Market-wide Moral Hazard and Price Walking in Automobile Insurance

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Introduction

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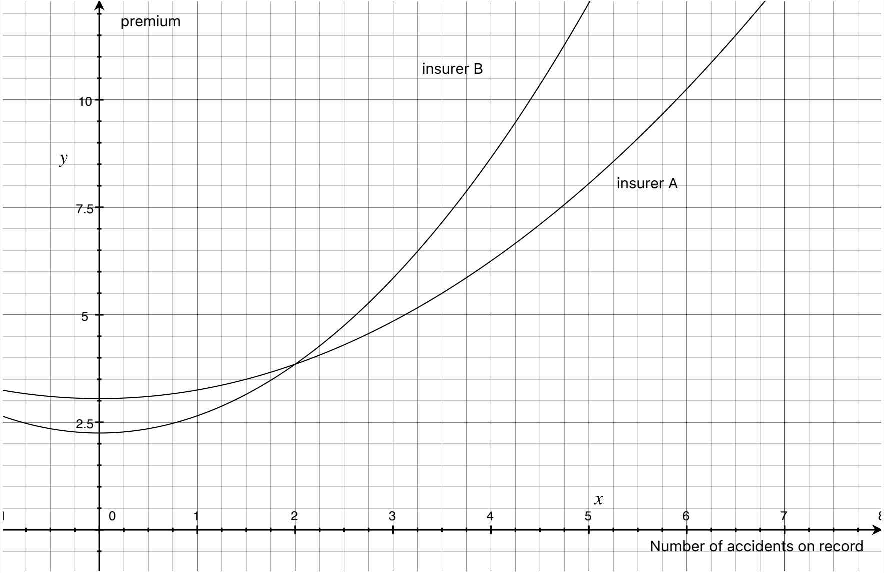
- Reforming BM system akin to increasing public information on individual risk
- Information on risk is used to adjust premiums and induce safe driving (reduce moral hazard)
- Mechanism: $\uparrow$ information $\rightarrow \downarrow$ penalties $\rightarrow \downarrow$ driving attentiveness $\rightarrow \uparrow$ accident frequency $\rightarrow \uparrow$ premiums
- Implication: increasing information + moral hazard might affect the level of premiums, not simply redistribution!
- Important to quantify moral hazard in the pre-reform to detect potential effect on post-reform premiums
- Caveat: we do not know how pricing strategies will change with more info (can leverage on ancillary evidence and/or experiments)

More Information and MH: Graphical Intuition



Moral Hazard: What We Know

1. Relies on limited price variations $\rightarrow$ test but not measure MH
2. Does not distinguish b/w state dependence and MH
3. Agents do not switch insurers strategically
4. Lack of understanding of the retention–MH trade-off faced by insurers
5. No knowledge on how selection and MH impact profits over the contractual relationship

Questions

1. Are experience ratings penalties a salient feature of auto insurance contracts?
2. Are insurers adopting different penalty structures and tenure-premium profiles? And how do they impact switching?
3. How large is (demand-side) market–wide elasticity of accident to penalties
4. Do experience ratings penalties by potential insurers affect driving behavior?

Market-Wide MH: Source of Bias

- Want to estimate β by FE in insurer B'sample relying on time-variation of penalties

$$\begin{aligned} a_{it} &= \alpha a_{it-1} + \gamma X_{it} + \beta \pi^b_{it} + \theta_i + \epsilon_{it} \\ \Delta a_{it} &= \Delta \alpha a_{it-1} + \gamma \Delta X_{it} + \beta \Delta \pi^b_{it} + \Delta \epsilon_{it} \end{aligned} \tag{1}$$

- OLS OK if no selection on entry and exit (attrition bias due to non-random switching)
- Even if no selection still have OVB if "right specification" is

$$a_{it} = \alpha a_{it-1} + \gamma X_{it} + \beta \Big((1 - s_{it}) \pi^b_{it} + s_{it} \pi^a_{it} \Big) + \theta_i + \epsilon_{it}$$

- time-varying error contains $\xi_{it} = \beta s_{it} (\pi^a_{it} - \pi^b_{it})$ correlated with π^b_{it} because
  - correlation of π^a_{it} and π^b_{it} through competition equilibrium effect
  - switching affected by π^b_{it}
  - $cov(\pi^b_{it}, \xi_{it}) < 0 \rightarrow$ downward biased estimates of β (MH overstated)

Premiums and Penalties

Baseline Hedonic Price Regression

- Main price regression, *i* policyholder, *j* insurer, *k* province

$$p_{i,jkt} = \underbrace{\sum_{r=1}^{9} \beta_j^r \mathbf{1}[BM_{it} = r] + \sum_{h=1,2,\geq 3} \beta_j^h \mathbf{1}[n_{it} = h]}_{\text{Driving Record}} + \underbrace{\sum_{\tau=0}^{14} \vartheta_{\tau j}}_{\text{tenure effects}} + \tag{2}$$

$$\gamma \mathbf{X}_{it} + \beta^z \mathbf{Z}_{i,t} + \iota_{jt} + \zeta_{kt} + \tau_t + \xi_i + \xi_{it}$$

Controls

- Insurer(province)-specific coefficients identified by switchers(movers) across insurers(provinces)
- recover penalties for each driving record, year: about 252 distinct values rich price variation

Price Walking in the Market

Penalties

- 252 distinct values $\rightarrow$ rich price variation
- Mean/Median Penalty $= 127/119$ euros, about 27% of the premium $\rightarrow$ extremely large penalties might due to inefficient mandatory coverage
- 5th percentile $= 109$ and 95th $= 176$ euros, standard dev $= 27$ euros
- penalty conditional (on driving record) differentials (wrt to small insurers): -9, 6, -3, -18, 22, -15 euros

- changing company reduces on average penalty to $35 = 127 - 92$ euros(=new customers discount)
- price walking + switching neutralize penalties effectiveness
- retention strategies to lock in drivers are key to reduce MH

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1. Premium increases over time: switchers obtain a discount
2. Switchers are risky: dynamic adverse selection
3. Is lemons poaching a puzzle?
4. $\rightarrow$ profits(tenure)=adverse selection(tenure) + MH(tenure)
5. Price walking $\rightarrow$ low switching probability within newer customers
6. Rationale for 1)+2): tenure affects selection and MH in opposite directions

Estimating Market-Wide MH

- First step: Estimate probit model for switching probability

$$\Pr(s_{ijt}=1)=\Phi\Big(\underbrace{\sum_{r=1}^{9}\beta_{jr}^{BM}\mathbf{1}[BM_{it}=r]+\sum_{h=1,2,\geq 3}\beta_{jh}^{AR}\mathbf{1}[n_{it}=h]+\beta^{a}a_{ijt-1}+}_{\text{selection effect}}\underbrace{\beta\delta_{jr}}_{\text{penalty effect}}+$$

$$\underbrace{\theta_{\tau j}+\widehat{\vartheta}_{\tau j}}_{\text{tenure dependence}}+\gamma\mathbf{X}_{it}+\delta\mathbf{Y}_{kt}+\iota_{jt}+\zeta_{kt}+\tau_{t}\Big)$$

- $\widehat{\vartheta}_{\tau j}$: price walking effect
- predict switching probability σ_{it}

Step 2: Accident Probability

- a_{ijkt} takes value 100 if one or more accidents at fault are provoked

$$a_{ijkt} = \theta\delta_{jt} + \overbrace{\sum_{k\neq j} \widehat{\sigma_{it}}\kappa_k(\delta_{kt} - \delta_{jt})}^{\text{estimated OVB}=\xi_{it}} + \overbrace{\vartheta_{\tau j}}^{\text{price walking wealth effect}}$$

$$\underbrace{+\gamma_1 a_{it-1} + \gamma_2 a_{it-2} + \sum_{h=1,2,\geq 3} \beta_h^{AR}\mathbf{1}[n_{it} = h]}_{\text{state dependence}} + \underbrace{s\mathbf{X}_{it} + \delta\mathbf{Y}_{kt} + \iota_{jt} + \zeta_{kt} + \tau_t + \eta_i + u_{it}}_{\text{obs. and unobs. heterogeneity}}$$

Market-Wide MH: Results

- a 10 euros increase in penalties reduces acc prob. by
  - 19 basis points without accounting for OVB (plain FE)
  - 11 basis points when controlling for $-\sigma_{it}\delta_{jt}$
  - 6 basis points when controlling for $\sum_{k\neq j}\widehat{\sigma_{it}}\kappa_k(\delta_{kt}-\delta_{jt})$
  - MH effect gets reduced by 40-60% $\rightarrow$ consistent with theory
- negative state dependence: consistent with "nearly missed accidents" literature (Shum and Xin (2019))
- $\widehat{\vartheta_{\tau j}}$ statistically significant: wealth effect matters

BM reform: policy implications from the MH effect

- standard theory: $\uparrow$ information $\rightarrow \uparrow$ coverage
- inefficiently high coverage $\rightarrow$ penalty=MH+AS
- more information $\rightarrow$ penalty$\approx$MH , e.g. $\downarrow$ penalty$\rightarrow \uparrow$ MH $\rightarrow$ accidents $\uparrow$ premiums
- MH crowds out the more information policy!