Institut für Versicherungswirtschaft

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Life Annuity Insurance versus Self-Annuitization

January 2006

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Introduction

- Topic: Life Annuity Insurance versus Self-Annuitization

- Two Papers:

  Part 1: Life Annuity Insurance versus Self-Annuitization: An Analysis from the Perspective of the Family

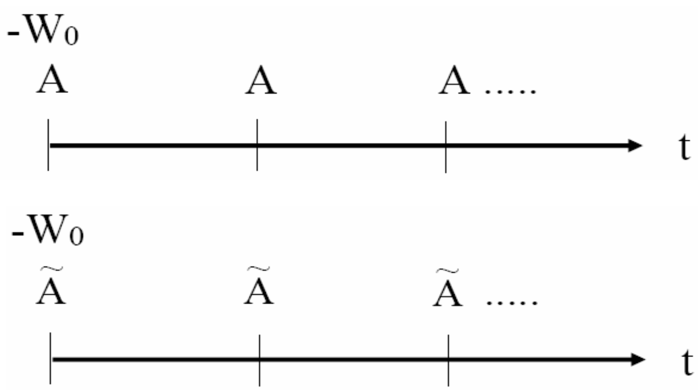
  – Hato Schmeiser, Thomas Post

  Part 2: What is the Best Retirement Arrangement for a Family?

  – Thomas Post, Helmut Gründl, and Hato Schmeiser

Introduction

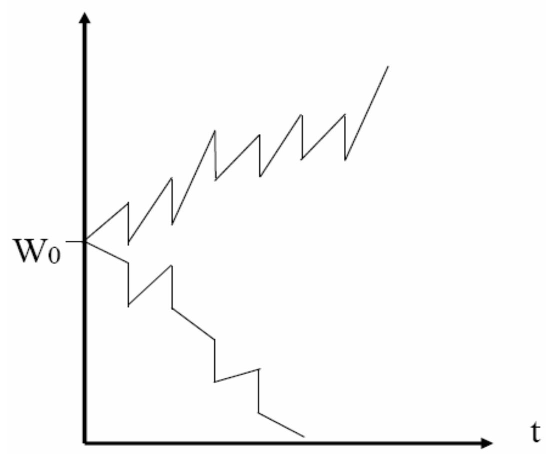
- Mandatory, government-organized pay-as-you-go pension schemes face serious challenges in most Western countries
- Need for additional private savings becomes obvious
- Focus: decumulation phase after retirement
- Two alternatives
  - Immediate life annuity
  - "Self-Annuitization"



Introduction

- Life annuity
  - constant income stream as long as the annuitant is alive ⇨ no risk of outliving your money (shortfall event)
  - BUT expensive (Mitchell et al. 1999)

- Self-annuitization via investment into a mutual fund
  - chance for bequests
  - more flexibility
  - BUT risk of outliving your money



Literature

- Main focus on possible shortfall events (e.g., Milevsky, Ho, and Robinson, 1997; Milevsky, 1998; Milevsky and Robinson, 2000; Albrecht and Maurer, 2002; Milevsky and Young, 2003)
- Chances of the self-annuitization strategy not evaluated
  - possibility to bequeath wealth
- Central problem
  - evaluation of bequest potential

Our approach

- **Paper 1**: Explore shortfall events and bequest distributions via simulation
- Integrate self-annuitization into a meaningful real-world strategy and look at the idea from that perspective
  - for most people, shortfall = "starving" in retirement
  - strong argument against giving up the security of an annuity for the chance to bequeath wealth
- BUT what about transferring this risk to the beneficiaries — the heirs
- "Family Strategy"

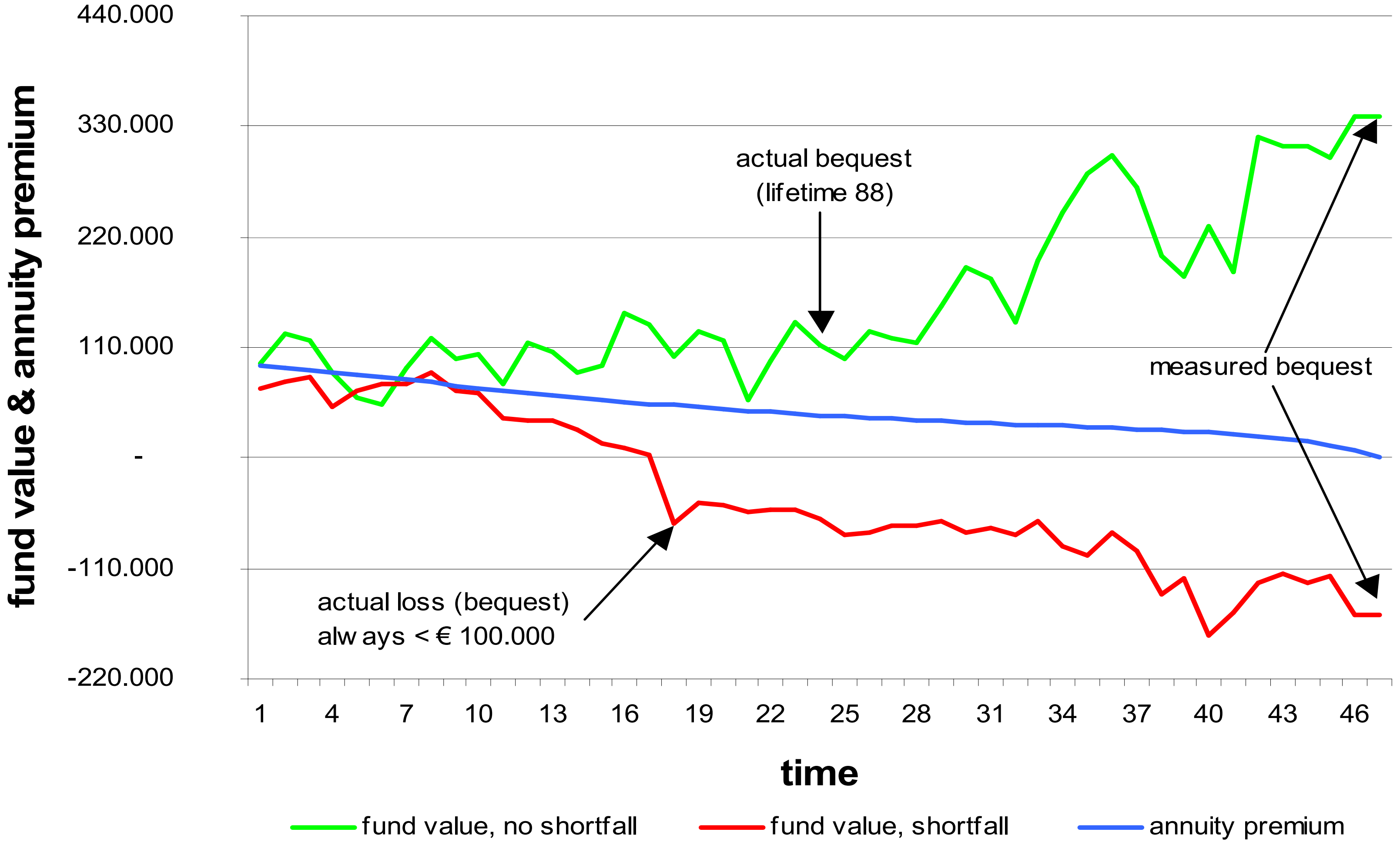
Model

- 65 (75, 80) year-old male (female) retiree, with wealth W_0 = € 100,000
- Benchmark investment: immediate life annuity
  - pays amount A at the beginning of each year
- *Family strategy*
  - Investment of W_0 into investment fund, withdrawal of amount A from fund at beginning of each year
  - Heirs: right to receive remaining fund on the retiree's death
  - BUT: obliged to purchase life annuity if fund is exhausted (shortfall)
  - Losses for heirs never greater than € 100,000
  - Retiree: never put in a position worse than he would be with annuity

Measurement of the bequest

- Bequests occur at different points in time t
- For comparison purposes, they are compounded to the year where the life-table ends (110 years ⇨ t = 46)
- Compounding with the investment fund return process
- Losses (purchase of the annuity) are compounded as well (process stays strictly negative)
  - think of opportunity costs

Measurement of the bequest



Model input data – returns, annuities

- German capital market data, DAX (stock index), REXP (bond index)
- Nominal continuous return r in annual terms
- Prices follow geometric Brownian motion

- German annuity payouts for constant annuities
- A = € 6,421 (0% tax) for W_0 = € 100,000
- Future annuity prices are calculated on a actuarial basis, using the internal rate of return of the current offer (2.76%) (+ one variant with stochastic annuity prices)

Model input data - mortality

- Use of life-tables that reflect the general population mortality
  - Insurance tables typically include loads to account for adverse selection effects
  - BUT our family may not necessarily be subject to such effects

Fund value at time t (before switch)

transaction costs 0.6 % p.a.

$$W_t = \left[\left(1 - f \right) \cdot W_{t-1} - I_{t-1} \cdot A \right] \cdot R$$

indicator variable

portfolio proportions

$$R = \alpha \cdot e^{r_1} + \left(1 - \alpha \right) \cdot e^{r_2}$$

Simulation results – the bequest at t = 46

Statistical Figures of the Wealth Distribution for the Family Strategy for a 65-Year-Old Retiree With a Marginal Tax Rate of 0 Percent

	Proportion α of Investment in Stocks					
	0%	20%	40%	60%	80%	100%
Male, 65						
Mean	532.1	1,251.2	2,752.9	5,810.1	11,905.0	23,853.2
Std. Dev.	446.3	1,053.2	3,441.9	11,677.0	39,534.1	133,241.0
LPM_0	5.51%	2.85%	4.50%	7.21%	10.38%	14.03%
LPM_1	7.3	6.6	23.0	77.8	235.2	657.4
Female, 65						
Mean	531.0	1,276.2	2,843.0	6,040.8	12,424.9	24,955.2
Std. Dev.	373.1	983.5	3,464.3	12,036.2	41,078.3	138,766.7
LPM_0	1.52%	1.08%	2.89%	5.67%	9.40%	13.51%
LPM_1	1.3	1.7	11.0	48.8	168.8	505.1

Mean in thousand € (T €); Std. Dev. = standard deviation in T €; LPM_0 = lower partial moment 0; LPM_1 = lower partial moment 1 in T €.

Simulation results – the bequest at t = 46

Statistical Figures of the Wealth Distribution for the Family Strategy for a 65-Year-Old Retiree With a Marginal Tax Rate of 36 Percent

	Proportion α of Investment in Stocks					
	0%	20%	40%	60%	80%	100%
Male, 65						
Mean	146.4	431.3	1,107.7	2,654.2	6,083.5	13,511.2
Std. Dev.	177.2	417.6	1,453.4	5,443.9	20,334.3	75,124.7
LPM_0	18.95%	8.03%	7.48%	8.95%	11.32%	14.14%
LPM_1	14.7	9.7	19.4	51.1	139.8	377.6
Female, 65						
Mean	135.5	425.3	1,122.8	2,725.8	6,291.3	14,025.7
Std. Dev.	147.8	380.3	1,445.1	5,576.2	21,032.2	77,921.1
LPM_0	14.19%	4.99%	5.70%	7.98%	10.83%	14.17%
LPM_1	7.6	4.4	11.4	36.1	107.8	306.0

Mean in thousand € (T €); Std. Dev. = standard deviation in T €; LPM_0 = lower partial moment 0; LPM_1 = lower partial moment 1 in T €.

Simulation results – the bequest at t = 36

Statistical Figures of the Wealth Distribution for the Family Strategy for a 75-Year-Old Retiree With a Marginal Tax Rate of 0 Percent

	Proportion α of Investment in Stocks					
	0%	20%	40%	60%	80%	100%
Male, 75						
Mean	236.3	485.2	925.0	1,692.7	3,013.5	5,251.2
Std. Dev.	321.6	557.8	1,259.0	3,193.4	8,376.6	22,313.8
LPM_0	21.77%	14.80%	13.05%	13.84%	15.54%	17.85%
LPM_1	42.9	39.2	56.3	101.8	196.0	381.2
Female, 75						
Mean	238.1	496.4	962.0	1,777.5	3,174.2	5,483.7
Std. Dev.	268.0	485.3	1,196.6	3,245.0	8,430.1	21,465.7
LPM_0	16.09%	9.14%	9.31%	11.52%	13.90%	17.27%
LPM_1	19.8	15.7	27.6	61.8	136.3	290.8

Mean in thousand € (T €); Std. Dev. = standard deviation in T €; LPM_0 = lower partial moment 0; LPM_1 = lower partial moment 1 in T €.

Simulation results – the bequest at t = 46

Statistical Figures of the Wealth Distribution for the Family Strategy for a 65-Year-Old Male Retiree With Annuitant Mortality at Marginal Tax Rate 0 Percent

	Proportion α of Investment in Stocks					
	0%	20%	40%	60%	80%	100%
Male, 65						
Mean	412.0	1,064.8	2,463.5	5,359.4	11,199.5	22,747.9
Std. Dev.	415.6	978.2	3,266.2	11,293.4	38,732.6	131,580.3
LPM_0	11.54%	5.42%	7.01%	9.98%	13.57%	17.52%
LPM_1	13.4	10.6	31.5	97.2	278.5	748.7
Female, 65						
Mean	451.4	1,158.2	2,666.5	5,773.9	12,018.2	24,312.6
Std. Dev.	343.9	928.8	3,359.1	11,834.3	40,716.5	138,283.7
LPM_0	3.33%	1.86%	4.01%	7.26%	11.30%	15.77%
LPM_1	2.3	2.5	13.5	56.4	187.5	567.2

Mean in thousand € (T €); Std. Dev. = standard deviation in T €; LPM_0 = lower partial moment 0; LPM_1 = lower partial moment 1 in T €.

Simulation results – the bequest at t = 46

Statistical Figures of the Wealth Distribution for the Family Strategy for a 65-Year-Old Retiree at Marginal Tax Rate 0 Percent and Stochastic Future Annuity Prices

	Proportion α of Investment in Stocks					
	0%	20%	40%	60%	80%	100%
Male, 65						
Mean	531.6	1,252.2	2,762.2	5,847.0	12,025.0	24,220.3
Std. Dev.	447.6	1,060.7	3,463.3	11,624.4	38,659.0	127,897.6
LPM_0	5.51%	2.85%	4.50%	7.21%	10.38%	14.03%
LPM_1	7.4	6.5	23.1	80.7	243.0	656.3
Female, 65						
Mean	530.3	1,275.7	2,848.5	6,069.6	12,522.9	25,253.9
Std. Dev.	372.3	985.6	3,470.3	11,926.7	40,003.0	132,759.7
LPM_0	1.52%	1.08%	2.89%	5.67%	9.40%	13.51%
LPM_1	1.3	1.6	10.5	49.2	175.0	525.8

Mean in thousand € (T €); Std Dev. = standard deviation in T €; LPM_0 = lower partial moment 0; LPM_1 = lower partial moment 1 in T €.

Conclusion and outlook (Paper 1)

- Family strategy offers chances of a bequest
- Chances are higher if
  - Retiree is younger
  - Retiree and heir have low marginal tax rate
  - Retiree is female (lower shortfall risk)
  - Retiree has general population mortality
- Family strategy can reduce cost of adverse selection
  - people who suffer from adverse selection have opportunity to access fair-priced products

Conclusion and outlook (Paper 1)

- But
  - Heirs give up some financial flexibility (maybe they have to give a collateral)
  - Moral hazard

- Future research
  - Spreading the risk over more family members (spouse, children, grandchildren…) => intrafamily hedging, see Kotlikoff/Spivak 1981
  - Utility based evaluation of the family strategy => Focus of Paper 2

Introduction

- Chance and risk profile looks promising, but no clear indication is given (no valuation)
- **Paper 2**: Goal: Under which conditions are heirs willing to agree to a family strategy?
- Family strategy is integrated into a discrete time – intertemporal consumption/saving – expected utility framework in the fashion of Gomes and Michaelides (2003, 2005)
- Realistic calibration to account for risks arising from stochastic life span, asset returns, and nontradable labor income

The model

- The heir maximizes expected lifetime utility, first without and then with the family strategy

- He chooses the alternative that gives the highest expected utility

$$\max_{\alpha_t, C_t} \mathrm{E}_0\left(U\left(C\right)\right) \qquad \textit{with } U\left(C\right) = \sum_{t=0}^{T-x} \delta^t U_t\left(C_t\right)$$

- The one period utility function $U_t(C_t)$ displays constant relative risk aversion of γ

The model

- Maximization is subject to consumption constrains:

$$C_0 = W_0 + P - S_0$$

$$C_t = \underbrace{S_{t-1}\left(1-\alpha_{t-1}\right)R_f + S_{t-1}\alpha_{t-1}R_{t-1} - A_{t-1} + L_{t-1}}_{W_t} - S_t \quad \forall \quad t \in \{1,2,\ldots,T-x\},$$

subject to borrowing/collateral size constrains:

$$col_0 \le S_0 \le W_0 + P$$

$$col_t \le S_t \le W_t \quad \forall \quad t \in \{1,2,\ldots,T-x\},$$

subject to collateral investment constrains:

$$col_t \le S_t\left(1-\alpha_t\right) \quad \forall \quad t \in \{0,1,\ldots,T-x\},$$

and subject to no-short-sale constrains

Base parameter configuration

parameter		value
age of the retiree		65
insurance premium	P	300,000 €
collateral at $t = 0$	col_0	395,777 €
annual annuity payment	A	20,514 €
age of the heir	x	45
maximum lifespan	T	121
mortality		population average
relative risk aversion	γ	2
subjective discount factor	δ	0.97
marginal tax rate		0%
inflation	π	0.0263
log-normal stock return	R_t	
E(R_t)		1.1502
Std(R_t)		0.3157
risk-free return	R_f	1.0481
log-normal labor income	L_t	
last year's net income of the heir	L_{-1}	30,000 €
E(L_t)		life-cycle-income profile
unemployment probability		1%
unemployment/welfare benefits		8,000 € · $(1 + \pi^t)$
Std(labor income; when not unemployed)		20%

Results base parameter configuration

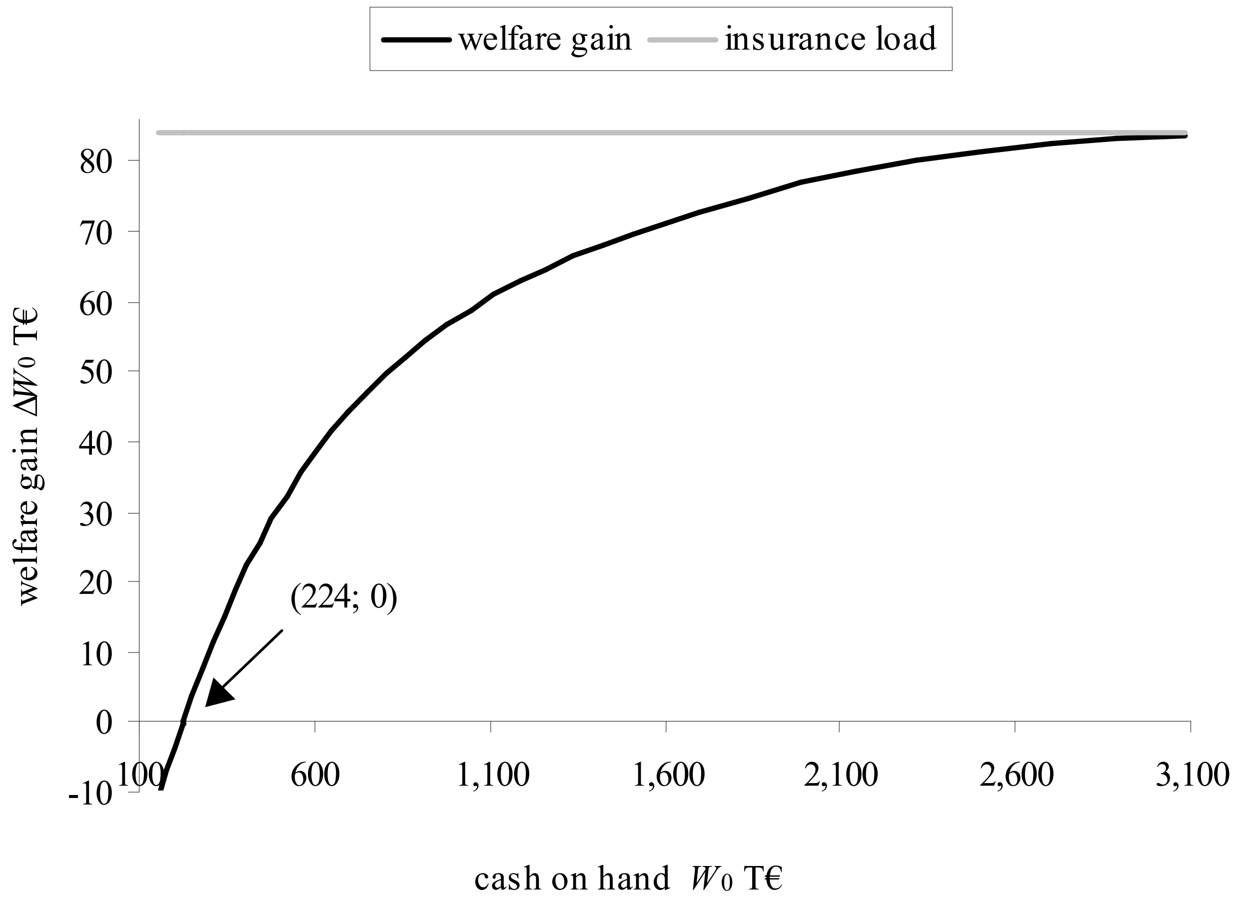
- The difference between participating in the family strategy or not can be expressed in €-terms

- We thereby apply an equivalent wealth calculation, i.e., we calculate how much additional cash on hand ΔW_0 the heir would need to be indifferent between the two alternatives (see Brown, 2001)

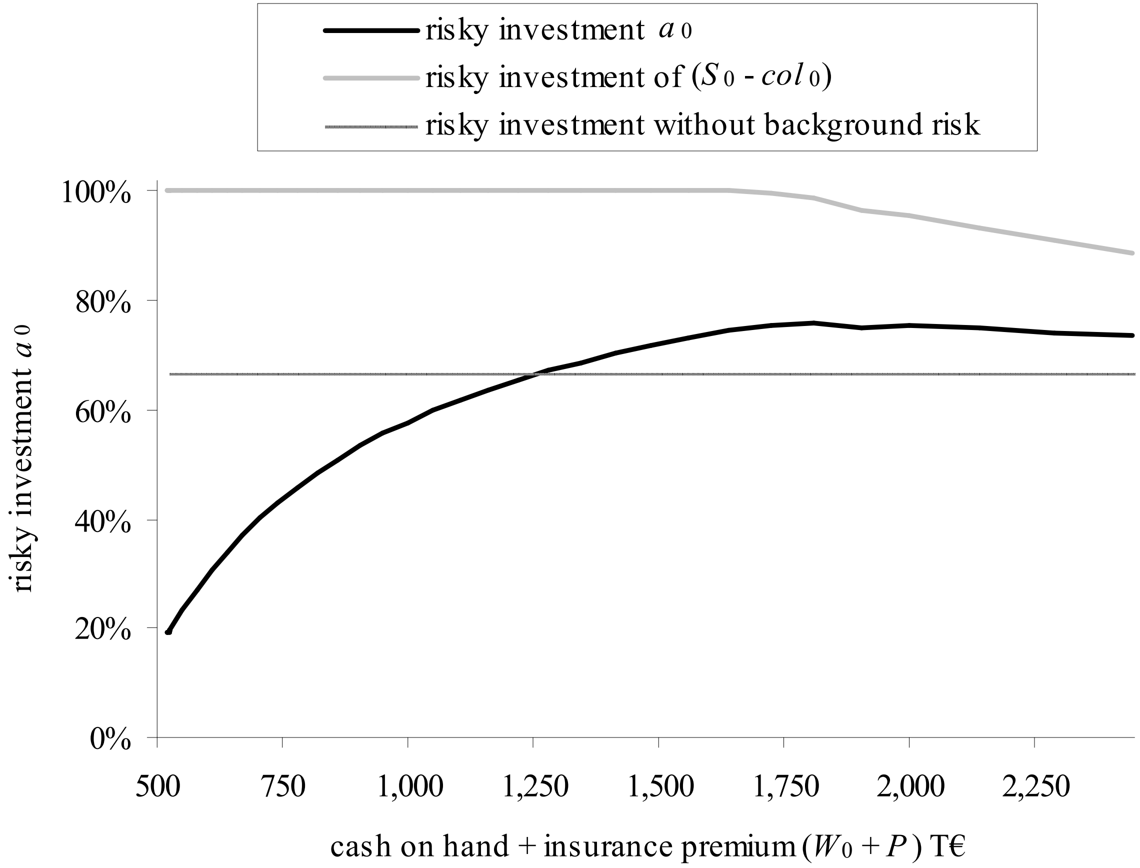
  W_0 = 224 T€ => indifferent

  Optimal saving decisions S_0 in t = 0

Results base parameter configuration



Results base parameter configuration



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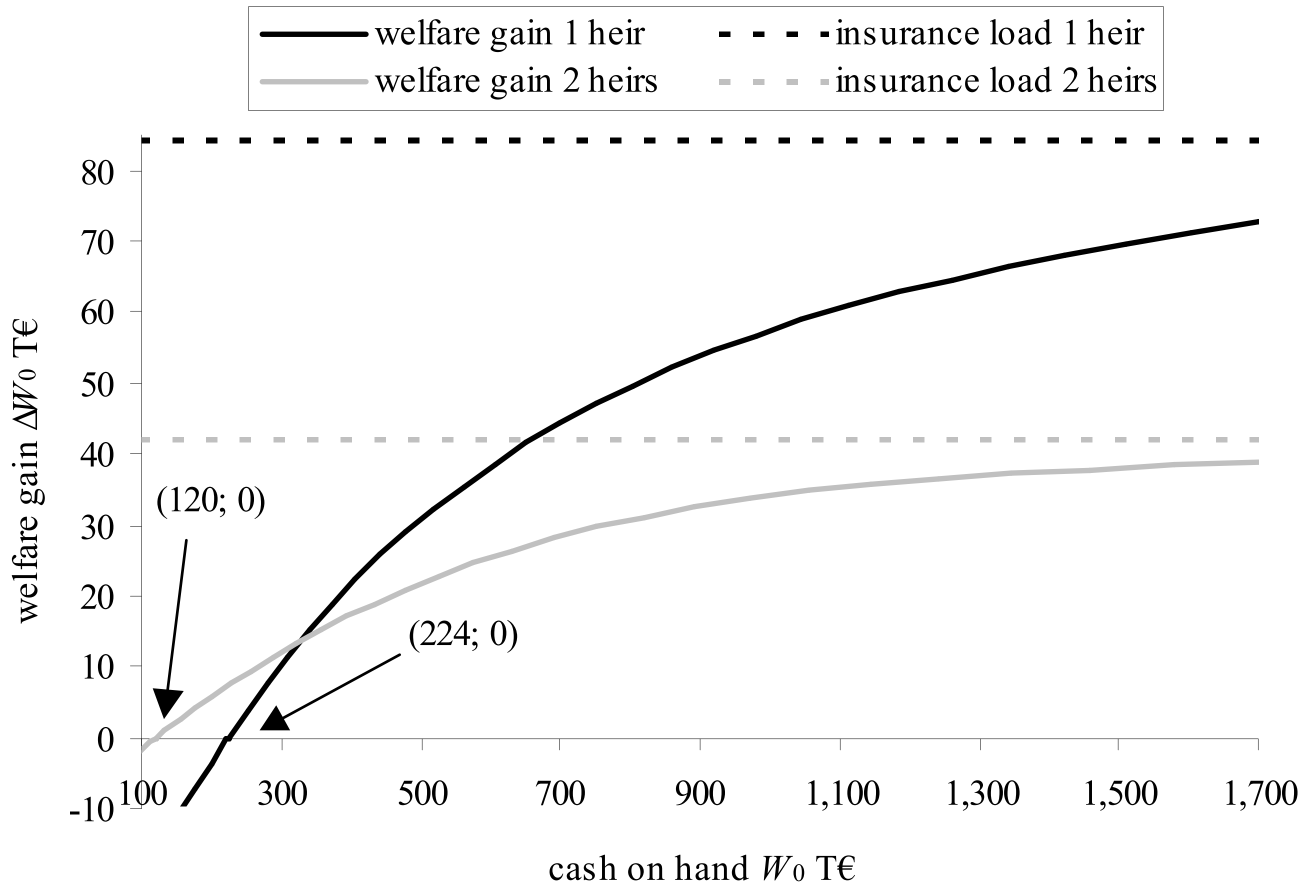
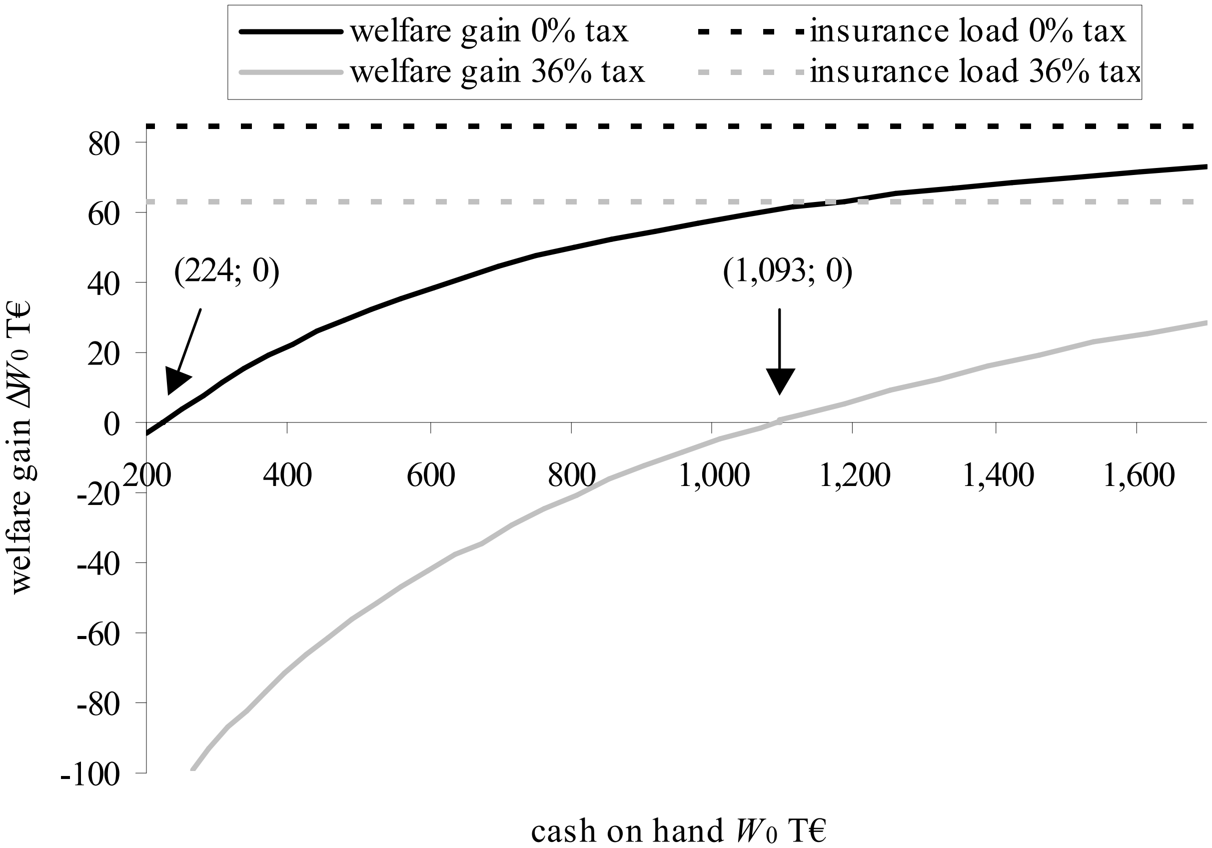
One vs. two heirs



0% vs. 36% marginal tax rate



Outlook

- Average vs. annuitant mortality; different levels of constant relative risk aversion of C_t; different subjective discount factors

- Summary:

  Family strategy is accepted for many parameter combinations

  Especially suitable for families with low marginal tax rates, wealthy heirs, or where the retiree has an average population life expectancy