

Equilibrium effects of price updating: evidence from a centralized marketplace for annuities

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- ▶ Before beginning: in red aspects I especially would like to get feedback on.
- ▶ How to start without having explained text

This research



- ▶ Aftermarkets: **allen_search_2019**
- ▶ Competition in selection markets: **mahoney_imperfect_2017**; **cuesta_price_2018**; **cosconati_competing_2025**
- ▶ Selection in multiple dimensions: **finkelstein_adverse_2004** and Finkelstein and McGarry (2006).

Outline

Setting and Data

Empirical Evidence

Model

Setting: annuities

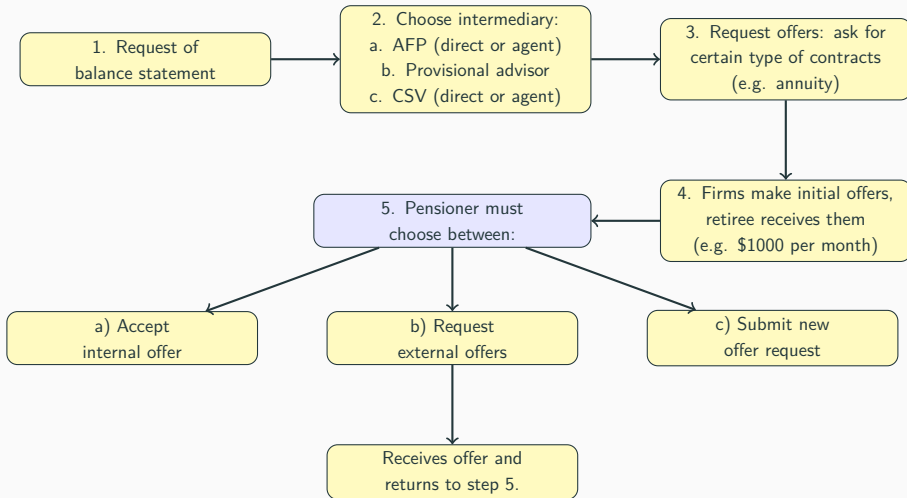
- ▶ Profits of firm j :

$$\pi_{ji}(F) = S_i - \mathbb{E}_T^j \left[\sum_{t=1}^T \frac{F}{(1+r_j)^t} | x_i \right]$$

S : stock of savings, F : per period annuity payment, x_i : individual mortality factors

- ▶ Firm heterogeneity: algorithm (mortality tables), financing costs (r_j) and risk ratings.

SCOMP Process Flow Diagram



- ▶ SCOMP data at the individual level
 - Posted and revised prices, and consumer decisions
 - Total savings
 - Demographics: age and gender Certificate with initial prices
- ▶ Retirement insurance companies: risk ratings

Particularities of the data/setting:

- ▶ One observes all the offers received by the buyers
- ▶ One observes the same information as the firms (gender, age, savings)

Outline

Setting and Data

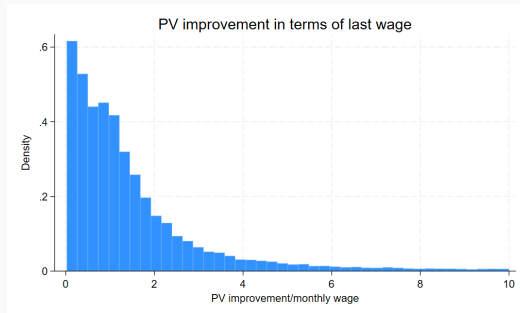
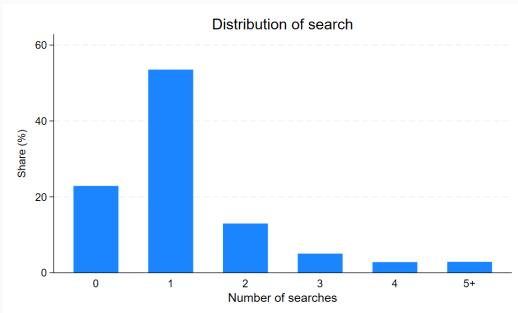
Empirical Evidence

Model

Descriptive Evidence

- ▶ Most buyers request external offers and the improvement is sizeable. External offers
- ▶ Products are differentiated Foregone value
- ▶ Selection into companies Heterogeneity in algorithm precision
- ▶ Firms learn about other firms' prices Learning

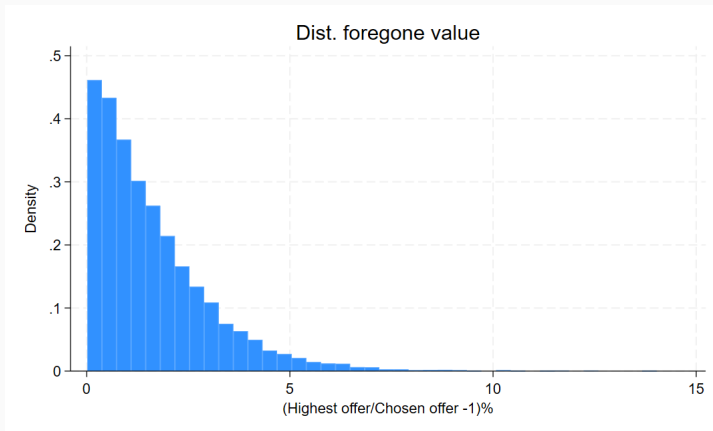
Prevalence of external offers



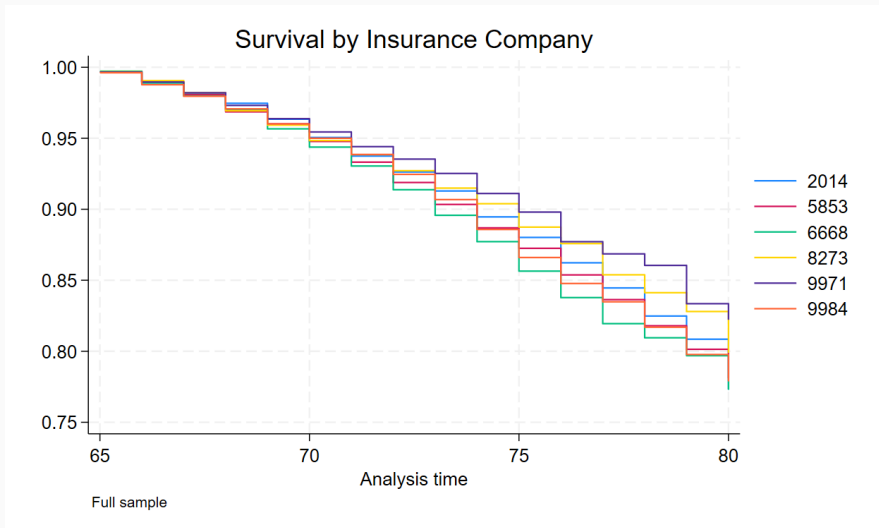
- 75% of the purchases are through external offers. [Go back](#)

Differentiation

Buyers do not always buy highest annuity. Average foregone value is 1.57 monthly wages.



Heterogeneity in algorithm precision



Learning

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Increase	Increase	Increase	Increase	Increase	Increase	Has External Offer
main							
Avg. Gap	0.316*** (0.006)	0.155*** (0.010)	0.155*** (0.010)	0.139*** (0.016)	0.147*** (0.019)	0.071*** (0.020)	
Max. Gap		0.110*** (0.009)	0.110*** (0.009)		-0.021 (0.029)	-0.006 (0.028)	
gap_from_avg							-0.191*** (0.032)
Constant	1.893*** (0.010)	1.375*** (0.082)	1.375*** (0.082)	1.381*** (0.045)	1.387*** (0.046)	1.511*** (0.121)	-2.012*** (0.028)
Observations	14133	14133	14133	2046	2046	2046	16164

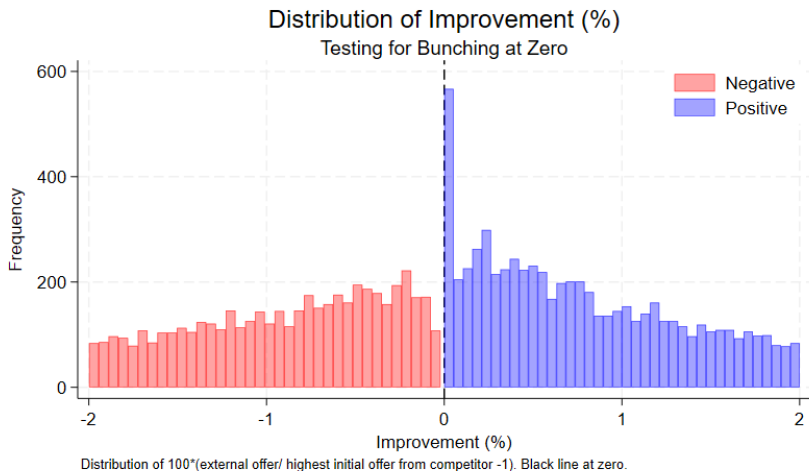
Average: is the difference between the mean of other firms' initial offers and own initial offer

Max Gap: is the difference between the highest other firm's initial offer and own initial offer.

Cols (1)-(3) use the population of initial offers that are not the highest, (4)-(6) only use the highest offer

Cols (4) and (6) include firm fixed effects

Learning(1)



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Learning Model: Overview

- ▶ **Goal:** Rationalize the increase in offers between initial and external offers
- ▶ **Key mechanism:** Firms learn competitors' offers when consumer requests external offers
- ▶ **Setup:**
 - One consumer and J firms
 - Firm j has private cost $c_j \sim F_j$ (due to interest rate variation)
 - Consumer chooses firm with probability $D_j(p)$ (logit demand)
- ▶ **Innovation:** Two-stage pricing with learning opportunity

Two-Stage Game: Timeline

1. Stage 1 (Initial offers):

- Firms simultaneously post initial prices p_j^{T1}
- Consumer observes all offers

2. Consumer decision:

- With probability $1 - \lambda$: accepts one of the initial offers
- With probability λ : requests external offer from random firm

3. Stage 2 (External offers):

- Selected firm observes all initial offers p^{T1}
- Can update its offer: $p_j^{T2}(c_j, p^{T1}) = \min(p_j^{T1}, p^*)$
- Consumer chooses among all available offers

Second Stage: Optimal Pricing with Learning

When selected for external offer, firm observes competitors' initial prices

Optimal updated offer:

$$p_j^{T2}(c_j, p^{T1}) = \min(p_j^{T1}, p^*)$$

where

$$p^* = \arg \max_{p_j} (p_j - c_j) D_j(p_j, p_{-j}^{T1})$$

Key insight: Firm can only lower its price (or keep it unchanged)

After observing competitors, firm best-responds to known prices rather than expected prices

Expected Profits in Second Stage

When consumer searches, firm j faces two scenarios:

1. Selected for external offer ($\frac{1}{J}$ probability):

$$\pi_j^{(j)}(p^{T1}, c_j) = (p_j^{T2}(c_j, p^{T1}) - c_j) D_j(p_j^{T2}(c_j, p^{T1}), p_{-j}^{T1})$$

2. Competitor j' selected ($\frac{1}{J}$ probability):

$$\pi_j^{(j')}(p^{T1}, c_j, c_{j'}) = (p_j^{T1} - c_j) D_j(p_{-j'}^{T1}, p_{j'}^{T2}(c_{j'}, p^{T1}))$$

Expected second stage profits:

$$\pi_j^{T2}(p^{T1}, c_j, c_{-j}) = \frac{1}{J} \left[\pi_j^{(j)}(p^{T1}, c_j) + \sum_{j' \neq j} \pi_j^{(j')}(p^{T1}, c_j, c_{j'}) \right]$$

First Stage: Strategic Pricing

Firms anticipate the second stage when setting initial prices

Expected profits in first stage:

$$\pi_j^{T1}(p^{T1}, c_j, c_{-j}) = (1 - \lambda) \underbrace{(p_j^{T1} - c_j) D_j(p^{T1})}_{\text{Immediate acceptance}} + \lambda \underbrace{\pi_j^{T2}(p^{T1}, c_j, c_{-j})}_{\text{Search occurs}}$$

Equilibrium condition:

$$p_j^{T1}(c_j) = \arg \max_{p_j} \int \pi_j^{T1}(p_j, p_{-j}^{T1}(c_{-j}), c_j) dF(c_{-j}|c_j)$$

Trade-off: higher initial price (if accepted) vs. competitive position if search occurs

- ▶ SHOW SIMULATION RESULTS TO BUILD INTUITION

MODALIDAD RENTA VITALICIA INMEDIATA

RENDA VITALICIA INMEDIATA SIMPLE

Annuitize full wealth, 0 guarantee, 0 deferral

N° Oferta	Compañía de Seguros de Vida Brand Name	Pensión final Mensual sin Retiro de Excedente UF	Pensión final Mensual en UF Considerando un retiro de excedente de 0,00 UF	Pensión con retiro de Excedente Máximo		Clasificación de riesgo de la Compañía de Seguros (2)
				Pensión final Mensual UF	Excedente UF	
43872093	CRUZ DEL SUR	26,61	<- Monthly payment		Risk rating ->	AA-
43872099	RENDA NACIONAL	26,58				BBB-
43872083	METLIFE	26,52				AA
43872100	CORPSEGUROS	26,34				AA-
43872094	PRINCIPAL	26,28				AA
43872097	CORPVIDA	26,26				AA-
43872084	EUROAMERICA VIDA	26,25				AA-
43872090	PENTA VIDA	26,25				AA-
43872091	OHIO NATIONAL	26,24				AA
43872098	SURA	26,21				AA
43872095	CN LIFE	25,90				AA
43872092	BICE VIDA	25,86				AA+
43872085	CHILENA CONSOLIDADA	25,59				AA
43872086	CONSORCIO VIDA	25,36				AA+