Regulation by Public Options: Evidence from Pension Funds

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August 2023

Motivation

- Individual Defined Contribution (DC) retirement systems widely used around the world.
  - Lack of intense price-based competition (high fees) reduces savings (OECD, 2018).

- Current debate analyze different regulations *including* public options:
  - Ambiguous effects on market prices, quality and welfare.

    (Hastings et al., 2017; Atal, et al., 2022; Jimenez-Hernandez et al., 2021).

- This Paper:
  - We study the *equilibrium welfare effects* of a Public Option under different regulatory environments.

The paper in a nutshell

- Research question: What are the welfare effects of having a Public Option competing with private firms?
- Contribution: We analyze the effects of having a public option and how it affects retirement savings through fees and returns.
- Approach: We estimate a model of demand and supply in the Pension Fund Administrators' market
  - Demand: myopic consumers with inertia.
  - Supply: forward looking firms set fees and expected returns.
    - We incorporate Non-Profit Motives (NPM) in the State Owned Firm (SOF).
    - Firms are heterogeneous in costs.
    - We leverage minimum quality regulation to understand investment abilities-costs.
- Results: We find that:
  - SOF exerts competitive pressure and helps reducing market power ($\downarrow \bar{f}^*$ 24%).
  - Current equilibrium generates higher expected savings for all workers, higher counterfactual returns don't compensate higher equilibrium fees.

Institutional background

Uruguayan Pension Fund Administrators' (PFA) market

- One fee (% over wage) for all enrollees, no price discrimination (new and old workers).
- Single "product" firms: 2 investment portfolios per firm, default assignment by age.
- Quality regulation: the Law imposes firms a minimum investment return $r_{\min}$:
  - The real annual return R_{jt} cannot be less than $r_{\min,t} = \min\{2\%, \bar{R}_t - 2\%\}$.
  - Firms must use their own capital to compensate workers when $R_{jt} < r_{\min,t}$. Returns
- Sale force goal is to attract workers not previously enrolled. Sales force by period
- A Public Option ($\approx$ 40% enrollees) competes with 3 Private Firms. Shares by bracket and period
- Almost no switchers (0.3% per year).

Additional demand descriptives

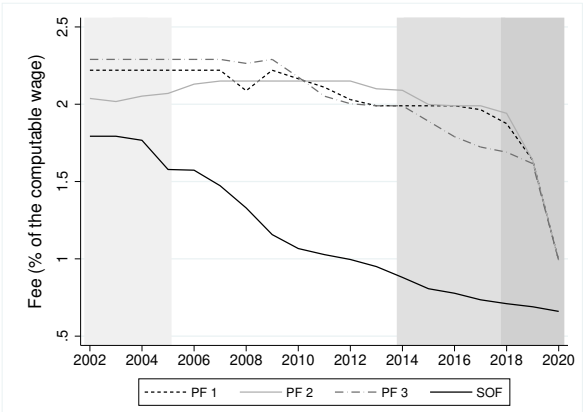
Data and descriptives

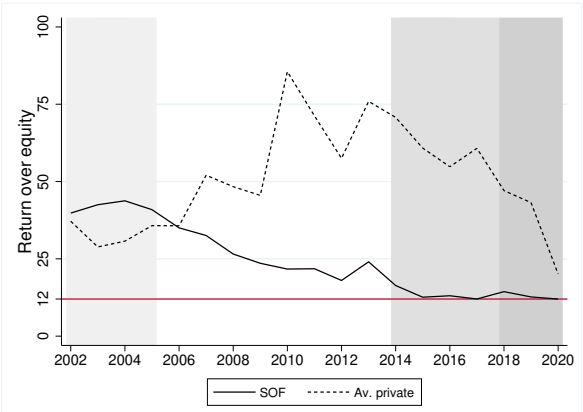
Data

We combine three data sources about consumer choices and firms behavior:

- Database with the social security administrative record collected by the Social Security Administration (BPS) for a random sample of 300.000 individuals (1996-2020).
  - Monthly information of wage, age, gender and area of residence.
  - Matched with information of the DC system: firm, enrollment mechanism (sales force or automatic), contributions, etc.
- Firms' financial statements (2001-2020) and SOF shareholders' meeting minutes.

Descriptives: Management Fees and Accounting Profits (ROE)





- Today: equilibrium 14-17. SOF charges low fees and obtains low profits.

Model

Model

- Key points from theoretical literature of switching cost:
  - Forward looking firms compete Nash-Bertrand and face an investing-harvesting trade-off.
    (Beggs and Klemperer, 1992)
  - Equilibrium with constant prices: stationary "no-sales" equilibrium.
    (Farrell and Klemperer, 2007)
- Assumptions:
  - Myopic consumers (consider current fees) with infinite switching cost
  - Prices: Firms set a single equilibrium fee (f_j) for all t
  - Quality: Firms choose mean returns (μ_j) to minimize the $\mathbb{E}$(Cap. Cost).
- Agents and timing:
  1. Firms simultaneously set (f_j) and mean returns (μ_j) for all t, taking as given workers' preferences and expected labor market conditions (share of new vs old workers, wages, employment).
  2. In every t, new workers choose firms based on fees and firms' characteristics.

Per-period profits' function: Expected Revenues

R_{jt} are the revenues for firm j in period t:

$$\begin{aligned}\mathbb{E}\left[R_{jt}\right] &= f_{jt} \times \Bigg(\underbrace{\sum_{i_n} w^n_{it} \times prob_{ij}(\mathbf{f})}_{\text{New workers}} + \underbrace{\sum_{i_o} w^o_{it} \times 1(d_i = j) \times (1 - \rho^o_{it})}_{\text{Old workers}} \Bigg) \\ &= f_{jt} \times \Bigg(\underbrace{\alpha \times M_t \times s^n_j(\mathbf{f})}_{\text{New workers' wages}} + \underbrace{(1-\alpha) \times M_t \times s^o_j \times (1 - \rho^o_t)}_{\text{Old workers' wages}} \Bigg)\end{aligned} \tag{1}$$

- f_{jt}: management fee (% gross wage) with $f_{jt} \in [0.0; 0.13]$
- w^n_{jt}: gross wage of new worker i with $w_{it} \in [0.0, \bar{w}_t]$
- $prob_{ij}(\mathbf{f})$: enrollment probability
- M_t: total wage mass relevant to DC sub-system
- $s^n_j(\mathbf{f})$ and s^o_j: re-weighted agg. monetary shares of new and old workers
- α: share of total wage mass of new workers
- ρ_t: percentage of retirees

Per-period profits' function: Expected Costs

C_{jt} **are the costs for firm** j **in period** t:

$$\begin{aligned}\mathbb{E}\left[C_{jt}\right] &= \underbrace{\sum_i prob_{ij}(\mathbf{f}) \times w_{it}^n \times MC_{jt}}_{\text{Enrollment Cost of New Workers}} \\ &+ \underbrace{\mathbb{E}\left[(r_{\min} - R_j) \times \text{PSF}_{jt} \middle| (R_j < r_{\min})\right]}_{\text{Expected Capitalization Cost}} \\ &+ \underbrace{f(\mu_{jt}|\kappa_j)}_{\text{Investment cost}} \\ &+ \underbrace{F_{jt}}_{\text{Fixed cost}}\end{aligned} \tag{2}$$

PSF_{jt}: Pension Savings Fund, total stock of workers' savings, F_{jt} Non-variable per period fixed cost.

Net Present Value of Expected Profits

Net Present Value of Expected profits of firm j:

$$
\begin{aligned}
\max_{\{f_{jt},\mu_{jt}\}_0^T} \mathbb{E}\left[V_{jt}\right] &= \sum_1^T \beta^{t-1}\mathbb{E}\left[\pi_{jt}\right] \\
&= f_{jt} \times M_t \times \left[W^n(\alpha,\beta)s_j^n(\mathbf{f}) + W^o(\alpha,\beta,\rho_t^o)s_j^o\right] \\
&- \sum_1^T \beta^{t-1}\Bigg\{\alpha M_t s_{jt}^n(\mathbf{f}) \times MC_{jt} + \mathbb{E}\Big[\mathsf{Cap.Cost}(\mathbf{f},\mu)\Big]_{jt} \\
&+ f(\mu_{jt}|\kappa_j)\Bigg\} - F_j
\end{aligned}
\tag{3}
$$

Similar to static problem, but with a different weight of news and old consumers.

State Owned Firm Non-Profit Motives

- **SOF objective function**: maximize expected profits and expected workers' savings

  (Atal, et al., 2022)

$$\mathcal{W}(\mathbf{f},\mu)_{sof,t} = (1-\lambda)\underbrace{\left(\mathbb{E}\left[V(\mathbf{f},\mu)_{sof,t}\right]\right)}_{\text{NPV Profits}} + \lambda\underbrace{\left(\mathbb{E}\left[\text{Savings}(\mathbf{f},\mu)_{sof,t}\right]\right)}_{\text{NPV Workers' Savings at SOF}} \tag{4}$$

- $\lambda \in [0,1]$ is a welfare weight captures Non-Profit Motives (1 is full Non-For-Profit).

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Estimation and results

Workers' Demand

- We use data on individual choices to estimate random utility models (Hastings et al., 2017)
- Conditional logit models separately for 16 demographic cells (c):
  $\{(\text{Wage Tertile}) \times (\text{Cat Age}) \times (\text{Gender})\}_{\textit{With Out.Opt.}} + \{(\text{Cat Age}) \times (\text{Gender})\}_{\textit{Without Out.Opt}}$

$$u^c_{ijt(i)} = (\alpha^c + \gamma^c w_{it(i)}) \times C_{ijt(i)}(y_{it(i)}, f_{jt}) + \eta^c_{jt(i)} + \epsilon^c_{ijt(i)} \tag{5}$$

- $\theta^c_i = \alpha^c + \gamma^c w_{it(i)}$ cost sensitivity parameter, and η^c_{jt} are firm/year fixed effects.
- Management cost $C_{ijt} = y_{it(i)} \times f_{jt}$ with $y_{it(i)}$ 1Yr gross wage and $\epsilon_{ijt} \sim$ T1EV.
- Identification: firms set unique fees f_j, but costs are worker-specific and vary with wages and spells in formal market.

Demand estimation | Elasticities | FE

Enrollment marginal cost

- We back out Private PFAs' marginal costs MC_{jt} for 2014-2017 using estimated preferences, observed shares s_{jt} and fees f_{jt}.
- Period after transition (see paper) and before cap on fees.
- For the SOF, we can't separately identify MC_{sof} from Non-Profit Motives λ_{sof}.

	Avg. Marginal Cost (US$ 2017)				SOF NPM ($\hat{\lambda}$)
Period	PF 1	PF 2	PF 3	SOF ($\lambda = 0$)	(Max. MC_{PF})
Period 2014/17	73	73	47	-249	0.74

Note: Cost of enrolling an individual with the average gross monthly wage of new workers.

- Secondary data relates these estimates with sales force variable payments.

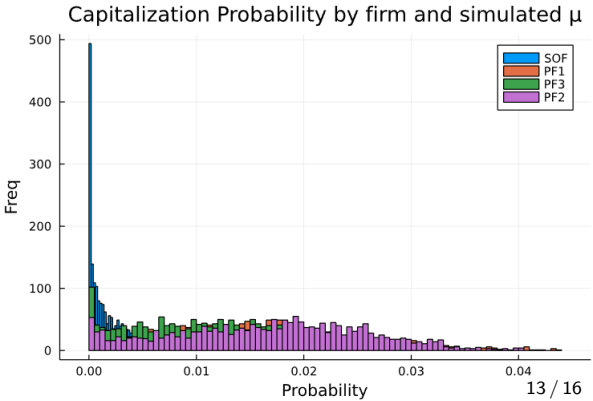
Investment marginal cost

- We use a non-linear function to capture the increasing cost of obtaining higher returns $[f(\mu;\kappa) = \kappa_2\mu^2 + \kappa_1\mu]$ for each j
- Reduced form can be rationalized by an efficient frontier, (μ_j, σ_j) trade-off (Markowitz, 1952).

Returns 2014/17	PF 1	PF 2	PF 3	SOF
μ_j^* (%)	1.6	1.5	1.6	1.2
$\mathbb{E}[\text{Pr(Cap)}_j]$	1.5%	1.7%	1.3%	0.2%
$f(\mu_j^*;\hat{\kappa}_j)$[1]	280.2	256.8	224.4	297.2

ω = [0.18; 0.09; 0.16; 0.57], σ = [0.055; 0.053; 0.055; 0.057],

ρ_{jk} = 0.95, Note: 1- In US$ 2017 (000')



Counterfactuals

- We perform a series of counterfactuals to answer the following questions:

1. What is the value of having a SOF in the market?
2. How are workers affected by the presence of the public option?
3. How does the regulation on minimum returns interacts with firms ownership and size?

Counterfactual analysis: what's the effect of the SOF?

	Fees f_j^* (% Gross Wage)		Returns μ_j^* 1Yr (%)		$\mathbb{E}[\pi_t]$ (US$ Mill.)		$\mathbb{E}$[Savings]* (US$ '000)	
	PF (Avg.)	SOF	PF (Avg.)	SOF	PF (Tot.)	SOF	PF (Avg.)	SOF
Avg. 2014/17	1.95	0.88	1.56	1.19	40.2	9.5	44.7	47.4
Counterfactual								
1) $\rightarrow \lambda = 0$	2.02	4.03	1.44	0.84	43.1	125.1	42.8	32.6
2) $\rightarrow$ 1) + $\eta_{sof} = \bar{\eta}_{pf}$	2.08	3.32	1.44	0.84	45.3	99.3	42.5	35.2
3) $\rightarrow$ 2) + $s_{sof} = s_j = 0.25$	2.24	2.04	1.96	1.90	92.1	14.1	44.0	44.4

*Mean savings for a worker that faces equilibrium f^* and μ^* for 40 years. Avg PF weighted by enrollees s_j.

- Average equilibrium fees $\downarrow$ 24% and $\downarrow$ 13% for private PFAs.
- Lower fees compensate lower returns in expectations.
- Worker's expected savings are higher in baseline, independent of labor market history.

Final comments

Final comments:

- SOF with positive NPM rationalizes equilibrium fee level.
- SOF presence increases competition and decreases fees for all workers ($\downarrow \bar{f}_j^*$ by 24%).
- Expected savings are between 1% and 10% higher in baseline scenario compared to counterfactual with 4 equal size PFs with higher investment ability.
- Lower equilibrium fees more than compensate lower returns due to big SOF.

- Additional results (in the paper)
  - NPM (λ) increased between 2002/05 and 2014/17.
  - Higher NPM increased market segmentation.
  - Higher NPM can not compensate for caps on fees (under revision).

Appendix

Affiliates shares

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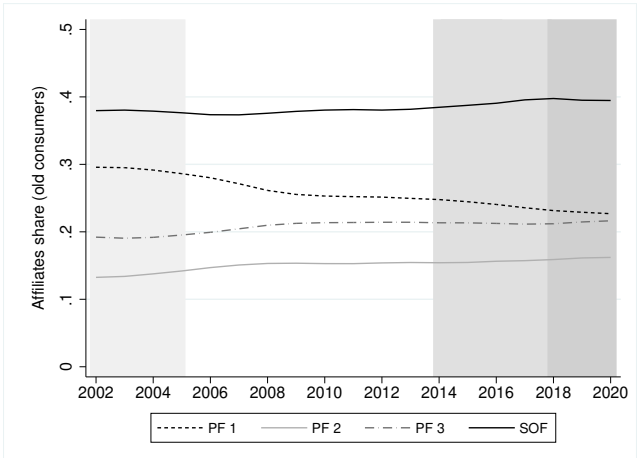
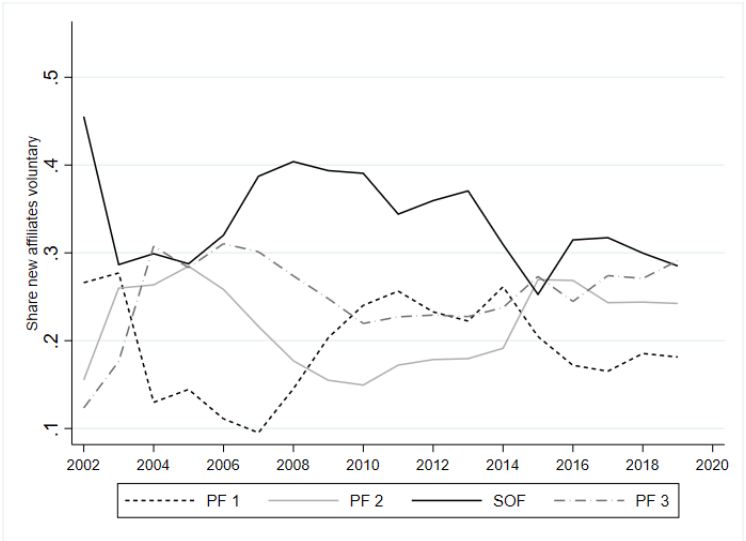


Voluntary affiliates shares

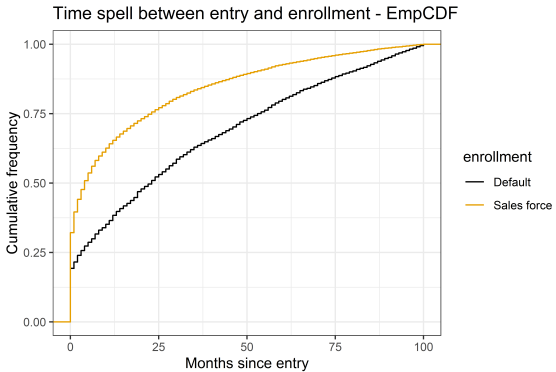


Additional demand descriptives

Table: Workers' Sample Summary Statistics

Individuals	125,453
Gender (female)	0.48
Age when entering the market (median)	23.2
Age when enrolling (median)	24.9
Gross wage (median, US$)	834
Share with enrollment gross wage above threshold (US$ 1,535)	0.15
Outside option (conditional on gross wage below US$ 1,535)	0.26

Notas. The Table reports descriptive statistics for selected demographics for the available sample. Average 1996-2020. UYU expressed in US$ 2017.



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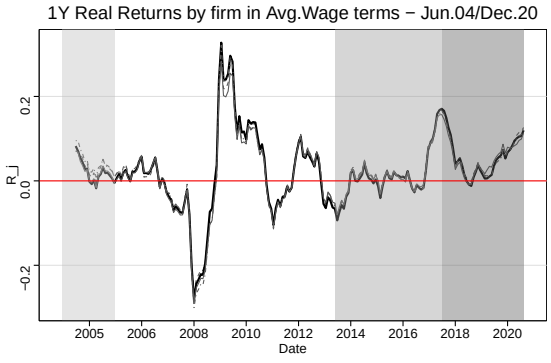
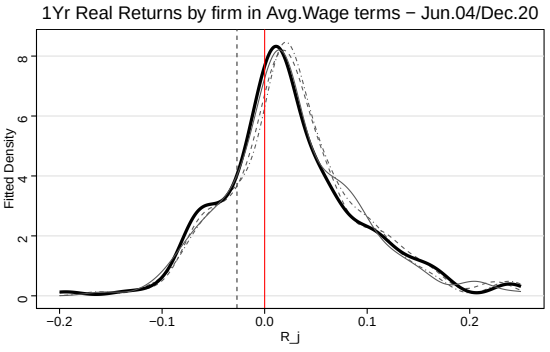
Descriptives: Investment Returns



Nominal Returns deflated by the Nominal Avg. Wage Index.



Notes: 1) Nominal Returns deflated by the Nominal Avg. Wage Index.
2) Avg real wages grew 2.7% per year during this period.

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SOF FOC

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$$\frac{\partial U(\mathbf{f},\mu)_{sof,t}}{\partial f_j} = (1-\lambda)\Big[\sum_{t=1}^{T}\beta^{t-1}\frac{\partial(R_{jt}(f)-C_{jt}(f))}{\partial f_j}\Big] + \lambda\Big[\sum_{t=1}^{T}\beta^{t-1}\sum_i \frac{\partial \mathbb{E}(S_{jit})}{\partial f_j}\Big] \tag{6}$$

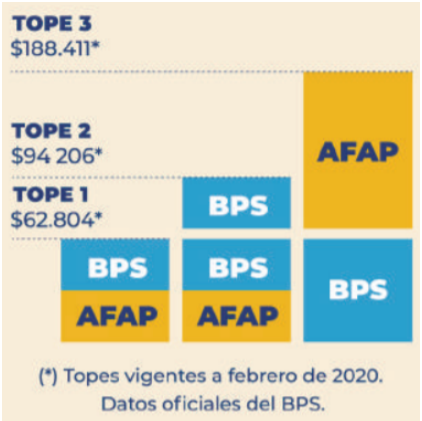
$$\frac{\partial U(\mathbf{f},\mu)_{sof,t}}{\partial \mu_j} = -(1-\lambda)\Big[\kappa_j\frac{(1-\beta^T)}{(1-\beta)} + \sum_{t=1}^{T}\beta^{t-1}\Big(\frac{\partial \mathbb{E}(\text{Cap. Cost})_{jt}}{\partial \mu_j} + \frac{\partial \mathbb{E}(\text{Equity Cost})_{jt}}{\partial \mu_j}\Big)\Big] \tag{7}$$

$$+ \lambda\Big[\sum_{t=1}^{T}\beta^{t-1}\sum_i \frac{\partial \mathbb{E}(S_{jit})}{\partial \mu_j}\Big]$$

Where $\mathbb{E}(S_{jit})$ are the expected savings of worker i enrolled at firm j that it's retiring at time t

$$\mathbb{E}(S_{jit}) = \mathbb{E}\sum_{t=1}^{t+40}\Big(w_{it}\underbrace{(0.15-0.02-f_{jt})}_{\text{Net contribution rate}}\prod_{k=t}^{40-t}(1+R_{jk})\Big)$$

Mixed system



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Results. Demand

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	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Total cost	-0.0073***	-0.0133***	-0.0032***	-0.0180***	-0.0147***	-0.0169***	-0.0138***	-0.0223***
	(0.0008)	(0.0009)	(0.0011)	(0.0011)	(0.0008)	(0.0009)	(0.0008)	(0.0010)
Cost Wage	3.0e-07***	5.3e-07***	1.9e-07***	6.7e-07***	3.4e-07***	4.0e-07***	3.4e-07***	5.2e-07***
	(4.3e-08)	(4.8e-08)	(5.6e-08)	(5.2e-08)	(2.7e-08)	(3.3e-08)	(2.6e-08)	(3.1e-08)
Tertile	1	1	1	1	2	2	2	2
Age	Young	Young	Old	Old	Young	Young	Old	Old
Gender	Male	Female	Male	Female	Male	Female	Male	Female
Outside option	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	36,975	35,390	30,195	38,395	47,690	39,045	27,150	27,070

	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Total cost	-0.0034***	-0.0044***	-0.0029***	-0.0039***	-0.0051***	-0.0017	-0.00048*	-0.00059
	(0.0002)	(0.0005)	(9.45e-05)	(0.0002)	(0.0009)	(0.0017)	(0.0002)	(0.0005)
Cost wage	5.7e-09***	2.1e-08***	9.3e-10***	7.1e-09***	8.0e-09	-2.8e-08*	3.3e-10**	1.4e-09*
	(8.8e-10)	(6.4e-09)	(5.2e-11)	(1.0e-09)	(6.1e-09)	(1.6e-08)	(1.4e-10)	(8.2e-10)
Tertile	3	3	3	3	-	-	-	-
Age	Young	Young	Old	Old	Young	Young	Old	Old
Gender	Male	Female	Male	Female	Male	Female	Male	Female
Outside option	Yes	Yes	Yes	Yes	No	No	No	No
Observations	43,600	25,675	41,045	30,635	5,032	2,856	4,128	3,068

Notes. Standard errors in parentheses*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Market shares of new enrollees by wage bracket and period.

	Firm			
	PF 1	PF 2	SOF	PF 3
Period 2002-2005				
Wage tertile 1	0.21	0.27	0.19	0.32
Wage tertile 2	0.18	0.25	0.31	0.27
Wage tertile 3	0.17	0.17	0.48	0.18
% above threshold	0.12	0.10	0.64	0.14
Period 2014-2017				
Wage tertile 1	0.25	0.28	0.21	0.26
Wage tertile 2	0.21	0.23	0.26	0.30
Wage tertile 3	0.16	0.22	0.36	0.27
% above threshold	0.10	0.15	0.57	0.18
Period 18-19				
Wage tertile 1	0.24	0.24	0.23	0.28
Wage tertile 2	0.20	0.22	0.24	0.34
Wage tertile 3	0.21	0.17	0.33	0.29
% above threshold	0.08	0.02	0.85	0.05

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Share of sale force agents by PFA and period.

Period	Firm			
	PF 1	PF 2	SOF	PF 3
02-05	0.21	0.24	0.35	0.21
14-17	0.22	0.15	0.36	0.27
18-19	0.24	0.15	0.36	0.25

Notes. Average share of the sales force by firm and period.

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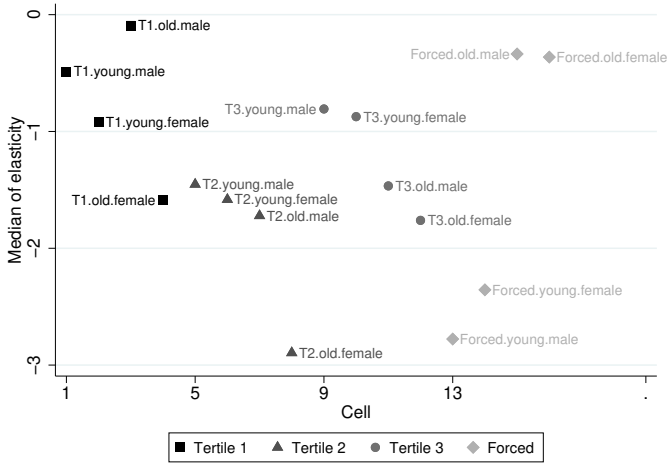
Workers' Demand: f_j^* elasticities by cell



Note. Median of elasticities by cell (all period).

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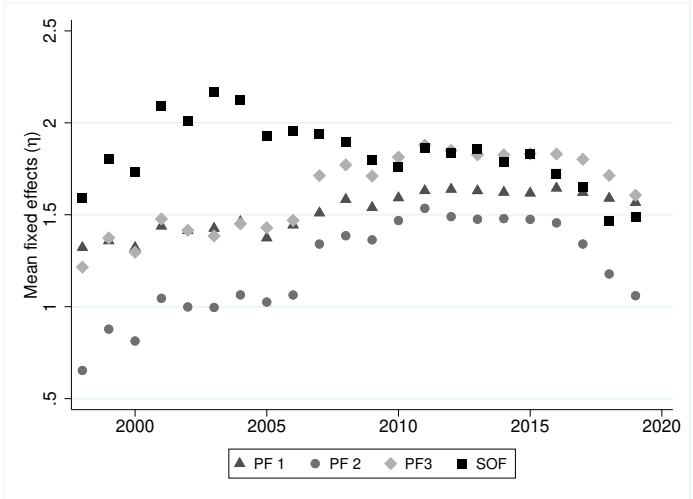
Results. Demand. Fixed effects by firm



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