Intergenerational Risk Sharing in Life Insurance: Evidence from France

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Life insurance

- Traditional role: insurance against idiosyncratic risk (mortality, longevity)
- More and more: insurance against aggregate risk (market risk)
  - US: variable annuities with minimum return guarantees = \$1.5 trillion = 34% of life insurer liabilities (Koijen-Yogo 2017)
  - Europe: Euro-denominated contracts = 80% of life insurance premiums (Insurance Europe 2016)
  - France: €1.3 trillion = 40% of household financial wealth (INSEE 2016)

Insurance against aggregate risk

Two ways to create insurance against aggregate risk (Allen-Gale 1997)

1. Cross-sectional risk sharing between insurer and investors (contract holders)
   - US: variable annuities with minimum return guarantees
2. Intergenerational risk sharing across generations of investors
   - EU: Euro-denominated contracts

This paper

- French life insurance market
- 1st contribution: Quantify intergenerational transfers

  1. Smoothing of contract returns relative to underlying asset portfolio: annual volatility 0.8% vs. 4.1%
  2. Smoothing through reserves: PPB, RC, unrealized capital gains
  3. Intertemporal transfers $\sim$ 3.7% of account value $\sim$ €44 bn/year
  4. Intergenerational transfers $\sim$ 1.4% of account value $\sim$ €17 bn/year

This paper

- 2nd contribution: Conditions for possibility of intergenerational risk sharing
- Theory
  - Stiglitz (1983), Gordon and Varian (1988): Competitive markets cannot implement intergenerational risk sharing, because future generations cannot share risk before they start participating in the market
  - Allen and Gale (1997): Even if an intermediary offers an intergenerational risk sharing arrangement, it will be undone by competition
- We show that:
  1. Insurers pay higher returns when they hold larger reserves
  2. This generates predictability in contract returns
  3. Inflows react only weakly to this predictability

Literature

- Borel-Mathurin et al. (2015): relation between contract return and *accounting* reserves (PPB, RC)
- Darpeix (2016): relation between inflows and *guaranteed* rate
- Frey (2016): relation between outflows and investor sophistication
- Koijen and Yogo (2017): US variable annuities with minimum return guarantees = no intergenerational risk sharing

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  Subject to minimum rate, often 0% ("taux technique")

  Enquête Revalo 2011-2015: non-binding for 94% of contracts

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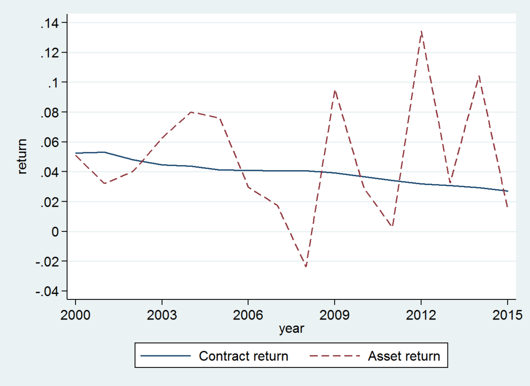

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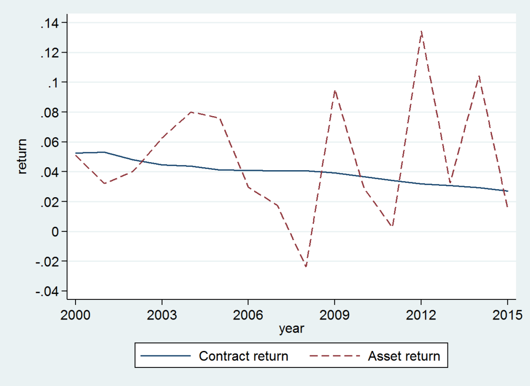

- Difference absorbed by:
  - Insurer profit Π_t $\rightarrow$ **cross-sectional risk sharing**
  - Variation in fund reserves ΔR_t $\rightarrow$ **intergenerational risk sharing**

3 components of fund reserves R_t

1. Profit-sharing reserve (Provisions pour Participations aux Bénéfices, PPB)

   - Fund income

     $$= \text{Financial income (Bond yield + Stocks dividends + Stock capital gains/losses)}$$
     $$+ \text{Technical income (Fees} - \text{Operating costs)}$$

     split between contract return and PPB (at least 85%) and insurer profit

   - PPB can only be distributed to investors $\rightarrow$ PPB belongs to (current and future) investors

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2. Capitalisation reserve (Réserve de Capitalisation, RC)
   - Bond capital gains credited to RC
   - RC can only be used to offset future bond capital losses → RC represents future fund income → RC belongs at 85% to investors

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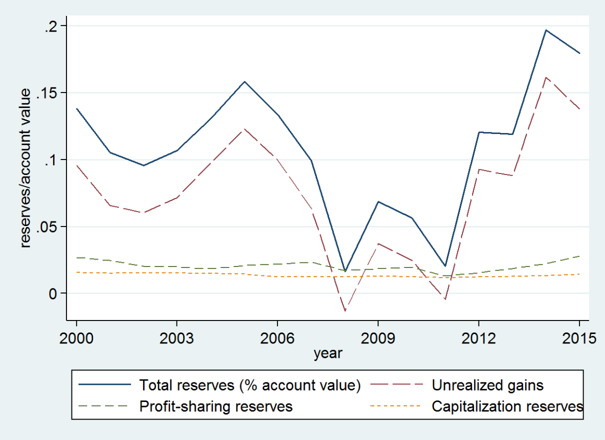
3. Unrealized capital gains
   - Represent future fund income → belong at 85% to investors

3 components of fund reserves R_t

- Unrealized gains $\approx 2/3$ total reserves
- Unrealized gains most variable component of reserves



Fund reserves

Two key features of fund reserves:

1. Reserves are **owed** (but not yet credited) to investors

2. Reserves are **passed on** between successive generations of investors

$\Rightarrow$ Variation in reserves generates redistribution across generations of investors

Economic balance sheet of a life insurance fund

Fund assets	Fund liabilities
A_t	V_t
	R_t

Economic balance sheet of a life insurance fund

Fund assets	**Fund liabilities**
$A_t = (1 + x_t)A_{t-1} + NetFlow_t - \Pi_t$	$V_t = \sum_i (1 + y_{i,t})V_{i,t-1} + NetFlow_{i,t}$
	$R_t = R_{t-1} + \Delta R_t$

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- Not all investors of a given insurer receive same return $y_{i,t}$. How much cross-contract dispersion is there? $\rightarrow$ Enquête Revalo 2011–2015:
  - Time-series s.d. of average contract return = 100 bp
  - Cross-contract s.d. of contract return = 30 bp

    $\rightarrow$ reflects contract FE (e.g. fees)?
  - Match contracts in successive waves of Enquête Revalo on name, category, return, account value to create panel (71% successfully linked)

    $\rightarrow$ Cross-contract s.d. of contract return net of contract FE = 10 bp

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    $\rightarrow$ Cross-contract s.d. of contract return net of contract FE = 10 bp
- $\Rightarrow$ Cross-contract return dispersion should affect little the amount of intertemporal redistribution

Risk sharing

- Assets=Liabilities implies:

$$\underbrace{x_t A_{t-1}}_{\text{asset income}} = \underbrace{y_t V_{t-1}}_{\text{payoff current investors}} + \underbrace{\Pi_t}_{\text{payoff insurer}} + \underbrace{\Delta R_t}_{\text{payoff other generations of investors}}$$

- → Risk sharing between current generation of investors, insurer, and past/future generations of investors

- Objective #1: Quantify amount of intergenerational redistribution

Data

- Dossiers Annuels 1999–2015
  - Contract categories 1, 2, 4, 5, 7 (exclude unit-linked)
  - Acount value V_t: Provisions techniques d'assurance vie
  - Return credited to contracts $y_t V_{t-1}$: Participations aux bénéfices + Intérêts techniques
  - Reserves R_t: PPB + RC + (Market value − Book value of assets)
  - Asset return $x_t A_{t-1}$: Fund income (Produit net des placements) + ΔRC + ΔUnrealized gains

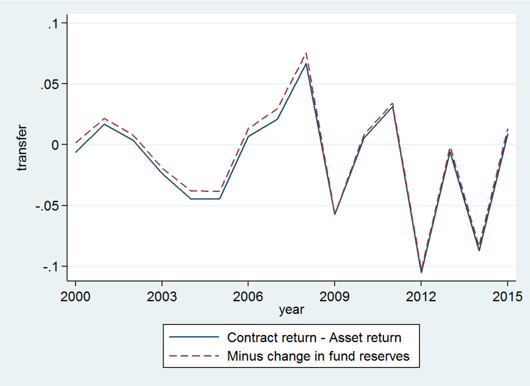
Return smoothing

- Risk sharing decomposition: $x_t A_{t-1} = y_t V_{t-1} + \Pi_t + \Delta R_t$
- Plot time-series x_t vs. y_t (weighted average across insurers)

- Risk sharing with insurer (Π_t) or with other generations of investors (ΔR_t)?

Transfer with fund reserves

- Risk sharing decomposition: $x_t A_{t-1} = y_t V_{t-1} + \Pi_t + \Delta R_t$
- Plot $y_t - x_t$ vs. ΔR_t (weighted average across insurers)



- Almost entirely intergenerational risk sharing

Quantify intertemporal transfers

- Minus change in fund reserves $-\Delta R_t$ represents transfers to accounts in year t from accounts in other years

- Define intertemporal transfer

$$|-\Delta R_t|$$

- Average intertemporal transfer $= 3.7\%$ of total account value/year

$$= €44 \text{ bn/year}$$
$$= 2\% \text{ GDP}$$

Quantify intergenerational transfers

- Intertemporal transfers over-estimate transfers across investors, because investors hold their contracts for several years

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- Define transfer to investor i in year s

$$\frac{-\Delta R_s}{V_{s-1}} V_{i,s-1}$$

Quantify intergenerational transfers

- Intertemporal transfers over-estimate transfers across investors, because investors hold their contracts for several years

- Define lifetime transfer to investor i

$$\sum_s \frac{-\Delta R_s}{V_{s-1}} V_{i,s-1}$$

Quantify intergenerational transfers

- Intertemporal transfers over-estimate transfers across investors, because investors hold their contracts for several years
- Define annualized lifetime transfer to investor i in year t

$$\frac{V_{i,t-1}}{\sum_s V_{i,s-1}} \sum_s \frac{-\Delta R_s}{V_{s-1}} V_{i,s-1}$$

Annualized lifetime transfers

- Calculate the annualized lifetime transfers by cohort

entry year \ exit year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
2000	0.2	1.1	0.6	0	-0.7	-1.2	-0.9	-0.5	0.4	-0.2	-0.2	0.1	-0.7	-0.6	-1.1	-1
2001		2	0.8	-0.1	-0.9	-1.5	-1.1	-0.6	0.4	-0.3	-0.2	0.1	-0.7	-0.7	-1.2	-1.1
2002			-0.4	-1.2	-1.9	-2.4	-1.7	-1.1	0.2	-0.6	-0.4	0	-1	-0.9	-1.5	-1.3
2003				-2	-2.6	-3	-2	-1.2	0.2	-0.6	-0.4	0	-1.1	-1	-1.6	-1.4
2004					-3.2	-3.5	-2	-1	0.7	-0.4	-0.2	0.2	-1	-0.9	-1.5	-1.3
2005						-3.8	-1.4	-0.2	1.7	0.2	0.3	0.7	-0.7	-0.6	-1.4	-1.1
2006							0.9	1.6	3.5	1.2	1.1	1.5	-0.2	-0.2	-1.1	-0.8
2007								2.2	4.8	1.3	1.1	1.6	-0.4	-0.4	-1.4	-1.1
2008									7.5	0.9	0.8	1.4	-0.9	-0.8	-1.9	-1.5
2009										-5.7	-2.6	-0.6	-3	-2.5	-3.4	-2.7
2010											0.6	2	-2.1	-1.6	-3	-2.2
2011												3.4	-3.5	-2.4	-3.8	-2.8
2012													-10.4	-5.3	-6.3	-4.3
2013														-0.2	-4.2	-2.4
2014															-8.2	-3.4
2015																1.4

- Reading: An investor buying a contract in 2006 and redeeming it in 2011 received an additional 1.5 p.p. per year relative to an investment in an hypothetical fund with same underlying asset portfolio and same fees structure without intertemporal smoothing

Annualized lifetime transfers

- Why do some cohorts appear to be losers?

  → This is insurance! Some end up on the receiving side of the intergenerational risk sharing scheme, some end up on the contributing side

  → Ex ante, all cohorts are better off

- Why are recent cohorts on the contributing side?

  → Post-2011 drop in interest rates → Capital gains on bond portfolio, hoarded as reserves → Recent cohorts contribute (to the benefit of future cohorts)

  NB: Reserves at their highest level in 2014 (20% of account value)

Annualized lifetime transfers

- Why does there seem to be more cohorts on the contributing side than on the receiving side?

  $\rightarrow$ Secular decline in interest rate

  $+$ Positive net flows over the period $\rightarrow$ Reserves dilution

- How does average performance compare to Livret A over 2000–2015?

  $\rightarrow$ Better before fees and taxes (4.0% vs. 2.2%), probably also after fees and taxes on average

Quantify intergenerational transfers

- Define total intergenerational transfer = Sum of lifetime annualized transfer over all investors
- No data on cohort-level flows → Assumption = No inflows after initial investment and constant hazard rate for outflows, calibrated to replicate actual outflow rate
- Average intergenerational transfer = 1.4% of total account value/year

  = €17 bn/year

  = 0.8% GDP

Insurer and investor behavior

- How do insurer choose the reserve policy (equivalently, the contract return policy)?
  - NB: No theory guidance on this! Closest is Gollier (2008) = socially optimal reserve policy if no competition (perfectly inelastic investor flows)
- How do investor choose their life insurance contract?
  - Are investors' flows elastic to expected returns?

Contract return policy

- Insurers pay higher return when current reserves are higher (same pattern as in social optimum (Gollier 2008))

	Contract return			
	(1)	(2)	(3)	(4)
Lagged reserves + Asset return	.029***		.029**	
	(.008)		(.013)	
Lagged reserves		.035***		.031**
		(.0078)		(.012)
Asset return		.017		.025
		(.011)		(.017)
Insurer FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Weights	Value	Value	Equal	Equal
Adjusted-R2	.8	.81	.53	.53
Observations	978	978	978	978

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- Not driven by contemporaneous returns

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Contract return policy

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- Not driven by contemporaneous returns
- Same with equal-weighting, i.e., true for both small and large insurers

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Return predictability

- Implication: Future contract returns are partially predictable

- Do investors' inflows react to this predictability?

  In a perfectly competitive market with infinitely elastic investors

  . . . investors would strongly react and flow into insurers with large reserves

  . . . fully diluting reserves and eliminating return predictability

Inflows

- Yes, but only to a very limited extent
  - +1 euro reserves ⇒ +8 cents inflows
  - Given reserves ≈ 12% of account value, endogenous inflows dilute $0.08 \times 0.12 \approx 1\%$ of reserves per year

	Inflows (1)	Inflows unit-linked (2)	Inflows (3)	Inflows unit-linked (4)
Lagged reserves	.08*	-.28**	.069*	-.029
	(.042)	(.097)	(.037)	(.18)
Insurer FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Weights	Value	Value	Equal	Equal
Adjusted-R2	.73	.5	.62	.31
Observations	735	735	735	735

Inflows

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  - +1 euro reserves $\Rightarrow$ +8 cents inflows
  - Given reserves $\approx$ 12% of account value, endogenous inflows dilute $0.08 \times 0.12 \approx 1\%$ of reserves per year
- Insurers with lower reserves have larger inflows into unit-linked contracts

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Take away & Avenues for future research

- **Take away:** Large intergenerational transfer $\approx$ 1.4%/year $\approx$ €17 bn

  $\Rightarrow$ Welfare calculation difficult, but suggests large risk sharing benefits

- Joint evidence of (1) large intergenerational transfers and (2) limited elasticity of inflows to reserves *qualitatively* consistent with theory saying that intergenerational risk sharing only possible if flows not perfectly elastic

  $\rightarrow$ Estimate structural model to tie together (1) and (2) *quantitatively*

- Gollier (2008) predicts that reserves & intergenerational risk sharing should allow life insurers to take more asset risk (e.g. hold more stocks vs. bonds)

  $\rightarrow$ Could be tested using holdings data