Regulation by Public Options: Evidence from Pension Funds

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Motivation and research question

Retirement systems with individually defined contributions are widely used globally.

- Pension Fund Administrators (PFAs) compete to enroll workers and invest their contributions until retirement.
- Lack of intense competition (high management fees) reduces savings (OECD, 2018).

Current debate analyzes alternative regulations to increase workers' savings, ***including public options (or State-Owned Enterprises (SOEs))***.

- Governments use ***public options*** to enhance competition or "regulate" markets.
- The literature finds ambiguous welfare effects (Hastings et al. 2017, Atal et al. 2021, Jiménez-Hernández et al. 2021)

Research Questions:

- What are the ***equilibrium welfare effects*** of having a public option in the market of PFAs?

We use data to estimate a demand and supply model of the Uruguayan market of PFAs, where a public option competes with private firms.

The Uruguayan market of Pension Fund Administrators

In 1996, PFAs were established to manage workers' savings.

A Public Option has existed from the start.

- Leader firm with about 40% of the enrollees

Competition and Quality Regulation

- One fee (%) 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 realized 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 $R_{jt} < r_{\min,t}$.
- Switchers annually represent about 0.31% of the total enrollees and 5.52% of the new cohort.
- Sales force goal is to attract workers not previously enrolled, not potential switchers.

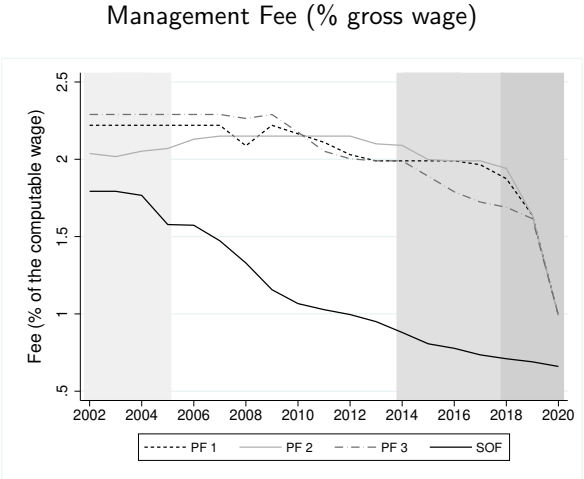
Data and Descriptives

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).
  - Matched with information of the DC system: firm, enrollment mechanism (sales force or automatic), contributions, etc.
- Firms' financial statements (2001-2020) and SOE shareholders' meeting minutes.

The SOE charges a lower fee



Today: equilibrium 14-17. SOE charges lower fees. Returns and ROE

Model

A model for workers' decision making and competition between firms

Built based on the literature of dynamic competition with switching costs (Beggs et al. 1992, Farrell et al. 2007)

- Forward-looking firms, investing-harvesting trade-off between new and old consumers.
- Nash-Bertrand competition, equilibrium with constant prices: stationary "no-sales" equilibrium.

Agents, timing and primitives

Firms:

- Set a single equilibrium fee (f_j) and mean returns (μ_j) for all t.
- Heterogeneous in marginal cost and the cost of generating portfolio returns
- The Public Option has Non-Profit Motives, its objective function considers own workers' savings.

Workers' Demand

- Consumers decide based on current period fees (f_{jt}), mean returns (μ_{jt}) and firms' characteristics (Luco 2019).
- Inattentive, once enrolled old workers may become aware of the problem and re-optimize (Ho et al. 2017).

New workers' demand

Conditional logit models for 5 demographic cells (c): four wage quartiles for non-mandatory and one for mandatory enrollees:

$$u^c_{ijt} = \underbrace{\theta^c \times C_{ijt}(w_{it}, f_j)}_{\text{NPV}_i \text{ of Administration Cost}} + \underbrace{\gamma^c_{NS} \times S_{ijt}(w_{it}, \mu_j)}_{\text{NPV}_i \text{ of Savings}} + \underbrace{\gamma^c_{SF} \times sf_{jt(i)} + \eta^c_j + \zeta^c_{t(i)}}_{\text{Aggregate Components}} + \epsilon^c_{ijt(i)} \quad (1)$$

- Administration Cost: $C_{ijt} = \sum_{k=t}^{40+t} \beta^{k-t} \times w_{ik} \times f_{jk}$ with cost sensitivity (θ^c).
- Net Savings: $S_{ijt} = \sum_{k=t}^{40+t} \beta^{k-t} \times w_{ik} \times (1 + (\mu_{jk} - \bar{\mu}_k))^{40+t-k}$ with return sensitivity (γ^c_{NS}).
- Sales Force (sf_{jt}) with sensitivity (γ^c_{SF}), Firm FEs (η^c_j), Inside-Option/Year FEs (ζ^c_t).

Identification: (Hastings et al. 2017) firms set unique fees f_{jt} and returns μ_{jt}, but costs and savings are worker-specific and vary with wages and spells in formal market.

Per-period profits' function: expected revenues

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

$$\mathbb{E}\left[Y_{jt}\right] = f_{jt} \times \Big(\underbrace{\alpha \times M_t \times s^{n}_{jt}(\mathbf{f}_t, \boldsymbol{\mu}_t)}_{\text{New workers' wages}} + \underbrace{(1-\alpha) \times M_t \times s^{o}_{jt}(\mathbf{f}_t, \boldsymbol{\mu}_t) \times (1-\rho^{o}_t) \times (1 - aw_{jt}(\mathbf{f}_t, \boldsymbol{\mu}_t))}_{\text{Old workers' wages}} \Big) \tag{2}$$

- f_{jt}: management fee (% gross wage) with $f^{\max}_{jt} = 0.13$ (max net ssc rate)
- M_t: total wage mass relevant for defined-contribution sub-system
- $s^{n}_{jt}(\mathbf{f}_t, \boldsymbol{\mu}_t)$ and $s^{o}_{jt}(\mathbf{f}_t, \boldsymbol{\mu}_t)$: re-weighted agg. shares of new and old workers in monetary terms.
- α: share of total wage mass of new workers.
- ρ_t: percentage of retirees.
- aw_{jt}: Awareness (and switching) probability to the Public Option (in baseline).

Per-period profits' function: expected costs

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

$$\begin{aligned}
\mathbb{E}\left[C_{jt}\right] &= \underbrace{\sum_{i_{c=t}} prob_{ijt}(\mathbf{f}_t, \boldsymbol{\mu}_t) \times w_{it}^{n} \times CPD_{jt}}_{\text{Enrollment Cost of New Workers}} \\
&+ \underbrace{\mathbb{E}\left[\left|(r_{\min,t} - R_{jt})\right| \times \text{PSF}_{jt}(R_{jt} < r_{\min,t})\right]}_{\text{Expected Capitalization Cost}} \\
&+ \underbrace{\mathbb{E}\left[(r_t^* - R_{jt}) \times 0.5\% \times \text{PSF}_{jt}\right]}_{\text{Expected Opp. Cost of Firm } j\text{'s Equity}} \\
&+ \underbrace{f(\mu_{jt}|\kappa_j)}_{\text{Investment cost}}
\end{aligned} \tag{3}$$

Pension Savings Fund (PSF_{jt}): Total Stock of Workers' Savings (Contributions + Capitalized Returns).

State owned firm Non-Profit Motives

SOE objective function: maximize expected profits and expected workers' savings (Atal et al. 2021)

- $\lambda \in [0, 1]$ is a parameter that captures the extent of Non-Profit Motives (1 is full Non-For-Profit)

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

Results

Enrollment marginal cost

- Back out Private PFAs' marginal costs MC_{jt} for each stationary equilibrium (2002-05, 2014-17 and 2020) using estimated preferences, observed shares s_{jt} and fees f_{jt}.
- For the SOE, we can't separately identify MC_{SOE} from Non-Profit Motives λ_{SOE}.
- Secondary data relates MC_{jt} estimates with sales force variable payments.

	Avg. Marginal Cost (US$ 2017)				SOE NPM ($\hat{\lambda}$)
Period	PF 1	PF 2	PF 3	SOE ($\lambda = 0$)	(Max. MC_{PF})
Period 2002-05 (1st eq)	10	29	21	-275	0.63
Period 2014-17 (2nd eq)	45	67	40	-394	0.86

Note: Cost of enrolling a new worker with the average gross monthly wage.

Back up κ | Awareness prob. estimation | Demand elasticities

Counterfactual Policies

Counterfactual: privatization

	Fees f_j^* (% Gross Wage)		Returns μ_j^* 1Yr (%)		$\mathbb{E}[\pi_t]$ (US$ Mill.)		$\mathbb{E}$[Savings]* (US$ '000)	
	PFs	SOE	PFs	SOE	PF (Tot.)	SOE	PFs	SOE
Avg. 2014/17 (eq 2)	1.94	0.8	1.36	1.33	40.97	6.87	**40.75**	**44.61**
Counterfactual								
1) $\rightarrow \hat{\lambda} = 0$	1.9	4.57	1.35	1.03	37.25	142.03	40.82	28.85
2) $\rightarrow \hat{\lambda} = 0 \ + \ s_{SOE}^{old} = s_j^{old} = 0.25$	2.1	2.51	1.34	1.25	85.10	22.48	40.04	37.65
3) $\rightarrow$ 2) $+ \ \eta_{SOE} = \bar{\eta}_{pf}$	**2.1**	**2.01**	**1.34**	**1.27**	**84.83**	**13.73**	**40.06**	**39.64**

*Mean savings for a worker that faces equilibrium f^* and μ^* for 40 years. Avg PF weighted by enrollees s_j. Awaking probability as a function of the difference of the fee and mean with the respective market average.

Privatization increases average fees and reduces mean portfolio returns.

Also, sensible on how privatization is implemented

Final Comments

Final comments

- Public options are used by governments to compete with private firms and curb market power.
- We study the market of pension fund administrators, where firms are forward-looking, workers have inertia and decisions are complex.
- We find that an SOE with Non-Profit motives helps raising expected savings for everyone, relative to an oligopoly with private firms only.
- Additional results
  - Demand side policies help, but unlikely to compensate.
  - Relying on the NPMs of the SOE $\uparrow$ market segmentation and $\downarrow E[\text{Savings}]_{PF}$ of low-wage workers.
  - The cap on fees achieves the highest level of savings and benefits low-wage workers relatively more.

Appendix

Summary all policies

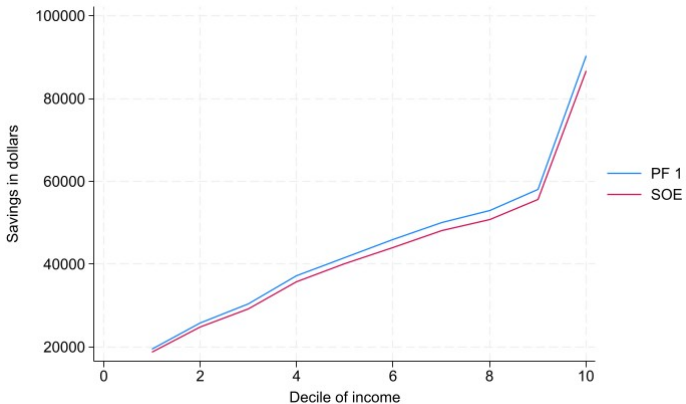
	Fees f_j^* (% Gross Wage)		Returns μ_j^* 1Yr (%)		$\mathbb{E}[\pi_t]$ (US$ Mill.)		$\mathbb{E}$[Savings]* (US$ '000)	
	PFs	SOE	PFs	SOE	PF (Tot.)	SOE	PFs	SOE
Baseline (2nd eq)	1,94	0,8	1,36	1,33	40,97	6,87	**40,75**	**44,61**
Counterfactual Policy								
Privatization	2,1	2,01	1,34	1,27	84,83	13,73	**40,06**	**39,64**
Privatization + ↓ Inertia	1,49	1,48	1,35	1,29	52,81	4,34	**42,36**	**41,67**
↑ NPM ($\mathbb{E}[\pi_{SOE}] = 0$)	1,95	0,61	1,36	1,34	41,27	0	**40,68**	**45,31**
Cap on Fees (3rd eq)	0,99	0,66	1,36	1,34	8,59	2,13	**44,27**	**45,13**

*Mean savings for a worker that faces equilibrium f^* and μ^* for 40 years. Avg PF weighted by enrollees s_j. In privatization scenarios, awaking probability as a function of the difference of the fee and mean returns with the respective market average. When consumers awake, they meet the sales force (as in their first choice).

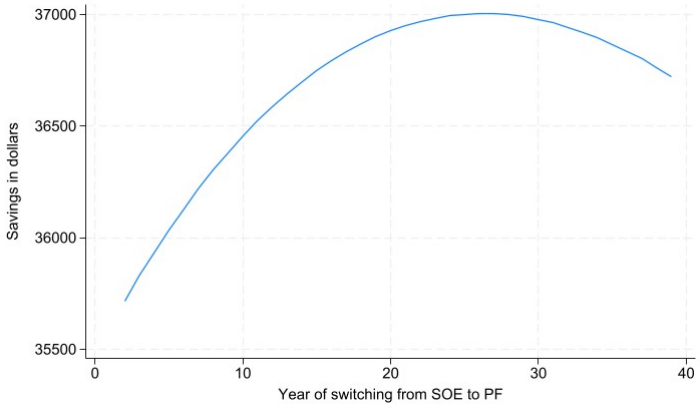
Back

The cap on fees raised the savings of workers enrolled in private firms

Figure: Savings in the Public Option vs Best PF - 2020 (3rd eq)



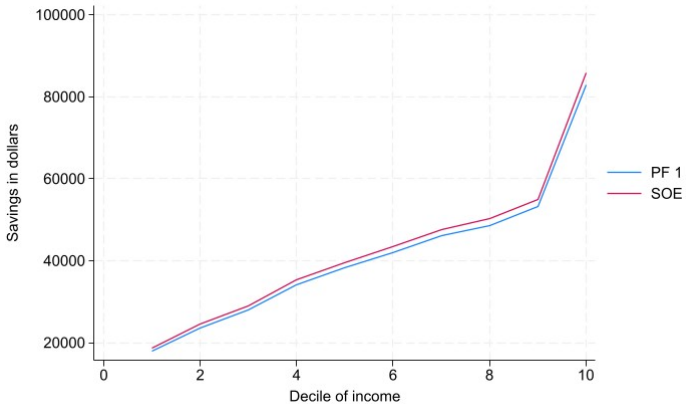
Optimal year for switching from Public Option to PF. 2014-2017



Return

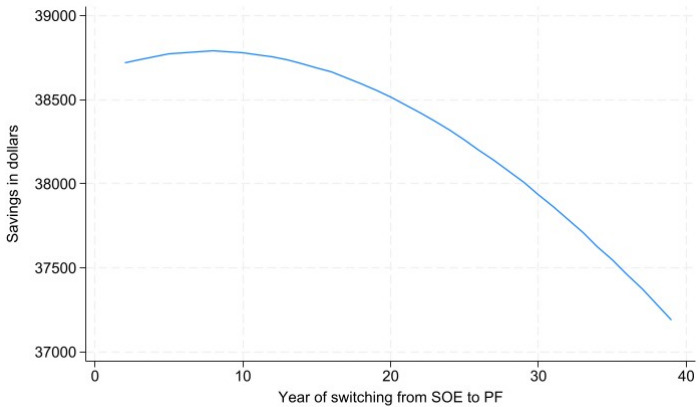
Private firms were dominated options before the cap on fees

Expected Savings in the Public Option vs in the Best Private PFA (2014-17, 2nd eq)



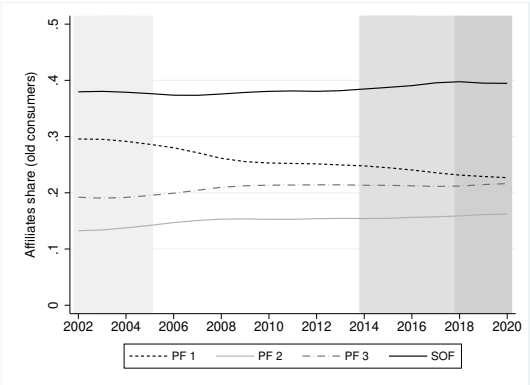
Return

Optimal year for switching from SOE to PF. 2020



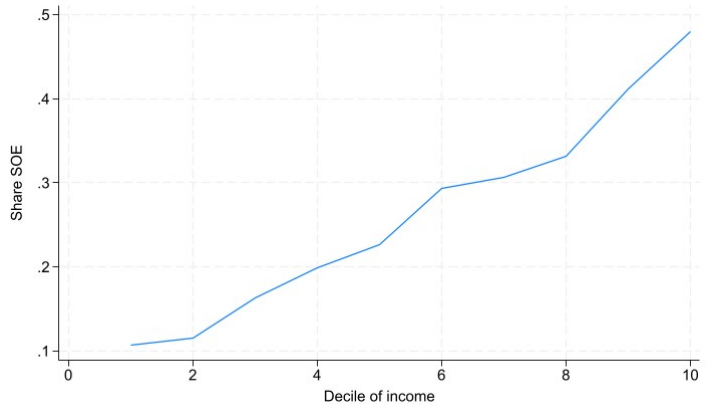
The Public Option is the largest firm in the market

Market Shares (% of Total Enrollees)



Higher wage individuals enroll relatively more in the Public Option

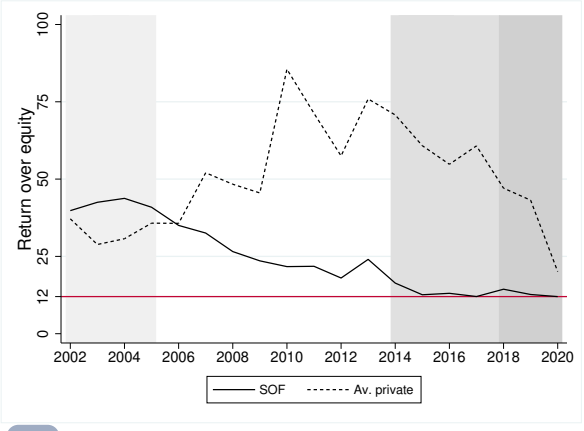
Predicted Enrollment Shares to the Public Option by Wage Decile



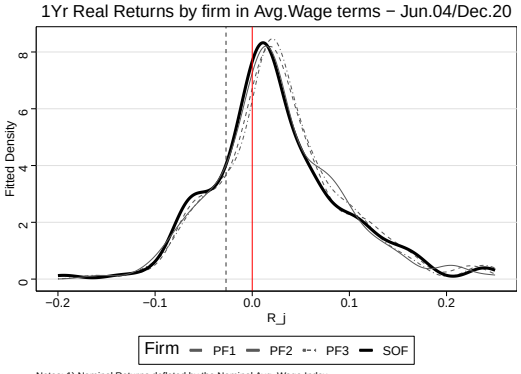
Return

Returns

ROE



Realized Returns

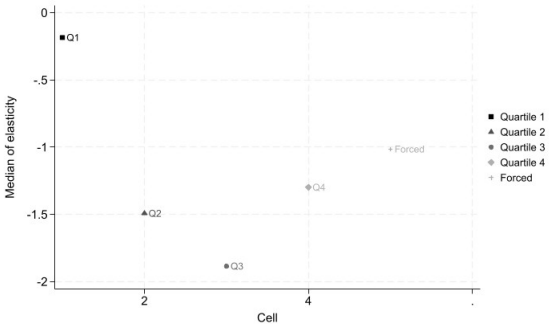


Notes: 1) Nominal Returns deflated by the Nominal Avg. Wage Index.
2) Avg real wages grew 2.7% per year during this period.

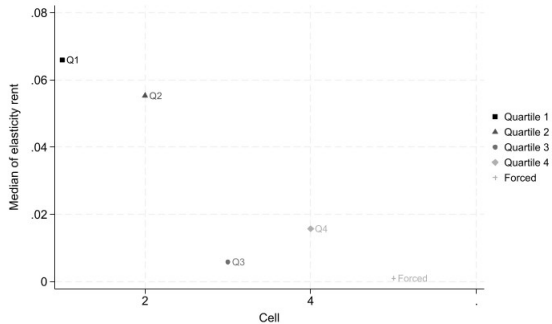
Back

Higher wage workers have higher fee and lower return elasticities

Median of cost elasticities by cell



Median of return elasticities by cell



- Higher wage individuals enroll relatively more in the Public Option. Back

Awareness and switching probability estimates

$$aw_{j(i)t} = \Phi(\beta_0 + \beta_1 \times (f_{jt} - f_{j,SOE}) + \beta_3 \times (\mu_{jt} - \mu_{j,SOE}) + \beta_4 \times \text{Post}_{2013} + \upsilon_j) \quad (5)$$

where:

Firm fixed-effect (υ_j)

β_4 captures the effect of a flexibilization in the switching procedure implemented in 2013.

- Estimates capture that the switching probability is:
  - Increasing in the fee differential $\hat{\beta_1} = 27.85(1.250) \rightarrow \uparrow$ 1 Std. Dev. $\uparrow$ 9 p.p. prob.
  - Decreasing in the mean return differential $\hat{\beta_3} = -1.974(0.338) \rightarrow \uparrow$ 1 Std. Dev. $\downarrow$ 2 p.p. prob.

Back

Counterfactual: privatization plus demand policies

	Fees f_j^* (% Gross Wage)		Returns μ_j^* 1Yr (%)		$\mathbb{E}[\pi_t]$ (US$ Mill.)		$\mathbb{E}$[Savings]* (US$ '000)	
	PFs	SOE	PFs	SOE	PF (Tot.)	SOE	PFs	SOE
Avg. 2014/17 (eq 2)	1,94	0,8	1,36	1,33	40,97	6,87	**40,75**	**44,61**
SOE private	**2,1**	**2,01**	**1,34**	**1,27**	**84,83**	**13,73**	**40,06**	**39,64**
Counterfactual								
$2 \times \hat{\beta}_1$	1,86	1,81	1,35	1,28	71,85	10,22	40,98	40,39
$3 \times \hat{\beta}_1$	1,66	1,64	1,35	1,28	61,51	7,09	41,72	41,07
$4 \times \hat{\beta}_1$	1,49	1,48	1,35	1,29	52,81	4,34	**42,36**	**41,67**

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

↓ Inertia (↑ Fee Sensitivity) lowers equilibrium fees but cannot fully compensate the privatization effect

Back

Counterfactual: increases in Non-Profit Motives

	Fees f_j^* (% Gross Wage)		Returns μ_j^* 1Yr (%)		$\mathbb{E}[\pi_t]$ (US$ Mill.)		$\mathbb{E}$[Savings]* (US$ '000)	
	PFs	SOE	PFs	SOE	PF (Tot.)	SOE	PFs	SOE
Avg. 2014/17 (2nd eq)	1,94	0,8	1,36	1,33	40,97	6,87	**40,75**	**44,61**
Counterfactual								
$f_{SOE} = 0$	2,03	0	1,34	1,34	43,56	-22,79	**40,27**	**47,58**
$\mathbb{E}[\pi_{SOE}] = 0$	1,95	0,61	1,36	1,34	41,27	0	**40,68**	**45,31**
Cap on Fees								
Avg. 2020 (3rd eq)	0,99	0,66	1,36	1,34	8,59	2,13	**44,27**	45,13

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

The cap on fees (price regulation) outperforms increases in Non-Profit Motives. Back

Counterfactual: using Non-Profit Motives is regressive

Savings Ratio - Counterfactual vs Baseline for each Policy

Figure: ↑ Non-Profit Motives ($\mathbb{E}[\pi_{SOE}] = 0$)

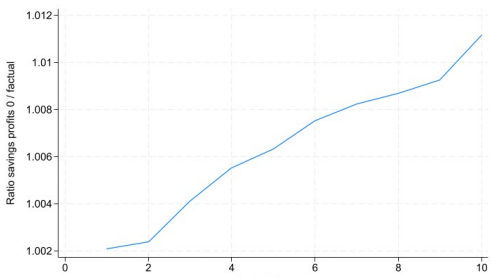
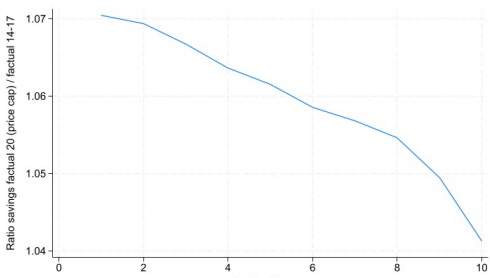


Figure: Cap on Fees



An increase in the NPM of the SOE benefits higher income individuals relatively more.

Cost per additional unit of portfolio return

- Increasing cost of obtaining higher returns $f(\mu; \kappa) = exp(\kappa.\mu)$ for each j
- Reduced form can be rationalized by an Efficient Frontier with no risk-free assets (Markowitz, 1952)

Returns	PF 1	PF 2	PF 3	SOE
μ_j^*	1.84	1.17	1.71	1.53
$\mathbb{E}[\text{Pr}(\text{Cap})_j]$	7.6%	10.7%	9.8%	4.3%
$\hat{\kappa}$	944	1,518	1,089	1,126

ω = [0.18; 0.09; 0.16; 0.57], σ = [0.089; 0.088; 0.095; 0.094], ρ_{jk} = 0.9

Back

Net present value of expected profits

Net present value of profits for firm j in the stationary equilibrium:

$$\begin{aligned}
\mathbb{E}\left[V_{jt}\right] &= \sum_{1}^{T} \beta^{t-1} \mathbb{E}\left[\pi_{jt}\right] && (6)\\
&= f_j^* M_t \times \left[W^n(\alpha, \beta, \rho_t^n) s_j^n(\mathbf{f}^*, \boldsymbol{\mu}^*) + W^o(\alpha, \beta, \rho_t^o) s_j^o(\mathbf{f}^*, \boldsymbol{\mu}^*)(1 - aw_j(\mathbf{f}^*, \boldsymbol{\mu}^*)) \right] \\
&- \sum_{1}^{T} \beta^{t-1} \Big[\alpha M_t s_{jt}^n(\mathbf{f}^*, \boldsymbol{\mu}^*) \times MC_{jt} + \mathbb{E}\Big[\text{Cap.Cost}(\mathbf{f}^*, \boldsymbol{\mu}^*) \Big]_{jt} \\
&+ \mathbb{E}\Big[(r_t^* - R_{jt}) \times 0.5\% \times \text{PSF}(\mathbf{f}^*, \boldsymbol{\mu}^*)_{jt} \Big] + f(\mu_j^* | \kappa) \Big] && (7)
\end{aligned}$$

Similar to a static problem, but with different weights for new $W^n(\alpha, \beta, \rho_t^n)$ and old $W^o(\alpha, \beta, \rho_t^o)$ workers. Back