Asymmetric Information in Secondary Insurance Markets: Evidence from the Life Settlement Market

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This talk is based on joint work with Daniel Bauer and Nan Zhu.

Agenda

- What is the Life Settlement Market?
- What is Asymmetric Information?
- How can we test for Asymmetric Information in the Life Settlement Market and what do we find?
- Who should care about our results and why?

What is the Life Settlement Market?
Definition

What is the Life Settlement Market?

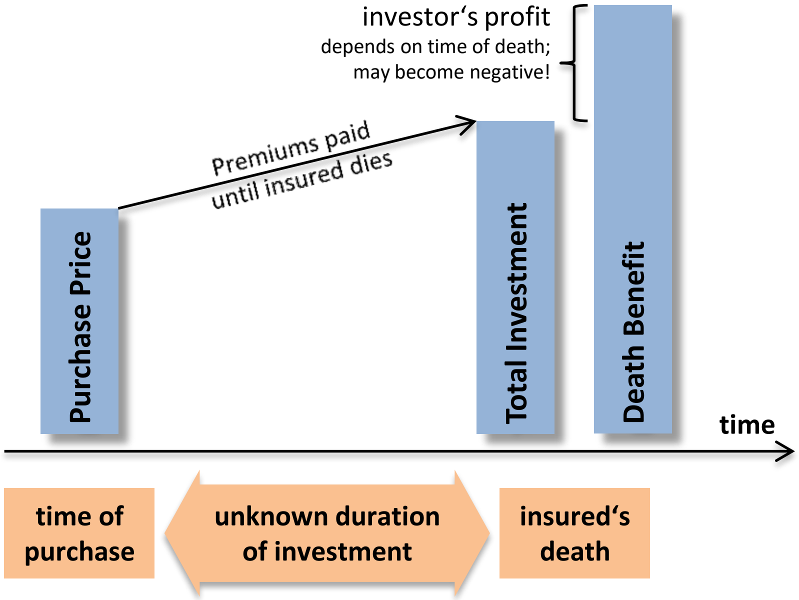
- A **secondary market for life insurance policies**, i.e. sale of an existing policy. It exists e.g. in the USA.
- Both, the insurance benefit and the liability of future premiums are transferred to an investor in exchange for a lump sum payment (settlement price).
- The market emerged form the “viatical settlement” market in the 1980s (AIDS).
- Today, it typically involves senior insureds with below average life expectancy.
- Not the focus of this paper:
  - Moral question: Betting on an individual’s death vs. beneficial for both parties?
  - Traded Endowment Policies (TEP). This is a different, well-known secondary market for life insurance policies. It exists in, e.g. UK or Germany and has entirely different economics.

What is the Life Settlement Market?

Typical Transaction

Simplified illustration of a typical transaction:

- An investor purchases a life insurance policy from the current policy holder.
  - Different types of polices with some death benefit
- The investor pays the purchase price and future premiums until the insured dies.
- The investor receives the death benefit.
- The key driver of the return is the time of death of the insured.
  - Low correlation with capital markets



What is the Life Settlement Market?

Involved Parties

Key parties:

Policyholder ↔ Broker	Life Expectancy Provider	LS Provider ↔ Investor

↔

- The **policyholder**, via a **broker**, offers her policy to a licenced **LS provider.**
- The provider [or the broker] obtains *individualized life expectancy reports* (LE reports) from **Life Expectancy Providers** (LE Providers), typically two; based on these reports, the provider makes an offer.
- If the offer is accepted, the policy is transferred to the provider, who holds it in its own portfolio or on behalf of some **investor** [also: securitization of pools of policies].

What is Asymmetric Information?

Definitions

The terms Asymmetric Information, Adverse Selection, and Moral Hazard are often confused.

Asymmetric information: In a transaction one party has more information.

- **In Life Settlements:** Beyond the documented medical record, the insured might know how well she feels, how her body reacts to a certain treatment, how rich she is, etc.

Adverse Selection:

- **In primary insurance:** a person who knows that she is a bad risk buys more insurance.
- **In Life Settlements:** a person who feels relatively well compared to her objective state of health (described by her medical record) is more likely to sell her policy.

Moral Hazard:

- **In primary insurance:** a person acts less carefully if she is insured.
- **In Life Settlements:** a person will change her lifestyle after the transaction because she now has more money (from the sale of her policy) or because she no longer has life insurance protection.

Adverse Selection seems to be more relevant in Life Settlements than Moral Hazard. But can we test this?

How can we test for Asymmetric Information?

Data

We have received Data from *Fasano Associates* (leading US LE provider)

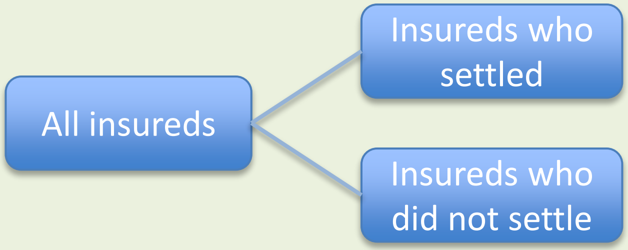
- More than 140,000 individualized life expectancy evaluations between 2001 and 2013.
- Eliminating duplicates (keeping only the earliest or latest observations): 53,947 records.
- In addition to the estimated life expectancy, we are given observables:
  - Time of underwriting, age, sex, smoking status, primary impairment
  - Realized death times (before Jan. 1st, 2015)
- **We know portfolios of polices that were settled, all in all 13,221 cases.**
- **<u>Question:</u> How does this subsample differ from the entire sample?**

How can we test for Asymmetric Information?

Data issues

Perfect world:

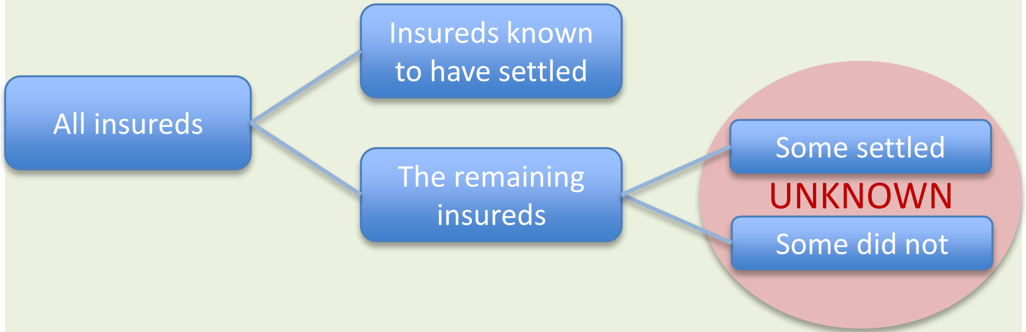
1. We know every settlement decision



2. We know when each insured has died

Real World:

1. Incomplete information on settlement decision



2. Many insureds are still alive → censored data

In a perfect world, a different pattern **in the two segments** of the **deviation between estimated life expectancy and actual remaining lifetime**, would be an indication for asymmetric information.

How can we test for Asymmetric Information?
Motivating a correlation test

Simple example:

- Suppose there are three groups of individuals.
- LE-estimates based on observables are the same.
- Individual LEs (unknown to the LE-provider) differ.

What happens if there is asymmetric information?

- Individuals in Group 1 know that their LE is shorter.
- They choose not to settle.

Under asymmetric information, a pool of **settled** policies will display **longer** lifetimes (relative to expectancies) than the entire population.
→ A **correlation test** can test for asymmetric information.

	Group 1	Group 2	Group 3	Average in LE-underwriter's Portfolio
LEs based on observables	6 years	6 years	6 years	6 years
Individual LEs	4 years	6 years	8 years	6 years

	Group 1	Group 2	Group 3	Average in settled Portfolio
LEs based on observables	don't settle	6 years	6 years	6 years
Individual LEs	don't settle	6 years	8 years	7 years

How can we test for Asymmetric Information?

Two test designs

Two survival regression tests to test for the above mentioned correlation:

$$\mu_t^{(i)} \;=\; \beta_0(t) \times \exp\Big\{\beta_1 \ln(\hat{\mu}_t^{(i)}) + \beta_2 \ln(1+\mathrm{DOU}_i) + \beta_3 \ln(1+\mathrm{AU}_i) + \beta_4\,\mathrm{SE}_i + \sum_{j=1}^{15} \beta_{5,j}\,\mathrm{PI}_{i,j} + \sum_{j=1}^{2} \beta_{6,j}\,\mathrm{SM}_{i,j} + \gamma\,\mathrm{SaO}_i\Big\},\ 1 \le i \le N.$$

$$\mu_t^{(i)} = \beta_0(t) + \beta_1\,\hat{\mu}_t^{(i)} + \beta_2\,\mathrm{DOU}_i + \beta_3\,\mathrm{AU}_i + \beta_4\,\mathrm{SE}_i + \sum_{j=1}^{15} \beta_{5,j}\,\mathrm{PI}_{i,j} + \sum_{j=1}^{2} \beta_{6,j}\,\mathrm{SM}_{i,j} + \gamma\,\mathrm{SaO}_i,$$

Test for asymmetric information: **negative γ**

- $\left(\hat{\mu}_t^{(i)}\right)_{t\geq 0}$ = estimated individualized hazard;
- DOU_i = date of underwriting;
- AU_i = individual's age at underwriting;
- $\mathrm{PI}_{i,j}$ = primary impairment dummies;
- SE_i and $\mathrm{SM}_{i,j}$ = sex and smoker dummies;
- SaO_i = "settled-and-observed" dummy

How can we test for Asymmetric Information?

Results of the tests

Results:

- γ is significantly negative (at a 1% level) in both tests. → **Existence of Asymmetric Information.**
- Individuals **possess private information** on their survival prospects **and make use of it** in their decision.
  - For two individuals with otherwise the same observables, the one that is known to have settled her policy will exhibit a **roughly 11% lower hazard**. She will therefore, on average, live longer.
- This result complements analyses of asymmetric information in **primary life insurance markets**: several papers fail to find evidence for the existence of asymmetric information based on correlation tests.
  - Finkelstein and Poterba (2014) argue that this may be due to confounding factors (risk aversion or wealth), or also from risk factors not included in the pricing.
  - In contrast, the evaluation of mortality for the pricing of Life Settlement is highly individualized and risk aversion may be less relevant. Therefore, our analysis may not be subject to the same confounding influences as purchasing coverage in the primary market, or at least not to the same extent.

How can we test for Asymmetric Information?

Non-parametric Estimation of Excess Mortality (Models)

Still open: What is the "Time Trend of Information Asymmetry"?

Derive "excess mortality" for policyholder that settled as a function of time.

- $\{\mu_t^S\}_{t\geq 0}$ [settled] and $\{\mu_t^R\}_{t\geq 0}$ [remaining]
- mortality not explained by any other factor than the fact that policy has been settled.

I. Multiplicative model:

- $\mu_t^S = \alpha(t) \cdot \mu_t^R$
- Nelson-Aalen estimator for $\int_0^t \alpha(s)\, ds$
- In the absence of asymmetric information, α should be flat at 1.

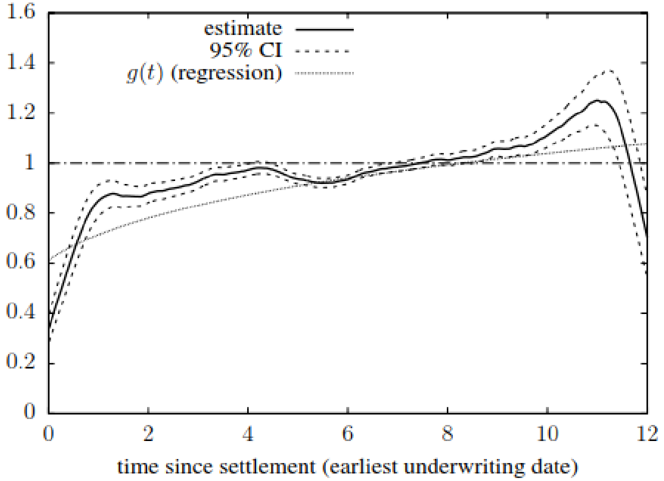
II. Additive model:

- $\mu_t^S = \beta(t) + \mu_t^R$
- Kaplan-Meier estimator for $\int_0^t \beta(s)\, ds$
- In the absence of asymmetric information, β should be flat at 0.

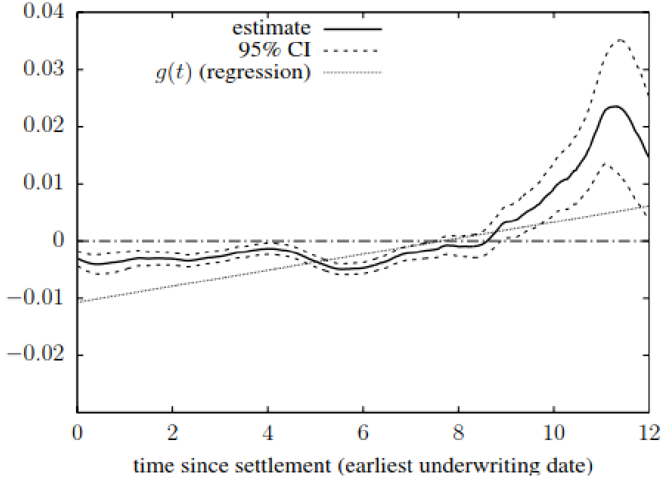
How can we test for Asymmetric Information?

Non-parametric Estimation of Excess Mortality (Results)

Results (multiplicative model)



Results (additive model)



Insureds who settled have a significantly lower mortality.

The effect is temporary.

This pattern provides strong indication that the reason is **adverse selection.**

In case of moral hazard, the difference would **increase** over time (→negative slope).

Note: We also added a time-trend term in the survival regressions (cf. Slide 10) and the results are consistent with the non-parametric models.

How can we test for Asymmetric Information?

Quantitative Impact on Life Expectancies

ICA CIA BERLIN 2018

Question of practical relevance: By how much should LE-estimates be adjusted when pricing policies?

- Depends on proportion of settled cases in whole dataset *p* (unknown!).
- 75-year old US male policyholder (10.48 for non-adjusted LE)

	p=30%	p=40%	p=50%	p=60%	p=70%
average LE for settled subset	10.90	10.95	11.01	11.09	11.20
LE difference	0.42	0.47	0.53	0.61	0.72

Adding roughly 6 months to the estimated LE seems appropriate to compensate for the effect of AI.

How can we test for Asymmetric Information?

Robustness

Are there alternative explanations for our results?

- LS company may possess additional information (second LE)

  → Would create a positive bias → our findings would even underestimate the true effect!
- Sample selection: Longer lasting policies more likely to be observed (tertiary trades)
  - Run regression using latest observation date. Findings analogous.
- Bias from settlement process (winner's curse)
  - If the company with the lowest LE purchases the policy, we would see a stable/diverging trend over time for additive/multiplicative variant. Observed converging pattern contradicts this explanation

Who should care about our results and why?

We found **strong evidence for asymmetric information** in the life settlement market. In particular, information friction seems to origin from **adverse selection** rather than **moral hazard**.

- Obviously, these results have immediate implications for life settlement market operations
  - e.g. adjusting LE-estimates when policy are being priced (and when calculating NAVs)
- The results also add some new insights to the existing (large body of) insurance-economics literature on Asymmetric Information and Adverse Selection – see details on Slide 11.

We also found strong evidence that [some] **individuals not only have** private information on mortality prospects, **but also use** this information (somewhat rationally) in a setting with significant monetary consequences!

- Potentially at odds with recent papers in behavioral economics questioning the ability to estimate own LE.
- Are people better in estimating their LE relative to a peer group of "similar" people than in absolute terms?

About the speaker

apl. Prof. Dr. Jochen Ruß
Managing Partner

Institut für Finanz- und Aktuarwissenschaften (ifa)

- ifa is an independent actuarial consulting firm. Our consulting services include:
  - typical actuarial tasks and actuarial modelling in all lines of insurance business
  - insurance product development
  - risk management, Solvency II, asset liability management
  - data analytics
  - market entries (cross-border business, setup of new insurance companies, Fintechs)
  - professional education
  - academic research on actuarial topics of practical relevance
- located in Ulm, Germany
- currently about 30 consultants
- academic cooperation with the University of Ulm (offering the largest actuarial program in Germany)

- Jochen joined ifa in 1996. Managing partner since 2002.
- Master degree (in mathematics; 1996), PhD (in economics; 1999), German post-doctorial degree "Habilitation" (in actuarial science; 2009).
- Adjunct professor for actuarial science at Ulm University lecturer at the Ludwig-Maximilians-Universität in Munich and at the EBS Finanzakademie.
- Author of roughly 100 publications. 9 research awards in Australia (1997 and 2000), Singapore (1998) and Germany (1999, 2000, 2004, 2006, 2009 and 2016).
- Associate editor of APJRI. Referee for 12 academic journals. Member of the advisory board of BVZL and MRIC, member of the German Society for Actuarial and Financial Mathematics (DGVFM), the American Risk and Insurance Association and the Asia-Pacific Risk and Insurance Association.

Thank you very much for your attention!

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