

Financial Economics of Insurance

Introduction to Modern Insurance¹

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Motivation for this course

- ▶ Insurance is an active field at the intersection of finance, IO, public economics, and health economics.
- ▶ Lots of research on health insurance based on Rothschild and Stiglitz (1976).
- ▶ The goal of this course is to
 1. Learn about a large share of the insurance sector that is not health insurance.
 2. Develop a unified framework to study the impact of financial and regulatory frictions on insurance pricing, contract design, reinsurance, portfolio choice, and risk management.

Our sponsors

- ▶ NSF grant 1727049.
- ▶ Workshop in 2022: [Macro Finance Research Program of the Becker Friedman Institute](#) at the University of Chicago.



- ▶ Workshop in 2018 and 2019: [Bendheim Center for Finance](#) at Princeton University.



Important economic functions of insurers

1. Diversify most important sources of idiosyncratic risk.
 - ▶ Life insurers: Annuities, life insurance, and accident and health.
 - ▶ Property-casualty insurers: Homeowners insurance and catastrophe insurance.
2. Smooth aggregate risk across cohorts (intergenerational risk sharing).
 - ▶ Replacing defined benefit plans and Social Security.
3. Tax efficient investing.
4. Provide long-term stable funding for macro investment and growth.
 - ▶ Largest institutional investors of corporate bonds.

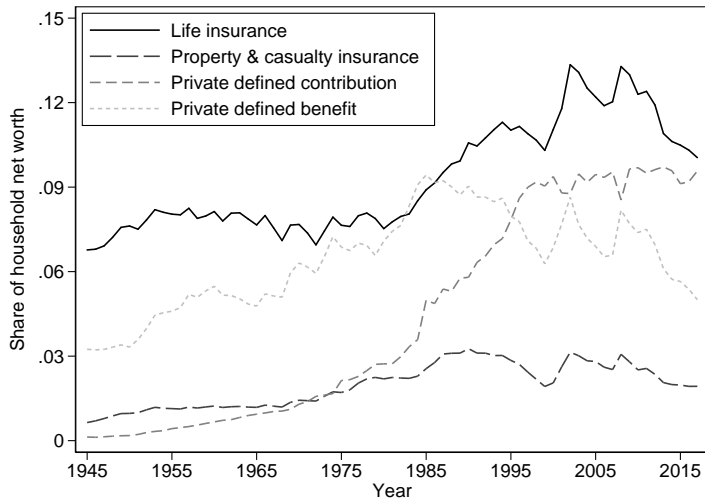
Liabilities of financial institutions in 2017

Sector	Trillion \$
Life insurance	6.5
Property and casualty insurance	1.2
Banks	16.9
Private defined contribution	6.2
Private defined benefit	3.2

Evolution of life insurers' liabilities

- ▶ Decline of defined benefit plans and Social Security.
- ▶ Growth of life insurers' liabilities since the 1980s.
 - ▶ Private retirement solution: Coincides with the growth of defined contribution plans.
- ▶ Evolution from life insurance to annuities, especially variable annuities in the separate account.

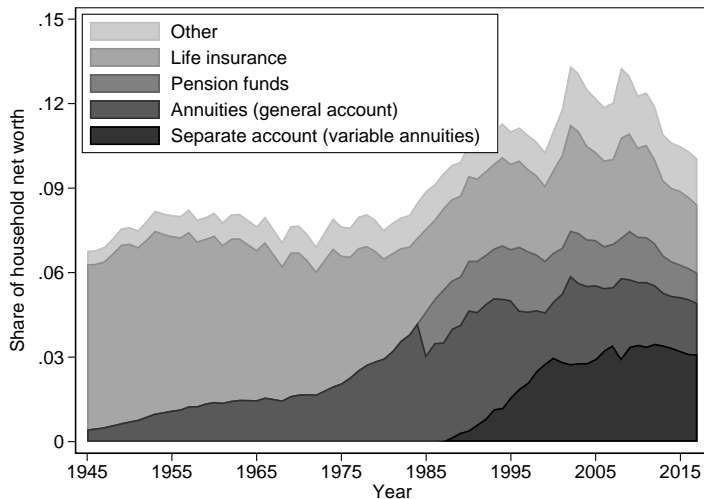
Insurance and pension liabilities



Composition of life insurers' liabilities in 2017

Liability	Trillion \$
General account	
Life insurance	1.2
Annuities	1.2
Pension funds	0.7
Other (including accident & health)	0.8
Separate account (variable annuities)	2.7

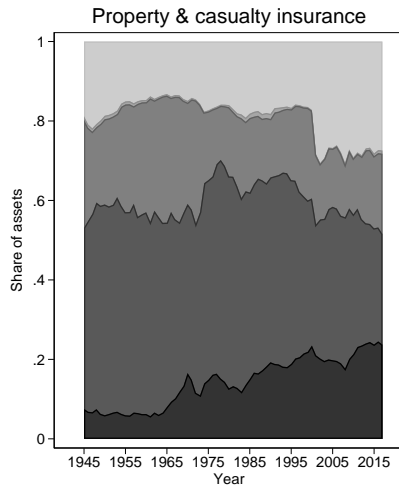
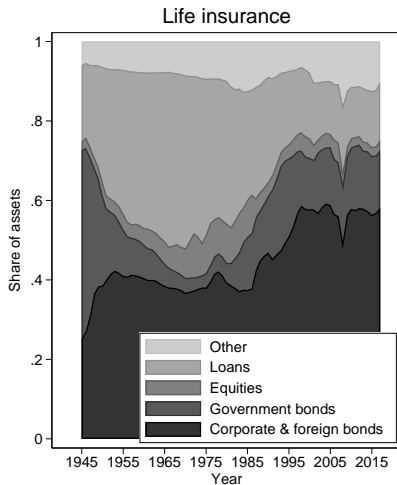
Composition of life insurers' liabilities



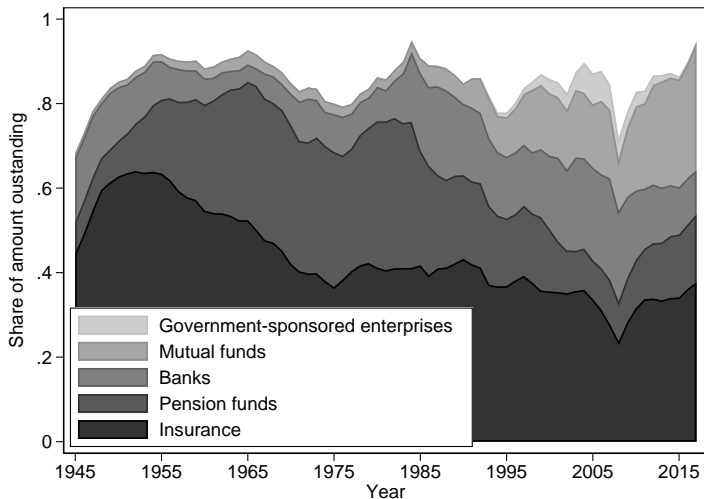
General account assets

- ▶ Life insurers are the largest institutional investors of corporate bonds.
- ▶ Substitution from loans to securities since the 1980s.
- ▶ Insurers use derivatives for risk management.
- ▶ Also sophisticated forms of leverage.
 - ▶ Shadow insurance (Kojen and Yogo 2016).
 - ▶ Securities lending (Foley-Fisher et al. 2016).

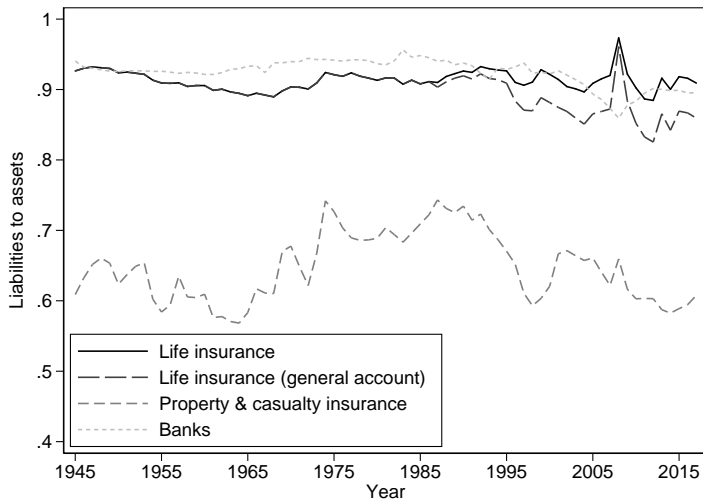
Composition of general account assets



Institutional ownership of corporate bonds



Leverage of financial institutions



Life insurers' leverage

- ▶ Nearly constant until 1980s, consistent with the nature of traditional business.
- ▶ Declining and more volatile since 1980s due to variable annuities that are harder to manage.
- ▶ Caveat: Leverage based on US balance sheets alone may be misleading since global insurers could move leverage offshore.
- ▶ Reasons for high leverage in banking also apply to insurance.
 1. Taxes: Insurance premiums are tax deferred.
 2. Insurance liabilities cheaper than market debt because of guaranty funds.
 3. Moral hazard due to guaranty funds and other agency problems.

Property-casualty insurers' leverage

- ▶ Lower level and more volatile due to tail risk.
- ▶ Underwriting cycles (Gron 1994, Froot and O'Connell 1999).
 - ▶ A large loss wipes out internal capital, and external capital slow to flow in.
 - ▶ Higher leverage coupled with higher prices and lower quantities.
- ▶ Recent issues:
 - ▶ New sources of capital such as hedge funds, pension funds, and sovereign wealth funds.
 - ▶ New markets such as climate risk and cyber risk.
 - ▶ Difficult to underwrite because of uncertainty in the loss distribution.
 - ▶ Stifles innovation if firms unwilling to adopt new technologies that cannot be insured.

Ownership structure

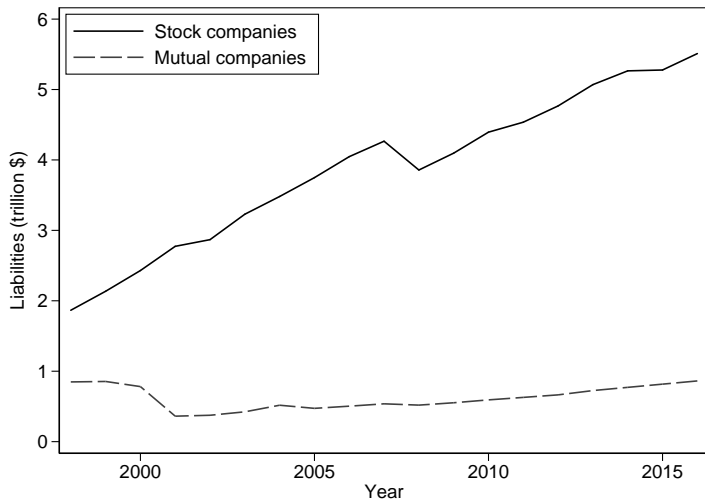
1. Mutual companies.

- ▶ Policyholders are also equity holders, bearing underwriting and investment risk.
- ▶ Alignment of incentives.

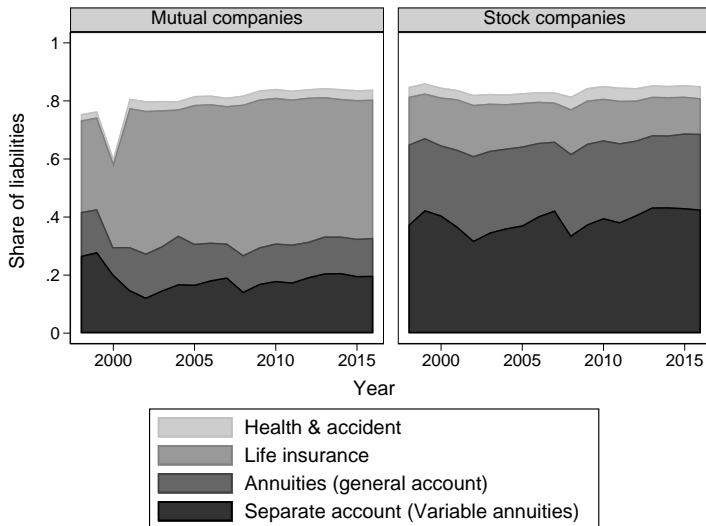
2. Stock companies.

- ▶ Policyholders are debt holders.
- ▶ Outside equity holders bear underwriting and investment risk..
- ▶ Access to external finance facilitates growth, especially into new markets.
- ▶ Incentives of equity holders may not be aligned with policyholders.

Life insurers' liabilities by ownership structure



Composition of life insurers' liabilities by ownership structure



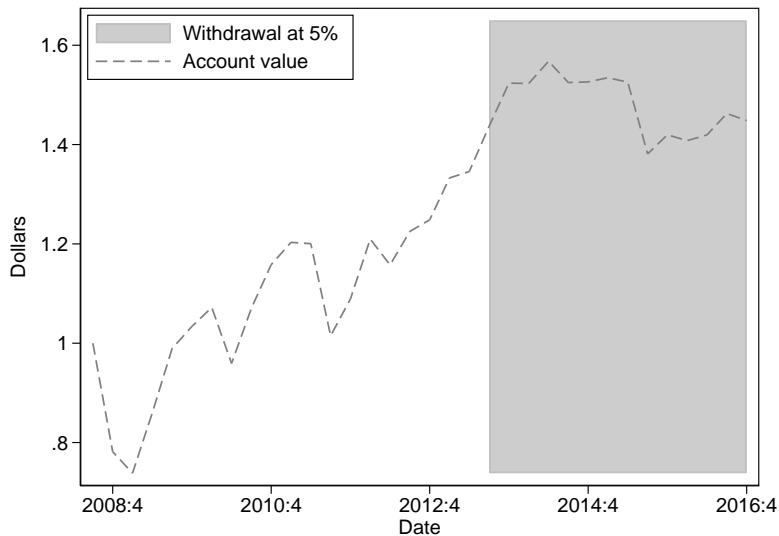
Insurance products

1. Life insurance.
 - ▶ Term life insurance.
 - ▶ Universal life insurance.
2. Fixed annuities.
 - ▶ Term annuities: Constant payoffs at fixed maturity.
 - ▶ Life annuities: Payoffs contingent on survival.
3. Variable annuities: Minimum return guarantees are essentially put options.

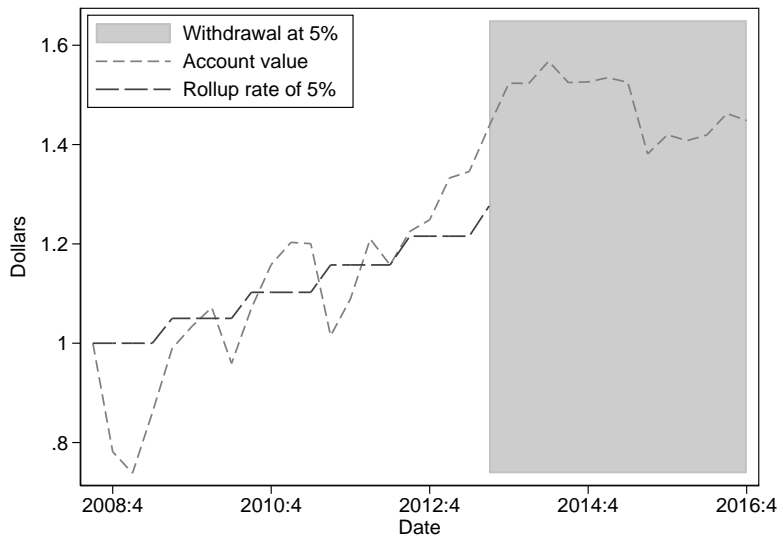
Example: MetLife Series VA

- ▶ Sold by MetLife Insurance Company USA.
- ▶ American Funds Growth Allocation Portfolio: Mutual fund with a target equity allocation of 70–85%.
- ▶ Annual base contract expense of 1.3%.
- ▶ Guaranteed Lifetime Withdrawal Benefit: Optional minimum return guarantee with
 - ▶ Annual fee of 0.5%.
 - ▶ Rollup rate (guaranteed return) of 5%.
 - ▶ Withdrawal rate of 5%.

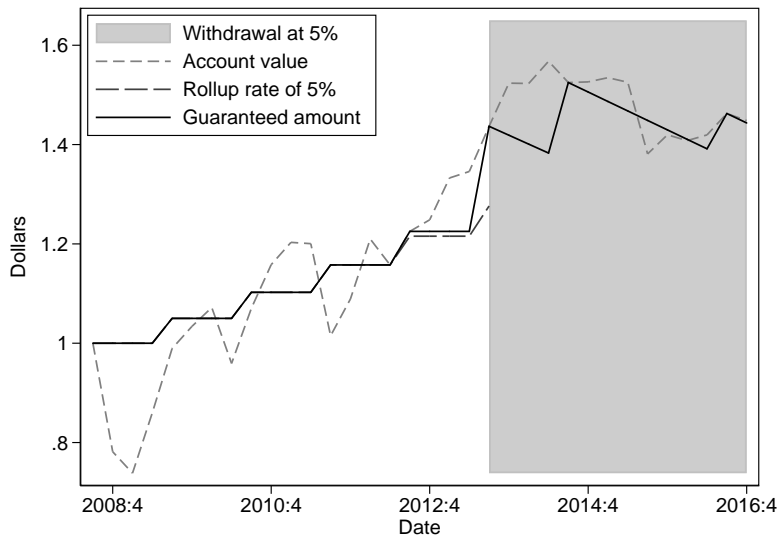
Example of a guaranteed living withdrawal benefit



Example of a guaranteed living withdrawal benefit



Example of a guaranteed living withdrawal benefit



Data

1. US financial statements filed with the NAIC. In addition to balance sheets,
 - ▶ Schedule D: Security holdings.
 - ▶ Schedule DB: Derivatives.
 - ▶ Schedule S: Reinsurance.

Cleaned up versions available through A.M. Best and SNL Financial.

2. Financial statements for European (Solvency II) and global insurers available as separate products from A.M. Best.
3. Insurance prices.
 - ▶ Compulife Software: Life insurance.
 - ▶ WebAnnuities Insurance Agency: Fixed annuities.
 - ▶ Morningstar Annuity Intelligence: Variable annuities.

Data

4. Security holdings.

- ▶ Thomson Reuters eMAXX: Global bond holdings.
- ▶ ECB Securities Holdings Statistics: Complete security holdings of euro-area institutions including insurers.

5. Other useful sources.

- ▶ Fed: Financial Accounts of the United States.
- ▶ LIMRA.

Institutions

- ▶ Insurance regulated at the state level, firmly established by the McCarran-Ferguson Act of 1945.
- ▶ National Association of Insurance Commissioners (NAIC) founded in 1871.
 - ▶ Coordinates product, accounting, and capital standards.
- ▶ State guaranty associations, first established in New York in 1941.
 - ▶ Like deposit insurance that protects policyholders in case of default.
 - ▶ Works through ex-post assessments on surviving companies.
- ▶ Rating agencies: A.M. Best Company, Moody's, and S&P.

Accounting standards

- ▶ Accounting standards differ between state (statutory accounting principles) and consolidated (GAAP).
- ▶ However, gaps and inconsistencies across states and countries.
 - ▶ Problematic for risk monitoring of global insurers.
 - ▶ Great for identification!
- ▶ European Union: Solvency II attempts to make reporting and capital standards uniform across countries.

Risk-based capital

- ▶ Insurance regulators and rating agencies use the risk-based capital ratio.

$$\text{RBC} = \frac{\text{Assets} - \text{Reserves}}{\text{Required capital}}$$

- ▶ Regulators monitor risk-based capital and take corrective action.
 1. Company action level of 2: Insurer must submit a plan of corrective actions.
 2. Regulatory action level of 1.5: Regulator examines the insurer and orders corrective actions.
 3. Authorized control level of 1: Regulator has the authority to place the insurer under regulatory control.
 4. Mandatory control level of 0.7: Regulator places the insurer under regulatory control.

Theories of insurance markets

1. Demand-side theories of idiosyncratic risk.
 - ▶ Yaari (1965): Life-cycle theory.
 - ▶ Rothschild and Stiglitz (1976): Informational frictions.
2. Demand-side theories of aggregate risk.
 - ▶ Dumas (1989): Efficient risk sharing of aggregate risk with heterogeneous risk preferences.
 - ▶ Allen and Gale (1997): Intergenerational risk sharing.
3. **Supply-side theories** with financial frictions and market power.
 - ▶ Gron (1990) and Froot (2007): Catastrophe insurance.
 - ▶ Koijen and Yogo (2015, 2016, 2022): Annuities and life insurance.