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

Lucas Condeza [1]

October 13, 2025

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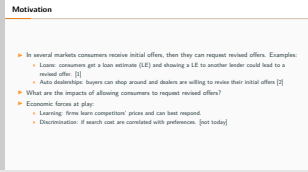
Motivation

- In several markets consumers receive initial offers, then they can request revised offers. Examples:
  - Loans: consumers get a loan estimate (LE) and showing a LE to another lender could lead to a revised offer. [1]
  - Auto dealerships: buyers can shop around and dealers are willing to revise their initial offers [2]
- What are the impacts of allowing consumers to request revised offers?
- Economic forces at play:
  - Learning: firms learn competitors' prices and can best respond.
  - Discrimination: if search cost are correlated with preferences. [not today]



- I am going to study the effects of being able to request revised offers in a centralized marketplace for annuities in Chile.

This research

- Studies a centralized marketplace for annuities in Chile (SCOMP)
- A recent law eliminated the possibility of requesting revised offers.
  - Before: consumers receive initial offers, then can request revised offers from one firm.
  - After: consumers can only accept/reject initial offers.
  - Rationale for elimination: "firms will not make their best efforts in the initial phase"
- Also provides evidence on assymmetries in infomration precision in selection markets.

This research
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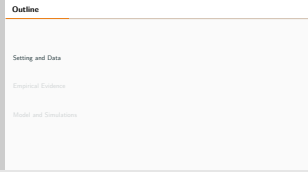
  - Rationale for elimination: "firms will not make their best efforts in the initial phase"
- Also provides evidence on assymmetries in infomration precision in selection markets.

Literature

- Search in selection markets: **allen_search_2019**
- Competition in selection markets: **mahoney_imperfect_2017**; **crawford_asymmetric_2018**; **cuesta_price_2018**; **cosconati_competing_2025**
- Centralized marketplaces in selection markets : **abaluck_when_2023**; **tebaldi_estimating_2025**
- SCOMP specific: **boehm_intermediation_2024**; **illanes_retirement_2019**; **alcalde_intermediary_2021**

ADD THE CONTRIBUTIONS TO EACH LITERATURE AND ADD MORE PAPERS

Outline

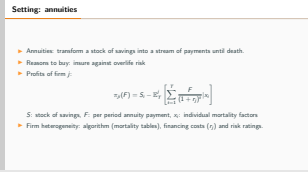


Setting: annuities

- Annuities: transform a stock of savings into a stream of payments until death.
- Reasons to buy: insure against overlife risk
- Profits of firm j:

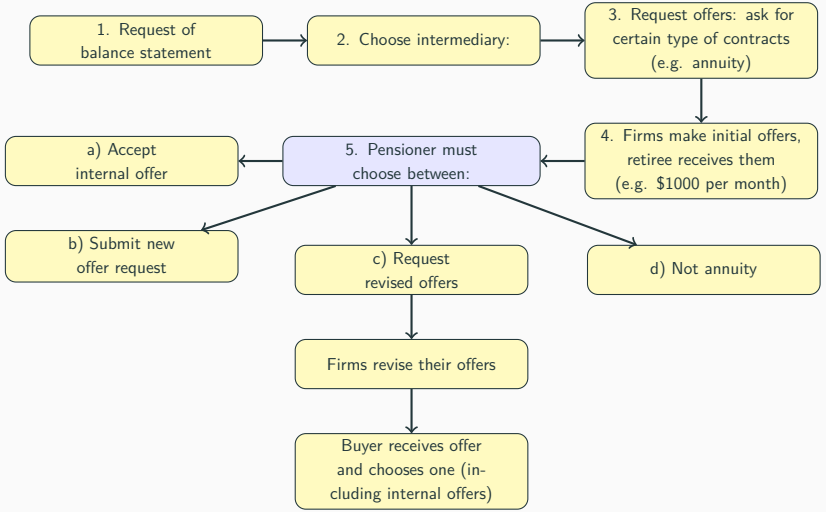
$$\pi_{ji}(F) = S_i - \mathbb{E}_T^j \left[\sum_{t=1}^{T} \frac{F}{(1+r_j)^t} | x_i \right]$$

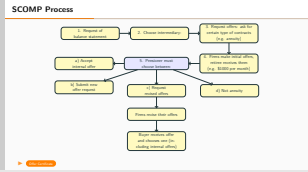
  S: stock of savings, F: per period annuity payment, x_i: individual mortality factors
- Firm heterogeneity: algorithm (mortality tables), financing costs (r_j) and risk ratings.



- Explicitly not link the annuities market with pensions because generates confusion
- Explain what annuities are.

SCOMP Process





Explain that:

- Mention that external offers are called this way because they are external to the system, moreover they are less regulated
- An exception to less regulation is that they can not be lower than initial offers.
- only initial bidders can make an external offer

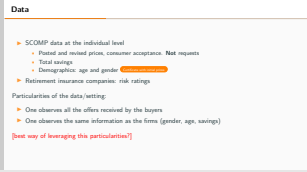
Data

- SCOMP data at the individual level
  - Posted and revised prices, consumer acceptance. **Not** requests
  - 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)

[best way of leveraging this particularities?]



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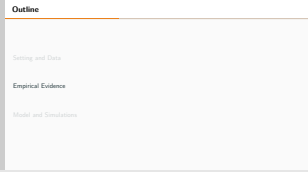
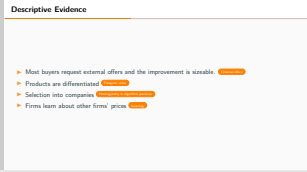
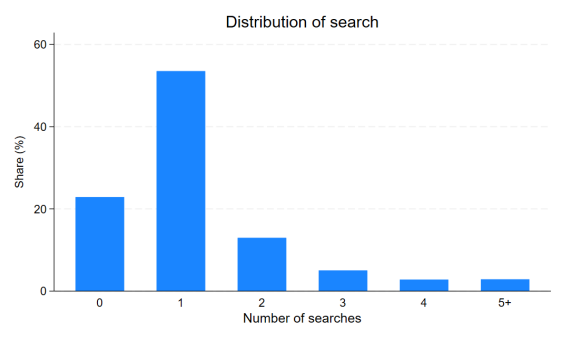


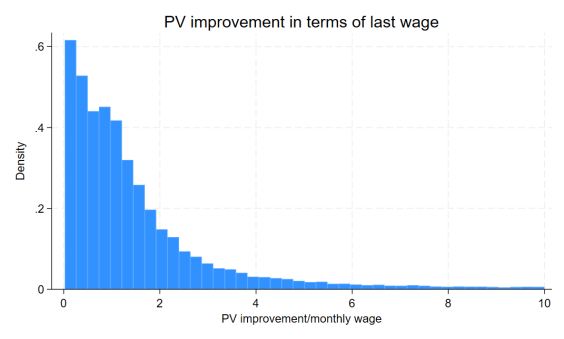
Descriptive Evidence

- 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

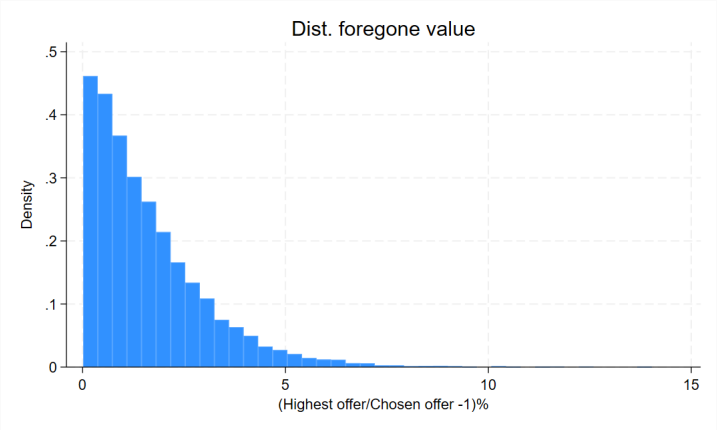
That only some people request revised offers suggests:

- There are search costs
- Firms could be discriminating based on the search likelihood.

Any assessment of the welfare effects of the aftermarket has to consider that by banning it buyers will save in search costs, but will not be able to improve on the initial posted prices.
In a model where search costs are not correlated with valuations, the aftermarket prices by the sellers are the same as the initial prices.

Differentiation

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



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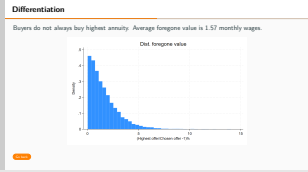
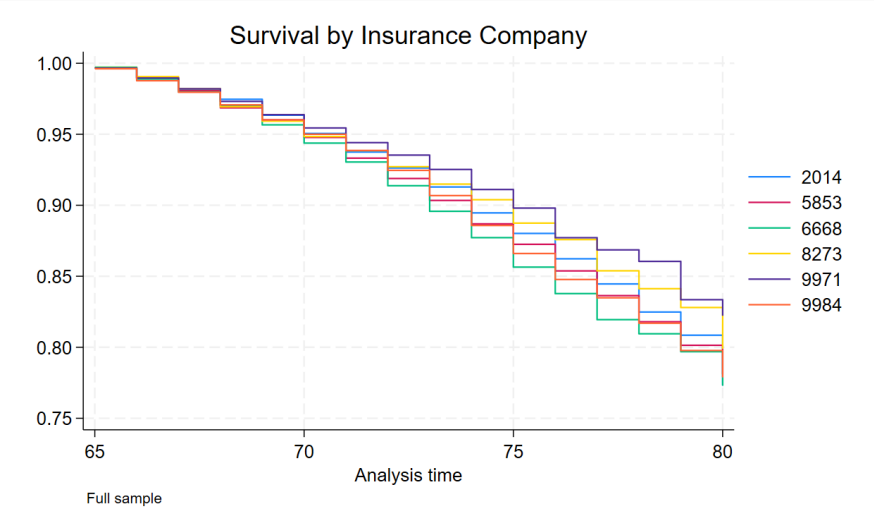


Heterogeneity in algorithm precision



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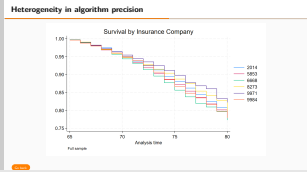

Learning

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

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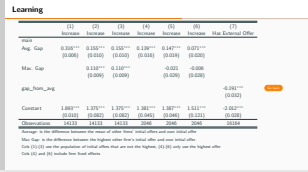
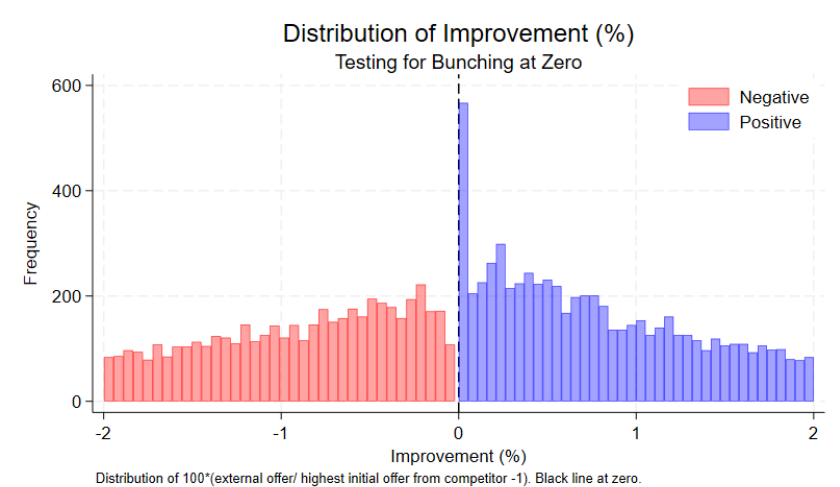


Learning(1)



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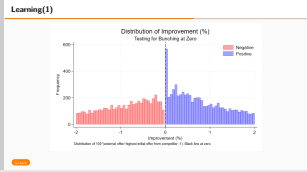
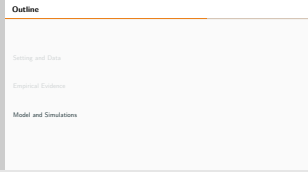
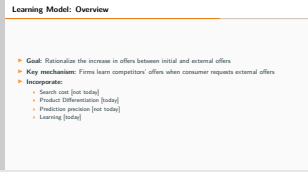


Outline



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
- **Incorporate:**
  - Search cost [not today]
  - Product Differentiation [today]
  - Prediction precision [not today]
  - Learning [today]

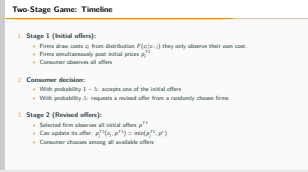


Two-Stage Game: Timeline

1. **Stage 1 (Initial offers):**
   - Firms draw costs c_j from distribution $F(c_j|c_{-j})$ they only observe their own cost.
   - 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 a revised offer from a randomly chosen firms

3. **Stage 2 (Revised 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

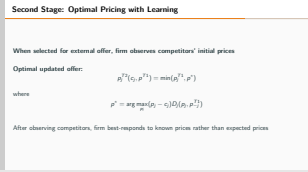
Optimal updated offer:

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

where

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

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):

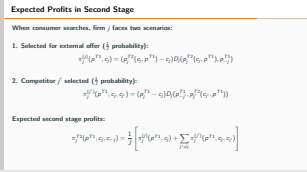
$$\pi_j^{(j)}(p^{T1}, c_j) = (p_j^{T2}(c_j, p^{T1}) - c_j) D_j(p_j^{T2}(c_j, p^{T1}), p_{-j}^{T1})$$

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:

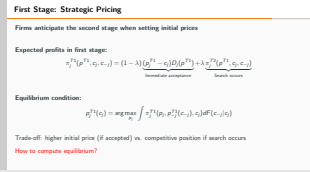
$$\pi_j^{T1}(p^{T1}, c_j, c_{-j}) = (1-\lambda)\underbrace{(p_j^{T1} - c_j)D_j(p^{T1})}_{\text{Immediate acceptance}} + \lambda \underbrace{\pi_j^{T2}(p^{T1}, c_j, c_{-j})}_{\text{Search occurs}}$$

Equilibrium condition:

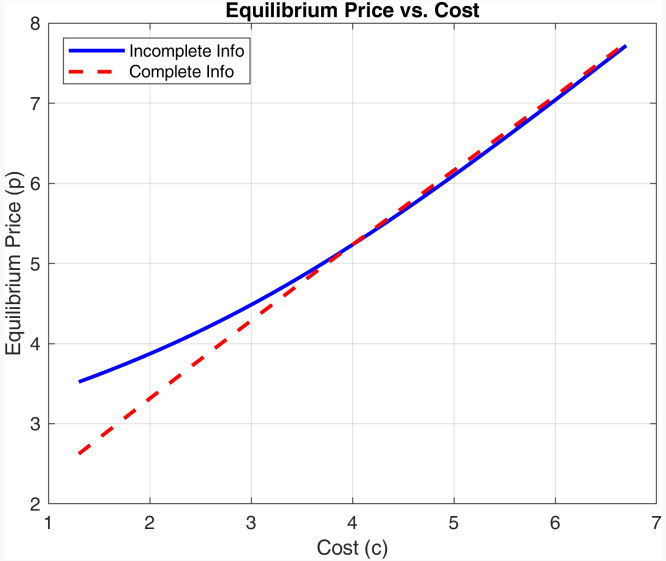
$$p_j^{T1}(c_j) = \arg\max_{p_j} \int \pi_j^{T1}(p_j, p_{-j}^{T1}(c_{-j}), c_j) dF(c_{-j}|c_j)$$

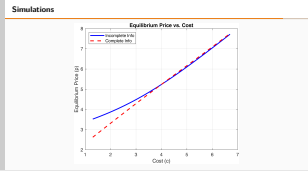
Trade-off: higher initial price (if accepted) vs. competitive position if search occurs

How to compute equilibrium?



Simulations





Extensions

Possible extensions

- To add search costs
- Allow for more than one search
- Model prediction precision

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- Model prediction precision

Initial prices

MODALIDAD RENTA VITALICIA INMEDIATA

RENTA 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	RENTA 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+

Go back: Diagram Go back: Data