2024 Spring Seminar

Analysis of Systemic Risk in the Insurance Industry

Department of Industrial and Management Engineering, POSTECH
Actuarial modeling, Insurance and Risk Management Laboratory

Keywoong Bae

Information

- **Title:** Analysis of Systemic Risk in the Insurance Industry
- **Authors:** Catherine Bobtcheff, Thomas Chaney, and Christian Gollier
- **Journal:** The Geneva Risk and Insurance Review
- **Year:** 2016

목차

Purpose of this study

- In 2008-2009, financial crisis has demonstrated.
  - Many of banks faced both a liquidity problem and a solvency issue when interbank markets froze and assets prices fell sharply. -> bank runs
  - suggestion that bank runs as created due to the intense interconnectedness that characterizes the banking sector.
  - Because of the systemic risk that this interconnectedness creates, governments may be forced to socialize the gigantic losses incurred by banks.

- In this paper, they are interested in determining whether this problem also arises in the insurance sector.

Research Questions that this paper wants to solve

Research Questions that this paper wants to solve

- What's the difference between a bank and an insurance company?
  -
  -
  -
- Why does systemic risk arise in insurers?
  -
  -
- Are larger firms more susceptible to systemic risk?
  -
- What is the impact on the economy (system) depending on the insurer/bank?
  -

The risk nature of insurance activities

- Banking and insurance business models have some **intrinsic differences** that need to be taken into account when translating these principles into measurable indicators.

- In this section, they review and discuss some main differences that could justify that some of the criteria of **systemic relevance** in the banking sector be adapted to the insurance sector.

The creation of value of insurance activities (1/2)

- Traditional insurance activities are not systemic.
  - Traditional insurance activities is to **interconnect economic agents** through a network of solidarity schemes in which the lucky contractually compensate the unlucky, thereby eliminating idiosyncratic risks.
  - Exceptional failures are easy to resolve, usually through the run-off of the bankrupt insurer or its merger with a healthy company (well-diversified insurance company with the law of large numbers)

- However, **undiversifiable systematic risks** cannot be completely washed out through diversification.
  - For instance, catastrophic risks such as earthquakes, terrorism attacks or a new Black Death, episode.
  - Such risks enter the class of **NTNI** (Not Traditional, Not Insurance) activities defined by regulators.

- Therefore, these risks must be shared by **a pool of (re)insurers** to be covered at a reasonable insurance price.
  - They create social value by disseminating undiversifiable risk within the largest possible set of risk-bearers.
  - The occurrence of loss will have an adverse effect on the economy as a whole and could thus be considered as a systemic risk.

- A necessary condition for efficient risk sharing is that all economic agents participate to the bearing of this systematic risk in proportion to their degree of **risk tolerance** → **partially insured!**

The creation of value of insurance activities (2/2)

- Life insurance, through a general account system, creates **social value** by mutualizing systematic risks (collective risks) among different generations of savers.
  - Such a mechanism requires a strong commitment from sides of this contractual arrangement.
  - These commitment devices raise intergenerational welfare → all generations are required to participate in the bearing of the collective risks.

- However, if there is a **minimum guarantee** in life insurance contracts, this satisfies the definition of systemic risk
  - When the collective portfolio is hit by a crash on asset markets, most of the shock is swallowed by a reduction of the fund's reserves, that is, by a transfer of the loss to future generations, but the current generations bear a fraction of the loss through a reduction of the benefits → offering a minimum guaranteed return is not efficient.
  - Because the **underlying assets** of the insurer is highly correlated to the growth of economy, a negative shock to the value of assets in the insurer's portfolio may trigger the guarantee, thereby causing a deterioration in its buffer stock of equity.
  - To prevent this problem, Solvency II imposes a **prohibitive** capital requirement to life insurers in Europe for holding stocks.

Comparison between insurance and bank industry (1/4)

The liquidity question

- There are difference between bank and insurance in terms of liability's liquidity

	Banks	Insurance
Liquidity of liability	• high • Bank liabilities are callable at will	• low • The callability of insurance liability can be triggered by predefined events that are usually not under the control of policyholders
Callability of liability	• the duration of liabilities depends on depositor	• Insurers have long liabilities (+ ALM)
Degree of systemic	• systemic	• non-systemic

- However, an unescapable **early surrender options** embedded in most life insurance contracts make the maturity mismatch.
  - ex) fast and unanticipated increase of interest rates → asset prices are depressed → some policyholders may exercise their option to surrender
  - Although this callability is limited by a penalty on the surrender value of the contract and the tax penalties for an early withdrawal, if these penalties are small, the life insurance contract should be assimilated to a bank deposit.

Comparison between insurance and bank industry (2/4)

The investment risk sharing and the interpretation of the leverage ratio in life insurance

- Leverage ratio(λ) determines the transfer of risk among the shareholders and debtholders of a company.
  - $\lambda \uparrow$ ~ High ratio of debt to equity, and it means shareholders bear a larger risk per share.
  - nonlife ($\lambda = 2.6$), life insurers ($\lambda = 9.6$), banks ($\lambda = 9.0$)

Banks	Insurance
• The reduction of asset value will have a larger adverse impact of the solvency ratio of more leveraged banks than healthy banks.	• Insurers are indebted to policyholders contingent on the occurrence of the insured event. • These debts correspond to the policyholder reserves in the liability side of the insurer's balance sheet.

- In a life insurance company, policyholders have a claim on a share of the value of the assets of the company, valued in the balance sheet by the policyholders' reserves.
  - Thus, they share the investment risk with the company's shareholders, through benefit participation and reserves.
  - Policyholders absorb a large fraction of potential investment losses.

Comparison between insurance and bank industry (4/4)

Insurers as large risk absorbers and countercyclical long-term investors

Bank	Insurance
Banks have absorbed large defaults in their portfolio of debtors	Insurers have been able to absorb large natural catastrophes and an impressive increase in longevity.
Bank have been criticized for their destabilizing the role during the recent financial crisis.	Insurers behave very differently compared with banks.
• The threat of bank runs and the freeze of interbank markets around the world have induced banks to cover their illiquidity risk by selling assets. • At that time, assets markets were facing a big drop in prices and a surge in illiquidity. • This procyclical behavior reinforced the crisis.	• Their liabilities are not callable at will, so life insurers usually benefit from a stable and predictable inflow of liquidity from their policyholders due to pre-committed nature of long-term saving plans. • Insurers are surrogate for their customers who have a long-term saving objective. • Efficient life insurers must thus be long-term investors.

Consequences for the presence of systemic risk in the insurance industry

- Insurance companies do not present systemic risk as far as they have a traditional insurance activity (standard diversification principles)

- However, when additional contractual clauses are attached to traditional insurance products (as for instance minimum guarantees or early surrender options in case of life insurance → NTNI), systemic risk may be generated.

- To prevent these problems, Solvency II imposes additional capital surcharge for life insures, in order to take account of scenarios such as decrease in interest rates and/or massive exercise of the surrender option by policyholders.

Research Questions that this paper wants to solve

- What's the difference between a bank and an insurance company?
  - **Banks have high liability liquidity (callable at will), while insurers have low liability liquidity (callable with a predefined event).**
  - **Unlike banks, policyholders of insurance share the risk with the company's shareholders.**
  - **In financial crisis, insurance can stabilize the economy.**
- Why does systemic risk arise in insurers?
  - **Non-traditional insurance can be systemic.**
  - **When additional contractual clauses are attached to traditional insurance products, such as minimum guarantee or early surrender options in life insurance, systemic risk may be generated.**
- Are larger firms more susceptible to systemic risk?
  -
- What is the impact on the economy (system) depending on the insurer/bank?
  -

Is there a “too big to fail” problem in insurance?

- **Size**, interconnectedness and substitutability are the three most important indicators of the presence of systemic risk.

- This section analyses the role of **size**, the relationship between the size and risk of individual firms, in the insurance sector, in the banking sector, and in the economy as a whole.

- They considered all U.S. firms in a sector (insurance, banking, or all sectors together), for the years 1992 and 1993.

Is there a “too big to fail” problem in insurance?

- Which one is more systemic? a large insurer of size $2X$ vs two small insurers each of size X
  - It depends on the diversification choices made by large and small insurers, on the type of clients they have, on the ability of managers to coordinate activities between different units within their firm.

- $S_{t+1} = \sum_{i=1}^{N} X_{i,t+1}$
  - A firm of size (an insurer, a bank, a manufacturer, etc.) is composed of $\boldsymbol{N}$ **subunits** (In initial, each size of them is 1 and size of a firm is N)
  - In the insurance sector, a subunit can be interpreted as a specific insurance line.
  - $X_{i,t+1}$: the market value of insurance line i at time t.
  - The variance of the growth rate is the same for all subunits, σ^2.

- Consider the following two polar case scenarios regarding the diversification of risk in large and small companies.
  - Polar 1 : full diversification scenario. Each of the N subunits is fully independent of each other.
  - Polar 2 : Perfect coordination scenario. The N subunits are perfectly correlated with each other.

Is there a “too big to fail” problem in insurance?

- Polar I and Polar II

	Polar I	Polar II
name	full diversification scenario	perfect coordination scenario
characteristic	• each of the N subunits is fully independent of each other. • their clients face independent risks • no shared within the firm.	• the N subunits are perfectly correlated with each other. • clients are all facing the very same risk. • the manager of a firm has direct authority over the entire hierarchy.
standard deviation of the growth rate of the firm	$St.Dev\left(\frac{S_{t+1}-S_t}{S_t}\right)=\sqrt{Var(\frac{S_{t+1}}{N})}=\sqrt{\frac{N\sigma^2}{N^2}}=\frac{\sigma}{\sqrt{N}}$	$St.Dev\left(\frac{S_{t+1}-S_t}{S_t}\right)=\sqrt{Var(\frac{S_{t+1}}{N})}=\sqrt{\frac{N^2\sigma^2}{N^2}}=\sigma$
conclusion	• the distribution of firm sizes has no bearing on aggregate uncertainty • The elasticity of the standard deviation of a firm’s growth rate with respect to its size is equal to $\mathbf{-1/2.}$	• the capital requirement per risk unit is independent of the size of the company. • The elasticity of the standard deviation of a firm’s growth rate with respect to its size is $\mathbf{0.}$

Is there a “too big to fail” problem in insurance?

- 1 sector and 2 firms: $X_{total} = X_1 + X_2 \quad (X_1 = sX_{total},\ X_2 = (1-s)X_{total})$

- Polar I : full diversification
  - $St.Dev\left(\frac{X_{total,t+1}-X_{total,t}}{X_{total,t}}\right) = \frac{\sigma}{\sqrt{X_{total,t}}}$
  - The distribution of firm sizes has no impact on aggregate volatility in the full diversification scenario I.

- Polar II : Perfect coordination
  - $St.Dev\left(\frac{X_{total,t+1}-X_{total,t}}{X_{total,t}}\right) = (\sqrt{s^2+(1-s)^2})\frac{\sigma}{\sqrt{X_{total,t}}}$
  - It is maximized for $s = 0\ or\ s = 1$, and it is minimized for $s = 1/2$.
  - Increasing the size of a firm → more subunits into that firm → more and more of the production units of the economy correlated with each other.
  - The distribution of firm sizes has impact on aggregate volatility.

Individual insurer’s size and systemic risk: an empirical evaluation (3/4)

- They quantify where they are in between those two extreme scenarios I and II, and whether the relation between size and risks differs systematically for the insurance and banking sector.
- They estimate the elasticity of the standard deviation of a firm’s growth rate with respect to its size using Ordinary Least Squares (OLS)
  - If elasticity is close to -1/2, there is no a priori justification for a regulator to pay particular attention to large firms, as they do not contribute more to aggregate volatility than small firms.
  - If elasticity is close to 0, large firms contribute disproportionately to aggregate volatility, and a regulator would want to subject large firms to more scrutiny than small ones.

Individual insurer's size and systemic risk: an empirical evaluation (4/4)

- $\ln\left(sd.\left[\frac{S_{i,1993}-S_{i,1992}}{S_{i,1992}}\right]\right) = \alpha + \boldsymbol{\beta}\ln(S_{i,1992}) + \epsilon_i$ ($\boldsymbol{\beta}$ means elasticity, and it describes how size affects volatility.)

- Neither the insurance nor the banking sectors look any different.
- The scaling of volatility with a firm's size is closer to scenario II, the perfect coordination scenario.
  - Large firms do indeed contribute more to aggregate volatility than smaller ones.

Table 3 Link between firm size and aggregate volatility

Dependent variable: $\ln\left(s.d.\left[\frac{S_{i,1993}-S_{i,1992}}{S_{i,1992}}\right]\right)$	*Insurance*	*Investment banking*	*Commercial banking*	*All sectors*
$\ln(S_{i,1992})$	−0.16	−0.13	−0.20	−0.18
	(0.041)	(0.029)	(0.038)	(0.006)
Constant	−0.78	−0.71	−0.49	−0.33
	(0.228)	(0.167)	(0.196)	(0.033)
Number Obs.	18	20	22	29
Number firms	214	355	165	7787
R-squared	46%	51%	56%	97%

Note: Robust standard errors in parentheses.

Research Questions that this paper wants to solve

- What's the difference between a bank and an insurance company?
  - **Banks have high debt liquidity (callable at will), while insurers have low debt liquidity (callable with a predefined event).**
  - **Unlike banks, insurance has long-term risk-bearers.**
  - **Banks raise capital from a portfolio of debtors, while insurers raise capital from the sale of insurance products.**
- Why does systemic risk arise in insurers?
  - **Non-traditional insurance can be systemic.**
  - **When additional contractual clauses are attached to traditional insurance products, such as minimum guarantee or early surrender options in life insurance, systemic risk may be generated.**
- Are larger firms more susceptible to systemic risk?
  - **β (elasticity parameter) was between -0.13 and -0.20, so large firms do contribute more to aggregate volatility than smaller ones. (OLS, Scenario I and II, all U.S. firms in a sector for the years 1992 and 1993)**
- What is the impact on the economy (system) depending on the insurer/bank?
  -

The contribution of the insurance sector to aggregate risk: A macro perspective

- In order to assess the contribution of the insurance sector to systemic risk, it is necessary to complement this firm-level analysis with a more macro analysis.
  - macro analysis of the insurance sector as a whole over the last 50 years (1960 ~ 2008) and contrast it with the role of the banking sector.

- To assess the distinct contributions of the insurance and banking sectors to aggregate volatility, they build upon the concept of “fundamental volatility”
  - Fundamental volatility ($\sigma_{F,t}$) is a weighted average of the intrinsic volatility of individual sectors.
  - High $\sigma_{F,t}$ means important for the whole economy, and high amplification of shocks emanating from this sector.

The contribution of the insurance sector to aggregate risk: A macro perspective

- Fundamental volatility : $\sigma_{F,t} = \sqrt{\sum_{i=1}^{n} \left(\frac{S_{it}}{GPD_t}\right)^2 \sigma_i^2}$
  - σ_i : the intrinsic volatility of sector i
  - S_{it}: the size of sector i at time t
  - $\frac{S_{it}}{GDP_t}$: the share of gross output of sector i in GPD (Domar weights)

- The cause of high $\sigma_{F,t}$ is
  I. because it is intrinsically a volatile sector (σ_i is large)
  II. because it is quite simply a large sector (S_{it} is large)
  III. because it is a sector with a low value added relative to gross output ($\frac{S_{it}}{GDP_t}$ is large)

The contribution of the insurance sector to aggregate risk: A macro perspective

$$\sigma_{F,t} = \sqrt{\sum_{i=1}^{n} \left(\frac{S_{it}}{GPD_t}\right)^2 \boldsymbol{\sigma_i^2}}$$

- Intrinsic volatility of insurance and banking (commercial and investment)
- The historical volatility of the growth rate of sectoral TFP, measure in percentage points from 1960 to 2008.

- The insurance sector is intrinsically a very stable sector, while the banking sector is intrinsically a very volatile sector
  - insurance (0.04), commercial banking (0.12), investment banking (0.37)

Table 4 Volatility of sectoral TFP (in percentage points)

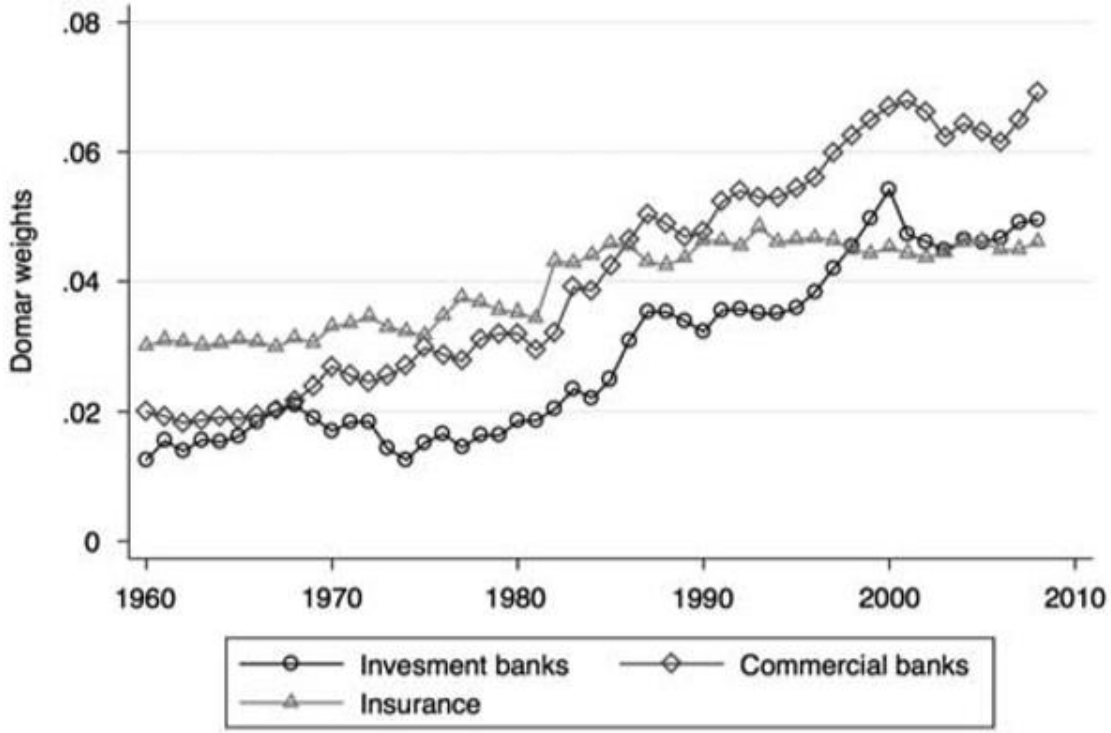
Rank	*Sector*	*Vol.*	*Rank*	*Sector*	*Vol.*
1	Real estate—other	0.02	38	Insulated wire	0.1
2	Food	0.03	39	Ships and boats	0.1
3	Nonmetallic mineral products	0.03	40	Lumber and wood	0.1
4	Furniture and fixtures	0.03	41	Aerospace	0.1
5	Textile	0.03	42	Medical equipment	0.11
6	Apparel	0.03	43	Local passenger transit	0.11
7	Publishing	0.04	44	Hospitals, private	0.11
8	Rubber and misc plastics	0.04	**45**	**Commercial banking**	**0.12**
9	Eating and drinking	0.04	46	Water transportation	0.12
10	Printing and reproduction	0.04	47	Offices of health practitioners	0.13
11	Motor vehicles	0.04	48	Radio and TV	0.13
12	**Insurance**	**0.04**	49	Misc repair	0.13
13	Fabricated metal prd.	0.04	50	Nonmetal mining	0.14
14	Recreation services	0.04	51	Research	0.15
15	Construction	0.04	52	Drugs	0.15
16	Electric utilities (pvt.)	0.05	53	Audio and video equipment	0.15
17	Educational services (pvt.)	0.05	54	Air transportation	0.15
18	Wholesale trade	0.05	55	Leather	0.16
19	Personal services	0.05	56	Farms	0.17
20	Paper and allied	0.06	57	Motion pictures	0.17
21	Trucking and warehousing	0.06	58	Water and sanitation	0.18
22	Telephone and telegraph	0.06	59	Communications equipment	0.21
23	Primary metals	0.06	60	Health services, nec.	0.23
24	Retail trade exc. motor veh.	0.06	61	Transportation and pipelines	0.24
25	Auto services	0.07	62	Computer services	0.25
26	Business svc exc. computer	0.07	63	Other instruments	0.26
27	Other Electrical machinery	0.07	64	Coal mining	0.28
28	Social services	0.08	65	Nursing and personal care	0.29
29	Railroad transportation	0.08	66	Agri. services, forestry	0.3
30	Hotels	0.08	67	Tobacco	0.3
31	Misc professional services	0.08	68	Oil and gas extraction	0.31
32	Legal services	0.09	69	Computers and office equipment	0.32
33	Machinery excl. computers	0.09	70	Metal mining	0.33
34	Measuring instruments	0.09	71	Electronic components	0.34
35	Misc manufacturing	0.09	72	Gas utilities	0.35
36	Retail trade, motor vehicles	0.1	73	Fishing	0.35
37	Chemicals excl. drugs	0.1	**74**	**Investment banking**	**0.37**
38	Insulated wire	0.1	75	Petroleum and coal products	0.41

Note: We highlight in bold the following sectors: insurance, commercial banking and investment banking.

The contribution of the insurance sector to aggregate risk: A macro perspective

$$\sigma_{F,t} = \sqrt{\sum_{i=1}^{n} \left(\frac{S_{it}}{GPD_t}\right)^2 \sigma_i^2}$$ (Domar weight)

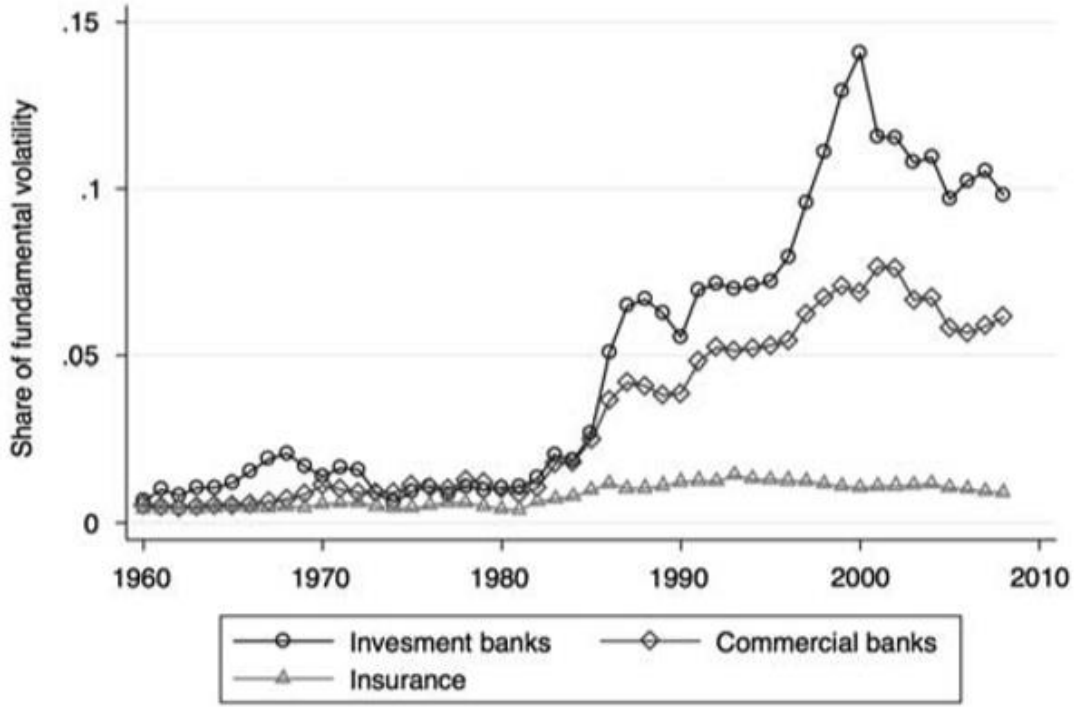
- All three sectors have seen a rapid rise starting in the early 1980s.
  - The share of insurance sector has remained relatively constant since that initial rise.



The contribution of the insurance sector to aggregate risk: A macro perspective

$$\sigma_{F,t} = \sqrt{\sum_{i=1}^{n} \left(\frac{S_{it}}{GPD_t}\right)^2 \sigma_i^2}$$

- They plot the shares of insurance, investment, and commercial banking.
  - $share_{it} = \frac{(S_{it}/GDP_t)\sigma_i^2}{\sum_{j=1}^{n}(s_{jt}/GDP_t)^2\sigma^2}$
  - The contribution of the insurance sector to aggregate volatility has remained very limited all throughout the 1960 ~2008 period.



- The reason why the insurance sector contributes substantially less to aggregate volatility than banking despite having a comparable macroeconomic size is because insurance has been historically stable sector.
- Given the very low historical volatility of the insurance sector, even a large increase in tis size does not raise aggregate volatility.

The contribution of the insurance sector to aggregate risk: A macro perspective

	insurance	**commercial banking**	**investment banking**
σ_i^2	**low**	high	high
$\left(\frac{S_{it}}{GPD_t}\right)^2$	high (relatively constant)	high	high
fundamental volatility	very limited	high	high

- The reason why the insurance sector contributes substantially less to aggregate volatility than banking despite having a comparable macroeconomic size is because insurance has been historically **stable sector**.
- Given the very low historical volatility of the insurance sector, even a large increase in tis size does not raise aggregate volatility.

Research Questions that this paper wants to solve

- What's the difference between a bank and an insurance company?
  - **Banks have high debt liquidity (callable at will), while insurers have low debt liquidity (callable with a predefined event).**
  - **Unlike banks, insurance has long-term risk-bearers.**
  - **Banks raise capital from a portfolio of debtors, while insurers raise capital from the sale of insurance products.**
- Why does systemic risk arise in insurers?
  - **Non-traditional insurance can be systemic.**
  - **When additional contractual clauses are attached to traditional insurance products, such as minimum guarantee or early surrender options in life insurance, systemic risk may be generated.**
- Are larger firms more susceptible to systemic risk?
  - **β (elasticity parameter) was between -0.13 and -0.20, so large firms do contribute more to aggregate volatility than smaller ones. (OLS, Scenario I and II, all U.S. firms in a sector for the years 1992 and 1993)**
- What is the impact on the economy (system) depending on the insurer/bank?
  - **The insurance sector contributes less to aggregate volatility than banking, despite having a comparable macroeconomic size, is because insurance has been historically a very stable sector. (fundamental volatility)**

Appendix

Overview

- The analysis of past insurance companies' bankruptcies is helpful to identify the mechanisms that led to such failures.
- Through **three examples** of past insurance companies' bankruptcies, we can identify the mechanisms that led to such failures.
  - Japanese insurance life companies
  - AIG
  - ING

Table 1 Causes of the insurance failures

	Company	*Cause of the failure*
Before 2008	Independent Insurance Company Limited	Mismanagement (underpricing)
	Europavie	Unit-linked contracts backed by real estate with guaranteed interest rates
	Japanese life insurance companies	Life insurance contracts with high guaranteed interest rates
	Equitable Life Assurance Society	Annuities with guaranteed annuity rates
	GAN	Mismanagement (underpricing and misreserving)
	HIH	Mismanagement (underpricing, underprovision and overuse of reinsurance)
After 2008	Ethias	Long-term pension plans with a guaranteed capital and a minimum return
	The Hartford	Annuity contracts with guaranteed returns
	Lincoln National Corporation	Exposure to the U.S. housing market through securitisations and direct lending
	Aegon	Exposure of the U.S. market
	AIG	Banking activities
	ING	Banking activities

Japanese insurance life companies (1/3)

Background

- To attract more policyholders, the companies were selling contracts with a high guaranteed interest rate
- In 1990s, these companies experienced large losses.
- The collected premiums were used to pay losses on previous contracts.
- In 1995, some of the companies decided to reduce the guaranteed return.
- However, this happened too late, and the number of redemptions by policyholders increased.
- About seven companies went bankrupt on April 1997, with the total cost for the public authorities amounts to €28.5bn, or 0.7 percent of the Japanese yearly GDP.

Lesson from this case

- When guaranteed returns are offered for long maturities, it is fundamental for any company to hedge such contracts with derivatives (e.g. put options) and to reinsure them.
- If the surrender penalties were too low, it allows policyholders to withdraw their capital before the term of the contracts. This increased liquidity of the insurer's liability exposes it to insurance run.

AIG insurance company (2/3)

Background

- In the 2000s, AIG operated four major LOB, and AIG Financial Service represented 9 percent of AIG's 2007 revenues. Among these 9 percent, **3 percent were attributed to AIG Financial Products (AIG FP).**
- AIG FP was a hedge fund that was attached to a large and stable insurance company. It was delicate both because of its business (thrift and not insurance) and its location (London although the holding AIG is an American company)
- So, the U.S. Office of Thrift Supervision (OTS), the supervisor of AIG FP, failed to take sound measures with respect to CDS exposure.
- A vicious circle was created: AIG FP had bet more than twice the market value of AIG in CDS, and the counterparties of these CDS had hedged themselves through AIG FP.
- The subprime crisis of 2007 caused heavy losses for AIG FP and the holding had to inject US $67bn of cash into AIG FP.
- The U.S. government bailed out AIG for about US$182bn and held up to 93 percent of its capital to rescue the company

Lessons from this case

- It originates purely from non-traditional and non-insurance activities (NTNI).
- This reminds us of the fundamental role of supervision to set correct tariffs, proper technical provision, sufficient capital and an efficient incentive-compatible mechanism.

ING Group (3/3)

Background

- ING Group expanded very rapidly by purchasing banks (mostly in Europe) and insurance companies (mostly in U.S.) and became the biggest financial group in the Netherlands in 2008.
- One of its businesses was an online saving company in the U.S. that had to satisfy the legal requirement of allocating more than 55% of its assets to mortgages.
- In 2008, ING got massive losses after acquiring a portfolio of mortgage-based securities.
- Other LOB had also been severely hit the crisis because of the presence of toxic assets in the balance sheet.
- The Dutch government injected total €13bn to consolidate the company's capital buffers.

Lesson from this case

- When an insurance company departs from traditional activity by merging with other types of businesses, the situation is more complex because different sets of rules should be applied to the different activities and a single supervision is not efficient anymore.

Comparison between insurance and bank industry (3/4)

The investment risk sharing and the interpretation of the leverage ratio in life insurance

- Leverage ratio(λ) is represented as $\lambda = L/E$
  - Suppose a unit reduction in A (asset) is shared between a reduction of liabilities by k and a reduction of equity by 1-k.
  - The company can absorb a negative shock on the value of its assets by as much as $\frac{|\Delta A|}{A} = 1/(1+\lambda)(1+k)$.
  - With no minimum guarantee and a general account, k is between 80 and 90 percent, however with minimum guarantees, k tends to 0 if the return of the asset portfolio is below the minimum guaranteed return (the corresponding policyholders do not bear any share of the investment risk anymore, as in the banking sector.)

- Because the risk on the assets side of financial intermediaries is systemic, it is socially desirable that it be shared within the largest possible community of stakeholders.