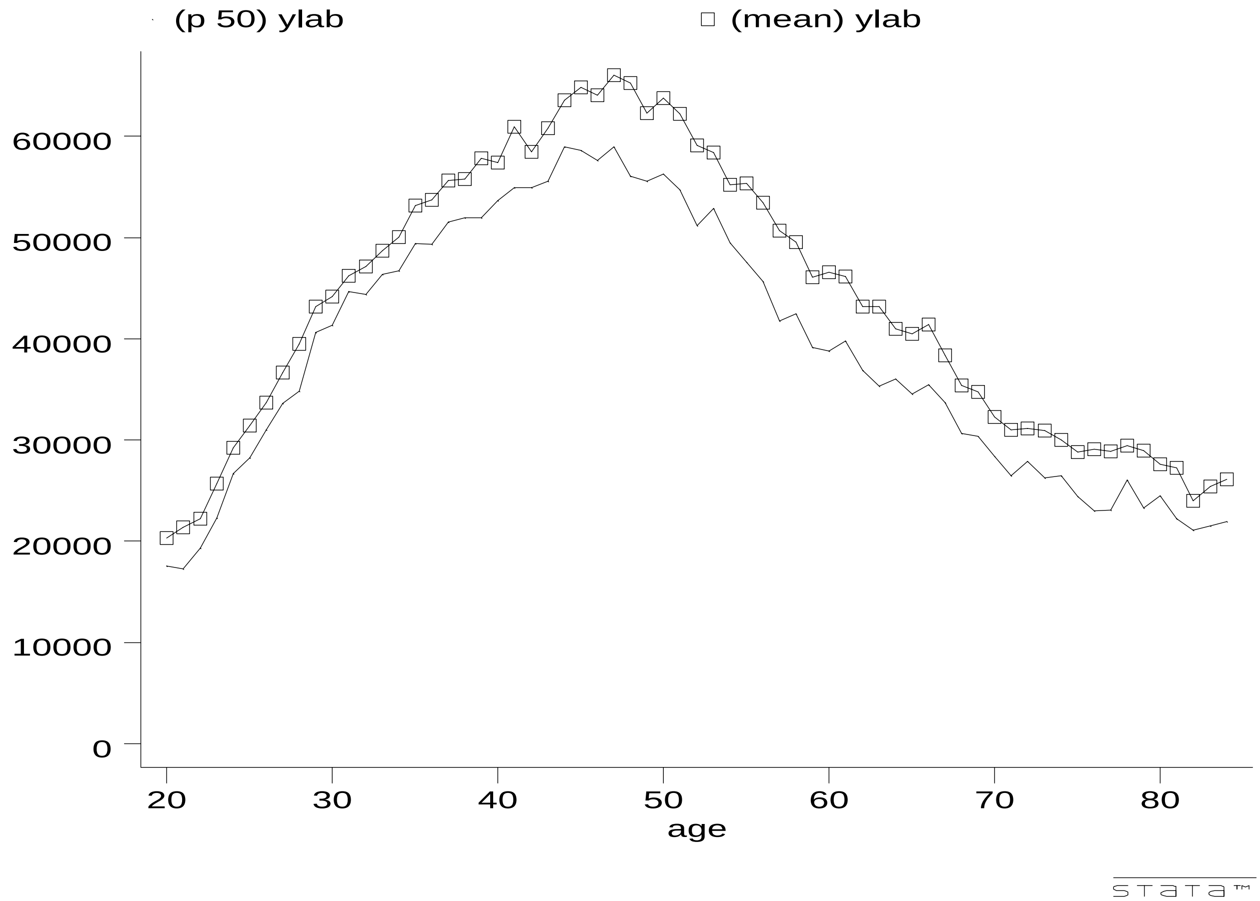

Figure 4: Mean and median net income by age group

Source: Einkommens- und Verbrauchsstichprobe (EVS) 1993; authors' calculations.

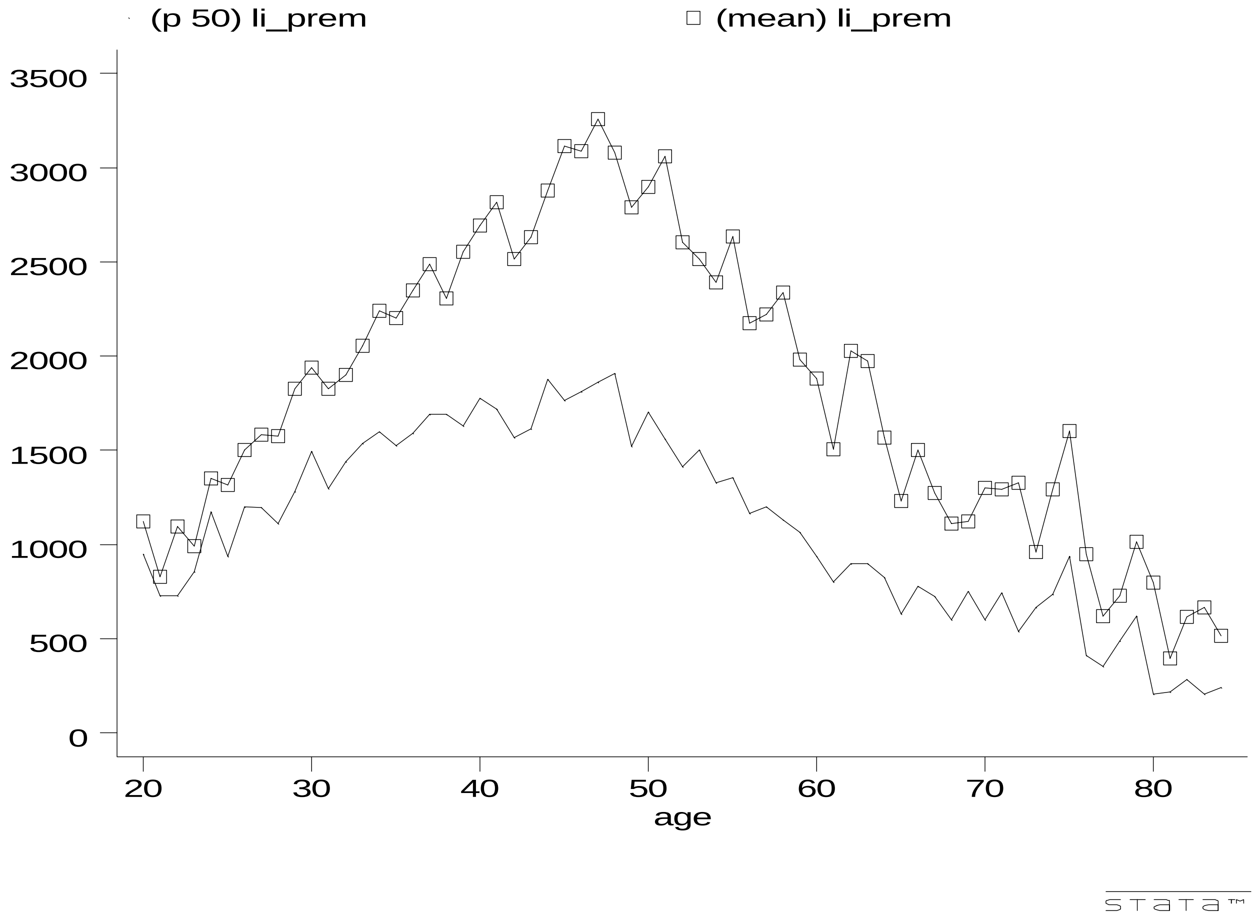

Figure 5: Means and medians of annual life insurance premium payments by age group

Note: Life insurance holders only.

Source: Einkommens- und Verbrauchsstichprobe (EVS) 1993; authors' calculations.

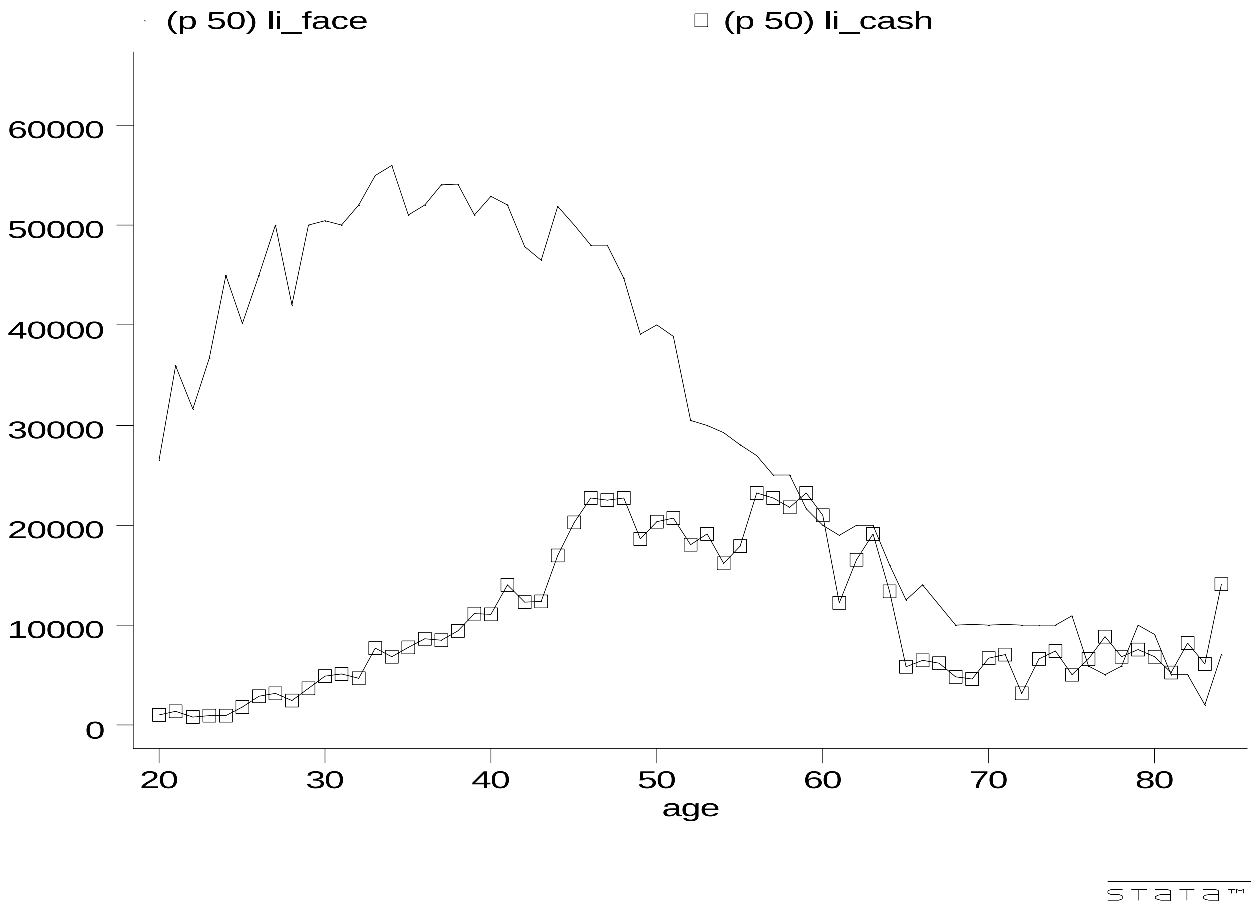

Figure 6: Median face and cash values of life insurance policies by age group

Note: Life insurance holders only.

Source: Einkommens- und Verbrauchsstichprobe (EVS) 1993; authors' calculations.

Nr.	Author	Title
01-52	Martin Hellwig Klaus M. Schmidt	Discrete-Time Approximations of the Holmström-Milgrom Brownian-Motion Model of Intertemporal Incentive Provision
01-51	Martin Hellwig	The Role of Boundary Solutions in Principal-Agent Problems with Effort Costs Depending on Mean Returns
01-50	Siegfried K. Berninghaus	Evolution of conventions - some theoretical and experimental aspects
01-49	Dezsö Szalay	Procurement with an Endogenous Type Distribution
01-48	Martin Weber Heiko Zuchel	How Do Prior Outcomes Affect Risky Choice? Further Evidence on the House-Money Effect and Escalation of Commitment
01-47	Nikolaus Beck Alfred Kieser	The Complexity of Rule Systems, Experience, and Organizational Learning
01-46	Martin Schulz Nikolaus Beck	Organizational Rules and Rule Histories
01-45	Nikolaus Beck Peter Walgenbach	Formalization and ISO 9000 - Changes in the German Machine Building Industry
01-44	Anna Maffioletti Ulrich Schmidt	The Effect of Elicitation Methods on Ambiguity Aversion: An Experimental Investigation
01-43	Anna Maffioletti Michele Santoni	Do Trade Union Leaders Violate Subjective Expected Utility?Some Insights from Experimental Data
01-42	Axel Börsch-Supan	Incentive Effects of Social Security Under an Uncertain Disability Option
01-41	Carmela Di Mauro Anna Maffioletti	Reaction to Uncertainty and Market Mechanism:Experimental Evidence
01-40	Marcel Normann Thomas Langer	Altersvorsorge, Konsumwunsch und mangelnde Selbstdisziplin: Zur Relevanz deskriptiver Theorien für die Gestaltung von Altersvorsorgeprodukten

Nr.	Author	Title
01-39	Heiko Zuchel	What Drives the Disposition Effect?
01-38	Karl-Martin Ehrhart	European Central Bank Operations: Experimental Investigation of the Fixed Rate Tender
01-37	Karl-Martin Ehrhart	European Central Bank Operations: Experimental Investigation of Variable Rate Tenders
01-36	Karl-Martin Ehrhart	A Well-known Rationing Game
01-35	Peter Albrecht Raimond Maurer	Self-Annuitization, Ruin Risk in Retirement and Asset Allocation: The Annuity Benchmark
01-34	Daniel Houser Joachim Winter	Time preference and decision rules in a price search experiment
01-33	Christian Ewerhart	Iterated Weak Dominance in Strictly Competitive Games of Perfect Information
01-32	Christian Ewerhart	THE K-DIMENSIONAL FIXED POINT THEOREM OF PROVABILITY LOGIC
01-31	Christian Ewerhart	A Decision-Theoretic Characterization of Iterated Weak Dominance
01-30	Christian Ewerhart	Heterogeneous Awareness and the Possibility of Agreement
01-29	Christian Ewerhart	An Example for a Game Involving Unawareness: The Tragedy of Romeo and Juliet
01-28	Christian Ewerhart	Backward Induction and the Game-Theoretic Analysis of Chess
01-27	Eric Igou Herbert Bless	About the Importance of Arguments, or: Order Effects and Conversational Rules
01-26	Heiko Zuchel Martin Weber	The Disposition Effect and Momentum
01-25	Volker Stocké	An Empirical Test of the Contingency Model for the Explanation of Heuristic-Based Framing-Effects

Nr.	Author	Title
01-24	Volker Stocké	The Influence of Frequency Scales on the Response Behavior. A Theoretical Model and its Empirical Examination
01-23	Volker Stocké	An Empirical Examination of Different Interpretations of the Prospect Theoryś Framing-Hypothesis
01-22	Volker Stocké	Socially Desirable Response Behavior as Rational Choice: The Case of Attitudes Towards Foreigners
01-21	Phillipe Jehiel Benny Moldovanu	License Auctions and Market Structure
01-20	Phillipe Jehiel Benny Moldovanu	The European UMTS/IMT-2000 License Auctions
01-19	Arieh Gavious Benny Moldovanu Aner Sela	Bid Costs and Endogenous Bid Caps
01-18	Benny Moldovanu Karsten Fieseler Thomas Kittsteiner	Partnerships, Lemons and Efficient Trade
01-17	Raimond Maurer Martin Pitzer Steffen Sebastian	Construction of a Transaction Based Real Estate Index for the Paris Housing Market
01-16	Martin Hellwig	The Impact of the Number of Participants on the Provision of a Public Good
01-15	Thomas Kittsteiner	Partnerships and Double Auctions with Interdependent Valuations
01-14	Axel Börsch-Supan Agar Brugiavini	Savings: The Policy Debate in Europe
01-13	Thomas Langer	Fallstudie zum rationalen Entscheiden: Contingent Valuation und der Fall der Exxon Valdez