Can Price Collars Increase Insurance Loss Coverage?

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Agenda

- Introduction
- Model Framework
- Results
- Conclusions

Background

Adverse selection:

If insurers cannot charge **risk-differentiated** premiums, then:

- higher risks buy more insurance, lower risks buy less insurance,
- raising the **pooled** price of insurance,
- lowering the demand for insurance,

usually portrayed as a bad outcome, both for insurers and for society.

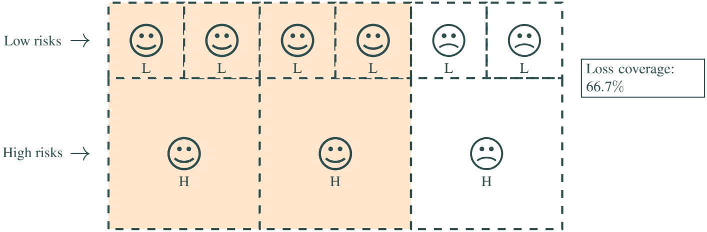
In practice:

Policymakers often see merit in restricting insurance risk classification

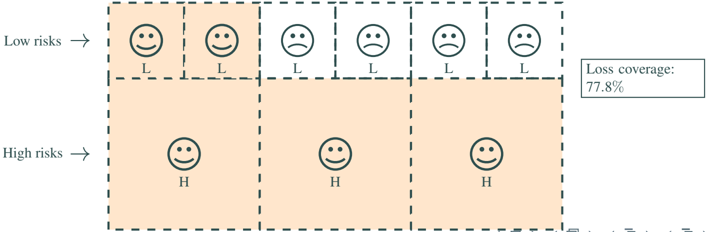
- EU ban on using gender in insurance underwriting.
- Moratoria on the use of genetic test results in underwriting.

Motivation: Two risk-groups $\mu_L = 0.01$ and $\mu_H = 0.04$

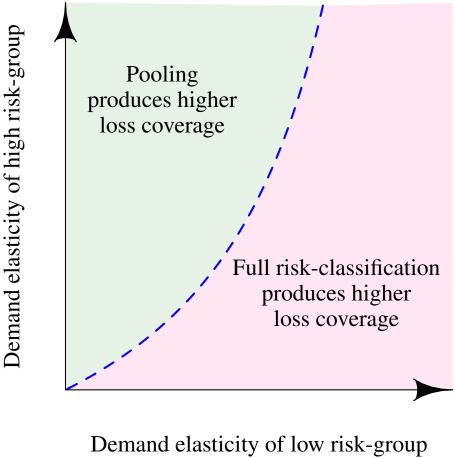
Scenario 1: No adverse selection: Risk-differentiated premiums: $\pi_L = 0.01$ **and** $\pi_H = 0.04$



Scenario 2: Some adverse selection: Pooled premiums: $\pi_L = \pi_H = 0.028$



Insurance loss coverage: Pooling vs full risk-classification



Question: Can setting an explicit price collar increase loss coverage?

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Risk-groups

Suppose a population can be divided into n risk-groups where:

- risk of losses: $\mu_1 < \mu_2 < \cdots < \mu_n$;
- population proportions: $p_1, p_2, \ldots, p_n$;
- premiums offered: $\pi_1, \pi_2, \ldots, \pi_n$;
- iso-elastic demand:

$$d_i(\pi_i) = \tau_i \left(\frac{\mu_i}{\pi_i}\right)^{\lambda_i}, \quad i = 1, 2, \ldots, n;$$

- fair-premium demand: $\tau_i = d_i(\mu_i)$ for $i = 1, 2, \ldots, n$;
- iso-elastic demand elasticities: $\lambda_1, \lambda_2, \ldots, \lambda_n$.

Market equilibrium and loss coverage

In a perfectly competitive insurance market, we then have:

$$\text{Premium income} = \sum_{i=1}^{n} p_i \, d_i(\pi_i) \, \pi_i.$$

$$\text{(Expected) insurance claim} = \sum_{i=1}^{n} p_i \, d_i(\pi_i) \, \mu_i.$$

$$\text{(Expected) profit} : E\left(\underline{\pi}\right) = \sum_{i=1}^{n} p_i \, d_i(\pi_i) \, \left(\pi_i - \mu_i\right).$$

$$\text{Market equilibrium} \Rightarrow E\left(\underline{\pi}\right) = 0.$$

Loss coverage (Population losses compensated by insurance)

Loss coverage (under equilibrium): $\sum_{i=1}^{n} p_i \, d_i(\pi_i) \, \mu_i$.

Political and regulatory constraints

Political: A politically acceptable premium regime needs to satisfy:

$$\mu_1 \le \pi_1 \le \pi_2 \le \cdots \le \pi_n \le \mu_n.$$

Regulatory: Given a prescribed **price collar**, κ, any premium regime needs to satisfy:

$$\pi_H \le \kappa\, \pi_L,$$

where $\pi_L = \min_i \pi_i$ and $\pi_H = \max_i \pi_i$.

Guaranteed issue: Insurers are required to quote a price to all applicants. Nobody can be declined for insurance.

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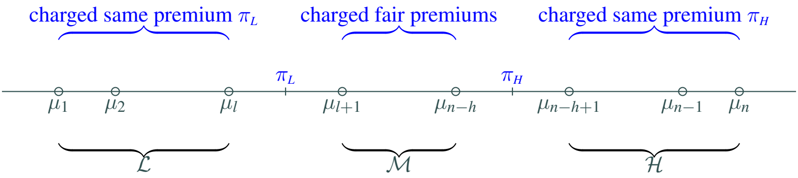
The price collar equilibrium: Tripartite solution



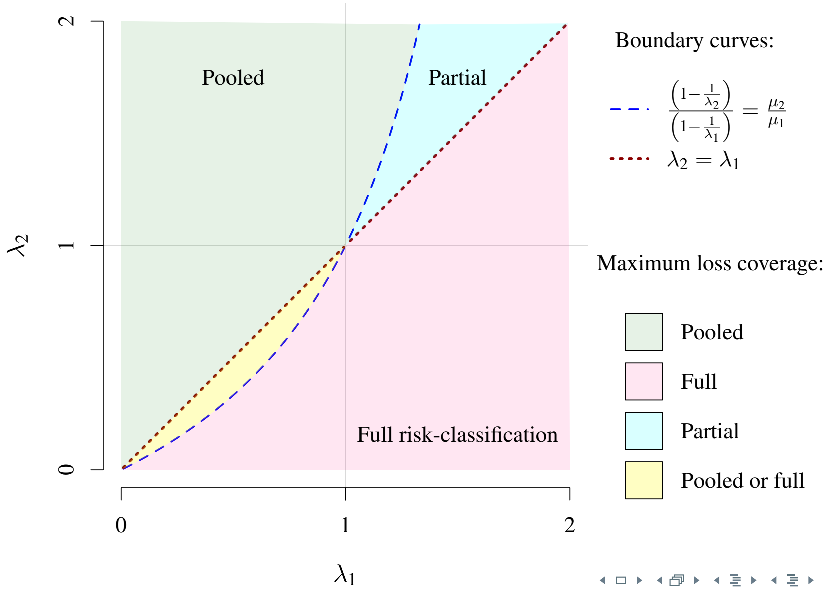
For $1 < \kappa < \mu_n/\mu_1$:

- super-group $\mathcal{L}$ of "low" risk-groups all charged π_L (more than their fair premiums);
- super-group $\mathcal{M}$ of "middle" risk-groups all charged their fair premiums;
- super-group $\mathcal{H}$ of "high" risk-groups all charged π_H (less than their fair premiums);

$\kappa = 1$: Pooling.

$\kappa = \mu_n/\mu_1$: Full risk-classification.

Two Risk-groups: Pooling vs full vs price collar



Generalistion to more than two risk-groups

For more than two risk-groups, tripartite structure under price collar creates:

- super-group $\mathcal{L}$ of “low” risk-groups with demand elasticity, say λ_L;
- super-group $\mathcal{M}$ of “middle" risk-groups;
- super-group $\mathcal{H}$ of “high” risk-groups with demand elasticity, say λ_H.

Risk-groups in $\mathcal{M}$ do not contribute to cross-subsidies, so can be disregarded.

Analysis of loss coverage can then be re-stated in terms of the two super-groups $\mathcal{L}$ and $\mathcal{H}$, with parameters set to their super-group values. The results of two risk-groups can then be extended to these two super-groups.

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Conclusions

- Loss coverage is a public policy criterion for comparing different risk-classification regimes.
- If low-risk elasticity is sufficiently low compared with high-risk elasticity, pooling is optimal.
- If low-risk elasticity is sufficiently high, full risk-classification is optimal.
- If the elasticities are not too far apart, a price collar is optimal, but only if both elasticities are greater than one.

Reference

Paper

CHATTERJEE, I., HAO, M., TAPADAR, P. & THOMAS, R. G. 2023. *Can price collars increase insurance loss coverage? Submitted.* *Link to paper.*

https://blogs.kent.ac.uk/loss-coverage/