

Workshop on the Financial Economics of Insurance Risks in the Insurance Sector¹

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Traditional risks in the insurance sector

- ▶ Traditional risks:
 1. Interest rates.
 2. Aggregate longevity or mortality.
 3. Policyholder behavior (lapsation, surrender, and withdrawal).
- ▶ These risks are relatively easy to manage.
 1. Duration matching of assets and liabilities.
 2. Offset longevity exposure (annuities) with mortality exposure (life insurance).
 3. Fees to discourage early surrenders and withdrawals.
- ▶ Strong prior that persists in the academic literature.
 - ▶ Insurance is stable and boring.
 - ▶ If there is any risk, some credit or equity risk on the asset side from investment in corporate bonds and equities.
- ▶ Good description of insurance business up to 1990s.

New risks in the insurance sector

- ▶ New risks:
 1. Variable annuities (minimum return guarantees).
 2. Derivatives.
 3. Shadow insurance.
 4. Securities lending.
 5. Persistent low-rate environment.
- ▶ Unlike traditional liabilities, variable annuities are exposed to market risk that is non-diversifiable.
- ▶ Larger balance sheets were safer with traditional liabilities, but may be riskier with modern liabilities that load on systematic risk factors.
- ▶ Derivatives, shadow insurance, and securities lending
 - ▶ Are ways to efficiently manage capital.
 - ▶ May be increasing leverage and risk in the insurance sector.

Life insurers during the 2008 financial crisis

- ▶ AIG lost \$21 billion from securities lending, compared with \$34 billion from CDS (McDonald and Paulson 2014).
- ▶ Hartford bailed out by TARP because of variable annuity losses.
- ▶ Others involved in variable annuities or securities lending applied for TARP: Allstate, Genworth, and Prudential.

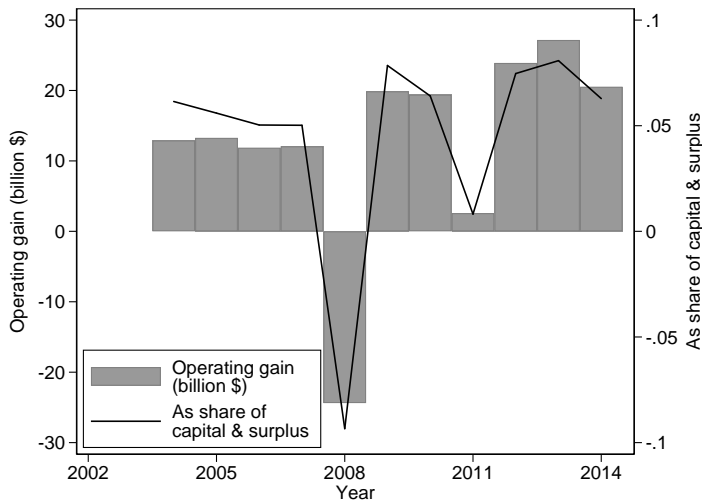
Why are variable annuities risky?

- ▶ Variable annuity = Mutual fund + Long-dated put option
- ▶ Completes a missing market for minimum return guarantees over long horizons.
- ▶ A private solution to the secular decline of defined-benefit plans and Social Security.
- ▶ Difficult to hedge because traded options have short maturity.
 - ▶ Someone has to hold aggregate risk, and insurers may have comparative advantage over other institutions.
- ▶ Dynamic hedging: Model uncertainty exposes insurers to basis risk.

Operating gain in 2008 for top 10 insurers by variable annuity account value

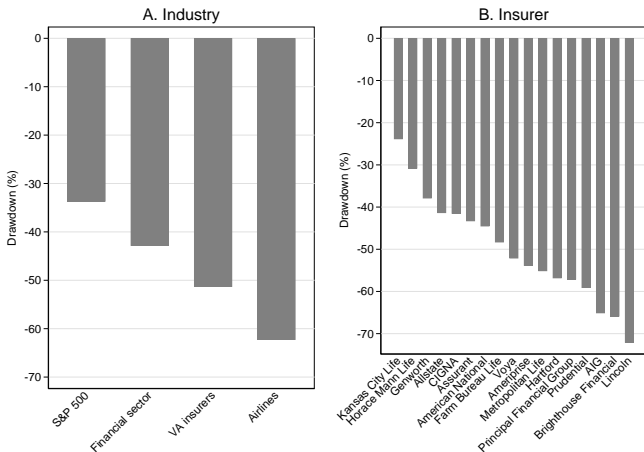
Insurer	Account value (billion \$)	Operating gain (share of capital and surplus)
MetLife	143	-0.05
AXA Financial	139	-0.18
Prudential of America	121	-0.28
ING USA Life	119	-0.14
Hartford Life	119	-0.52
AIG Life	105	0.00
Lincoln Financial	97	-0.01
Manulife Financial	94	-0.46
Ameriprise Financial	81	-0.44
Aegon USA	62	-0.26
Total for insurers		
with VA guarantees	1,542	-0.09
without VA guarantees	0	0.01

Operating gain from annuities for insurers with variable annuity guarantees



Life insurers during the COVID-19 crisis

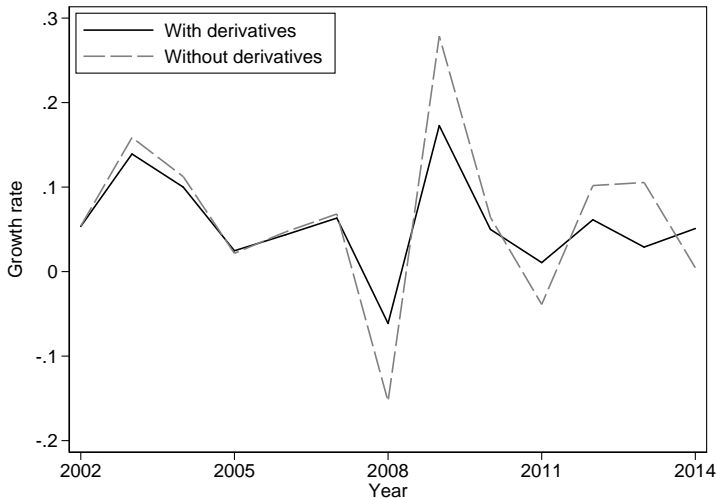
- ▶ Due to the long maturity of VA contracts and the low-rate environment, the sector is still fragile today.
- ▶ Drawdowns during the ongoing COVID-19 crisis:



Do derivatives hedge volatility?

- ▶ Total notional amount of OTC derivatives held by U.S. life insurers was \$1.1 trillion in 2014 (Berends and King 2015).
- ▶ Analysis of Schedule DB shows that insurers hedge little variable annuity risk (Drexler et al. 2017 and Ellul et al. 2018).
- ▶ How about more broadly? Do derivatives hedge or amplify volatility?
 - ▶ Derivatives amplify volatility for banks (Begenau et al. 2015).

Growth rate of capital and surplus with and without derivatives



Changing role of reinsurance

- ▶ Traditional reinsurance: Transfer risk to third-party reinsurers.
- ▶ Modern reinsurance: Transfer liabilities to off-balance-sheet entities.
- ▶ Due to changes in regulation.
 1. Higher capital requirements for life insurance after 2000.
 - ▶ Regulation XXX and AXXX.
 - ▶ Applies to operating companies under statutory accounting, but not necessarily to reinsurers under GAAP.
 2. New state laws allowed creation of captives and SPVs in South Carolina, Vermont, etc.
 - ▶ Less capital: GAAP accounting and no RBC regulation.
 - ▶ Confidentiality of financial statements.
 - ▶ More flexible financial structure: Funding through letters of credit and securitization.

Traditional versus modern insurance company

Traditional insurance company

Customer pays premium of \$100. (Actuarial value of \$90.)

⇓ \$100

Operating company in NY

A		L	
Premium	\$100	Reserve	\$110

Modern insurance company

Operating company in NY

A		L	

⇓ \$100

Captive in SC

A		L	
Premium	\$90	Reserve	\$90

⇓ \$10

Holding company

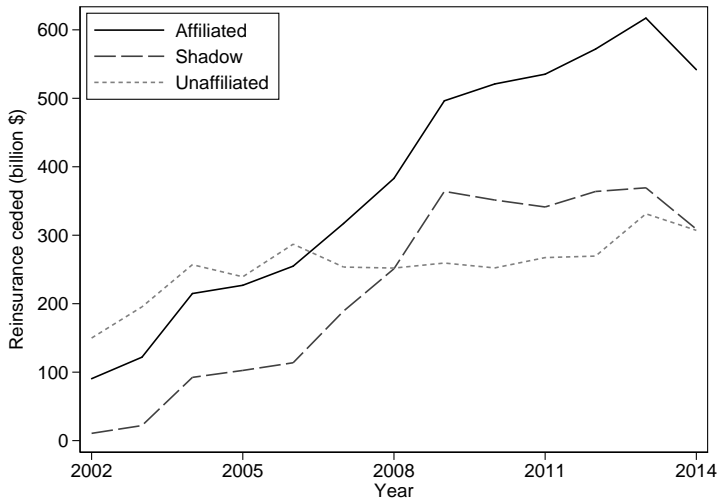
What is shadow insurance?

- ▶ **Shadow insurance:** Affiliated reinsurance with an unauthorized and unrated reinsurer.
- ▶ Potential risks.
 1. Liquidity risk from mismatch between letters of credit and insurance liabilities.
 2. More investment risk?
 3. Less equity and higher leverage?
 - ▶ Lawsky (2013): Conditional LOC and naked parental guarantees.
 - ▶ Iowa released financial statements for 8 captives in 2014. Under statutory accounting, surplus would be $-\$2.663$ billion (instead of $\$1.497$ billion).

Top 10 insurers by shadow insurance

Insurer	Reinsurance ceded (billion \$)
John Hancock Life Insurance	118
MetLife	45
Athene USA	40
Hartford Life	40
Aegon USA	26
Great-West Life	14
Voya Financial	13
AIG Life and Retirement	12
Global Atlantic	11
Lincoln Financial	7

Reinsurance ceded to affiliated, shadow, and unaffiliated reinsurers



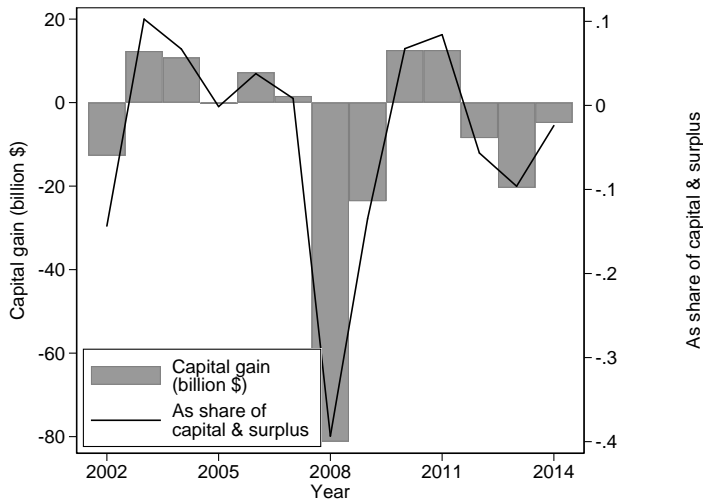
What is securities lending?

- ▶ Insurer lends bonds in exchange for cash collateral with an agreement to exchange back at some future date.
- ▶ Insurer could reinvest the cash collateral in riskier securities.
- ▶ Gap in regulation: Prior to 2010, insurers were not required to report how collateral was reinvested.
- ▶ Liquidity risk: Lending agreements have short maturity, so insurer may be forced to liquidate the risky investment if borrowers are unwilling to roll over the lending agreement.
- ▶ AIG had reinvested in MBS and ABS, losing at least \$21 billion during the financial crisis.

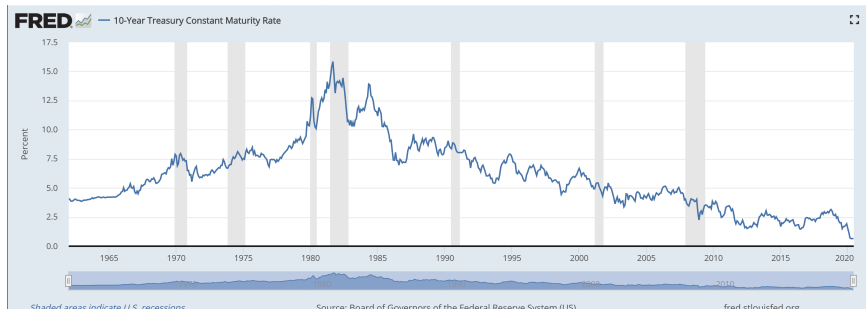
Capital gain in 2008 for top 10 insurers by securities lending agreements

Insurer	Amount of assets (billion \$)	Capital gain (share of capital and surplus)
AIG Life	54	-1.69
MetLife	38	-0.07
New York Life	6	-0.34
Prudential of America	5	-0.28
Northwestern Mutual	4	-0.52
Hartford Life	2	-0.07
Genworth Financial	2	0.12
Allstate Financial	2	-0.48
Manulife Financial	2	-0.07
Woodmen Life	1	-0.26
Total for insurers		
with securities lending	128	-0.39
without securities lending	0	-0.18

Capital gain for insurers with securities lending agreements



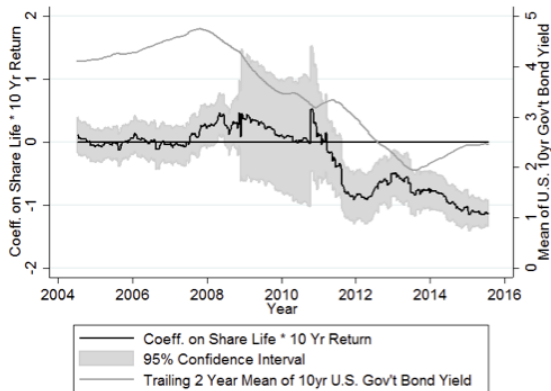
The dynamics of 10-year yields interest rates



- ▶ The non-linear exposure of variable annuities make it challenging to even hedge interest rate risk, particularly when rates are low.
- ▶ In addition, the regulatory framework may provide disincentives to hedge mismatch risk (Sen, 2018).

Equity prices and the bond beta of insurance companies

- ▶ Since the financial crisis, the bond beta of life insurers' equity returns has decreased significantly.



- ▶ [Source](#): Hartley, Paulson, and Rosen (2016).

Lessons

- ▶ Gaps in regulation lead to risk taking (e.g., shadow insurance and securities lending).
- ▶ Risk concentration: Aggregate activity for sector mostly due to top 10 insurers.
- ▶ Insurance underwriting works in conjunction with capital management. For example, sell variable annuities and move them off balance sheet through shadow insurance.
- ▶ Two sides of every activity: Efficiency vs. risk.
 - ▶ Shadow insurance useful for avoiding (unnecessary) regulation and taxes.
 - ▶ But could also increase leverage and risk.

Systemic risk ranking using NYU Stern's SRISK

Systemic Risk Rankings for 2020-06-12 View changes

Institution	SRISK %	↓ SRISK (\$ m)	LRMES	Beta	Cor	Vol	Lvg
Citigroup Inc	15.47	127056.4	65.17	2.06	0.80	106.14	19.61
Wells Fargo & Co	11.88	97550.2	56.22	1.62	0.67	99.41	16.67
Bank of America Corp	11.68	95913.2	53.44	1.50	0.77	80.04	11.93
JPMorgan Chase & Co	10.86	89206.0	49.76	1.35	0.79	70.03	10.44
Prudential Financial Inc	6.45	55467.9	58.63	1.73	0.79	89.79	33.41
Goldman Sachs Group Inc/The	5.54	45521.4	46.53	1.23	0.80	63.13	15.35
MetLife Inc	4.43	38074.2	51.05	1.40	0.76	74.98	20.63
Morgan Stanley	4.08	33499.0	47.50	1.26	0.75	69.08	12.78
American International Group Inc	2.78	23870.3	54.09	1.52	0.67	92.60	16.77
Lincoln National Corp	2.52	21613.2	64.70	2.04	0.76	109.60	39.43

Geographic Area

Region Americas Cap Req 8.0%

Country United States

Separate Accounts

% to include: 100%

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Potential transmission of risks

1. Banks.

- ▶ Shadow insurance funded by letters of credit.
- ▶ Counterparties in securities lending and derivatives.
- ▶ Funding through corporate bonds.

2. Corporate bond market.

- ▶ Fire-sale dynamics (Ellul et al. 2012).
- ▶ Higher borrowing costs for firms.

3. Households.

- ▶ Solvency worries could lead to debt overhang and collapse in demand.
- ▶ Increase in precautionary saving and welfare loss.