# Design of Framework Agreements

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April 14, 2025

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# Introduction

- Governments make repeated purchases of certain products (e.g. medical devices, gasoline, laptops)
- Framework Agreements (FAs) streamline procurement through a two-stage process.
  - **Stage 1 (Auction):** Pre-selection of suppliers/products via auction.
  - **Stage 2 (Marketplace):** Creation of a "marketplace" where pre-selected suppliers offer goods/services to government agencies.
- FAs are widely used in public procurement, yet understudied empirically.
- Goals: product variety and low prices
- **Research Question:** What is the optimal design of a FA?
- Focus on FAs for vehicles between 2017 and 2024 in Chile

- not say some usefulness
- said no paper that studied their design -> false. just say there is lack of empirical work. we are empirical

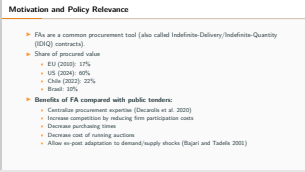
- in transitions from slide to slide I say ' just to motivate.... ' dont do it. repeat too much.


repeated is across agencies and over time. Also I should mention the case of medical devices, where each hospital needs some devices and then it is wasteful to do a public tender each time they want to buy a new one

mention that buyers have 1. heterogeneous preferences/needs

# Motivation and Policy Relevance

- FAs are a common procurement tool (also called Indefinite-Delivery/Indefinite-Quantity (IDIQ) contracts).
- Share of procured value
  - EU (2010): 17%
  - US (2024): 60%
  - Chile (2022): 22%
  - Brasil: 10%
- **Benefits of FA compared with public tenders:**
  - Centralize procurement expertise (Decarolis et al. 2020)
  - Increase competition by reducing firm participation costs
  - Decrease purchasing times
  - Decrease cost of running auctions
  - Allow ex-post adaptation to demand/supply shocks (Bajari and Tadelis 2001)




In the US case I havent researched properly

mention that is just to fix ideas of what are people in the pbulci procurement system looking for when they design a FA.

# Stages of FAs

1. First Stage: selection through auction
   - The procurement agency calls for a public tender.
   - Firms submit bids (price, characteristics).
   - Subset of firms/products are selected.
2. Second Stage: marketplace
   - Selected firms offer products on a government-run online platform.
   - Government agencies purchase directly.
   - First-stage bid acts as a price-ceiling

# Literature

- Framework Agreements
  - Choi et al. (2023), Gur et al. (2017), and Saban and Weintraub (2021)
    $\Rightarrow$ Theoretical literature, we aim to estimate a structural model
- Effects of centralizing procurement
  - Castellani et al. 2021; Dubois et al. 2021; Ferraresi et al. 2021; Lotti et al. 2024
    $\Rightarrow$ We study FAs, a specific way of centralizing procurement
- Market design
  - Agarwal and Budish (2021) and Kapor et al. (2024)
    $\Rightarrow$ Optimal design of FAs


ask for feedback about how does this project fit in the previous literature. The first bullet is relevant, but I am not sure about the second and third.

# Institutional Context and Data

# Institutional Context: Chile Compra

- Chilean public procurement system managed by *Chile Compra* through the *Mercado Público* platform.
- Most gov. agencies (hospitals, ministries, universities) are required to use this platform.
  Details
- FAs account for 25% of procurement value
- Currently 18 active FA. Examples: medical devices, hardware products, food, stationery, etc.
- FA for vehicles are active for $\approx$ 3 years and the public tender takes $\approx$ 5 months

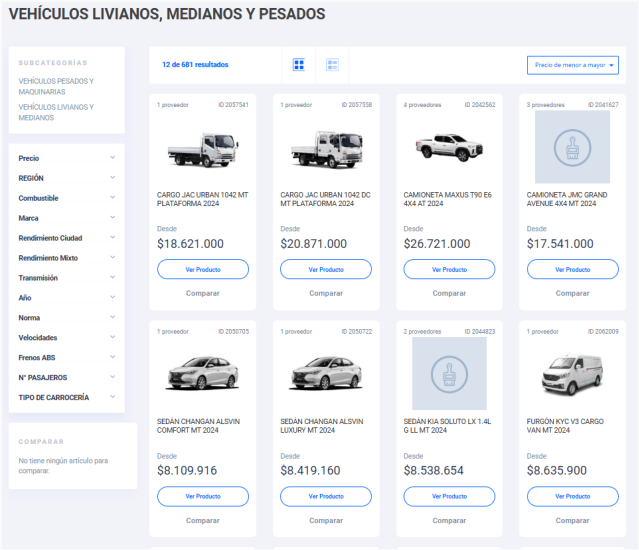



**Figure 1:** Marketplace for vehicles

# Some details

| | 2017 | 2021 | 2023 |
|---|---|---|---|
| **Categories** | Pick-up, SUV, sedan, minibuses, vans | SUV and pick-up | Pick-up, SUV, sedan, minibuses, vans |
| **Bids** | Discount over list price (e.g. 8%) | Price and delivery fee | Discount over list price and delivery fee |
| **Market** | National | 5 macro-regions and 4 tiers | Region |
| **Selection criteria** | Score threshold | 2-3 lowest price depending on region | 60% highest scores, minimum of 5 |
| **Auction level and number** | 1 | Product-tier-region: 40 | Product-region $\approx 70$ |

The tender for a fourth FA will be implemented this year

**Some details**

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The tender for a fourth FA will be implemented this year

Important to highlight that we have around 150 auctions and that we will have even more with the last FA, hence even though there are only 3-4 FAs we can estimate an auction.

# Data

- **Purchase Data:** All vehicle transactions through FAs (2017-2024).
  - Buyer (agency type, location), Seller
  - Product (type, model)
  - Price
- **Auction Data:** Bids from 3 vehicle FAs (2017, 2021, 2023).
  - Bidder identity
  - Bids
  - Date of bid
  - Product (model, category, region)
- **Web-scraped data:** product characteristics (preliminary data)

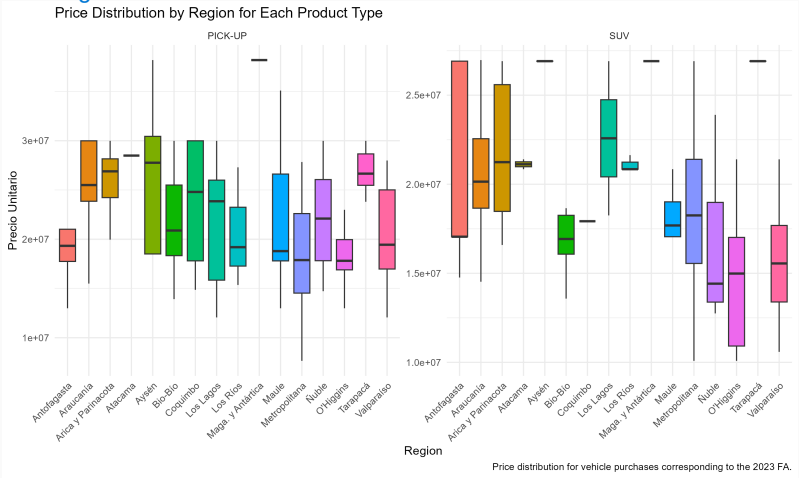
just say work in progress, do not say why the data is no good


Mention that we still do not have list prices and that this is an important variable to have.

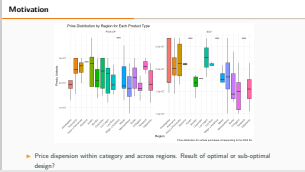
just say quickly that web-scraped data and list prices are something we are wokring on

# Motivation

here to motivate with variety
emphsize revealed pref. argument and avoid talking about wast.




- Price dispersion within category and across regions. Result of optimal or sub-optimal design?



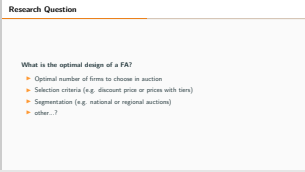

- Mention that the price dispersion is because the 23 FA's auction was based on discount over list price.
- One extreme is to select only the lowest price product, but as long as agencies value variety it would be sub-optimal.
-
- what does the dispersion across regions tells us (is given by cost or preferences)

# Research Question

segmentation national-regional auctions but also by types of products(tiers and categories: e.g. separate SUV and pickup)

**What is the optimal design of a FA?**

- Optimal number of firms to choose in auction
- Selection criteria (e.g. discount price or prices with tiers)
- Segmentation (e.g. national or regional auctions)
- other...?




Explain: we are thinking about selection rules in the first stage. But we are open to any suggestions. make a pause and explain what comes: 1. we are going to present a model where we define what optimal means

# Empirical model

# Overview

- Model stages
  - Second stage: Demand estimation following Berry et al. (1995) and Petrin (2002)
  - First stage: Auction (toy model)

# Demand

think of how to model the random coefficients.

- We consider the demand of gov. agencies in markets defined as a region-semester. Given evidence of different consumption patterns we group gov. agencies in types according to their sector (e.g. hospital, university, etc.)

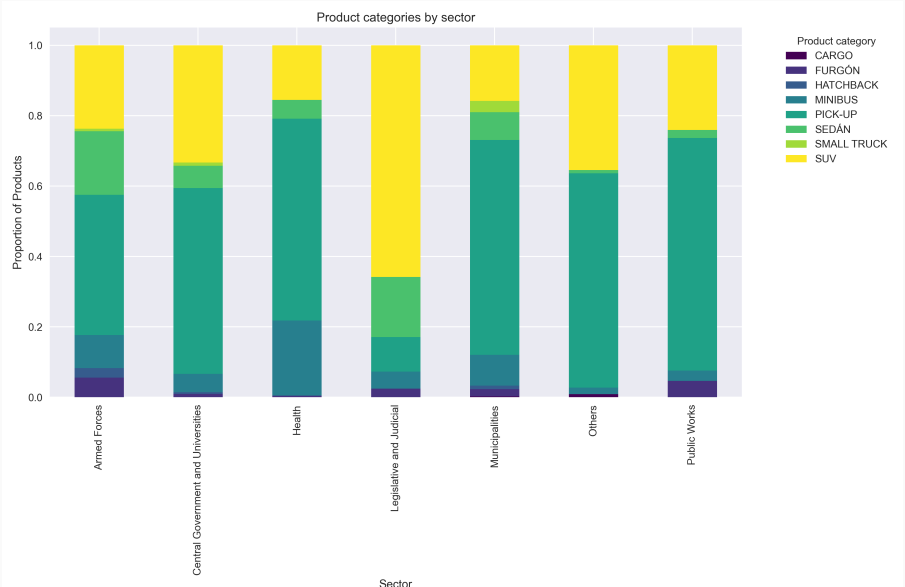
fast through demand model pretyy standard. . put more emphasis on suppyl side.

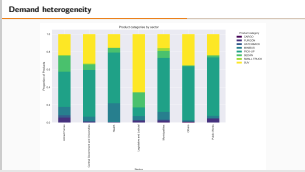
- Gov. agency $i$, in market $t \in \mathcal{T}$ in sector $s$ has a utility for product $j \in \mathcal{J}_t$.

$$u_{ijts} = \underbrace{x'_{jt}\beta_s + \xi_{jt}}_{\delta_{jts}} + + \varepsilon_{ijts}, \quad u_{i0t} = \varepsilon_{i0t} \tag{1}$$

where $(y_{it}, \nu_{it})$ are region-level demographics and random taste shocks. still have to show the plots region specific demand differences

# Demand heterogeneity






Evidence that different government sectors have different demand.

# Demand(2)

make this slide consistent with the previous slide. The probability that a consumer of type $s$ in sector $s$ chooses a product $j \in \mathcal{J}_t$

$$s_{jts} = \frac{\exp(\delta_{jts} + \mu_{ijt})}{1 + \sum_{k \in \mathcal{J}_t} \exp(\delta_{kts} + \mu_{ikt})} \tag{2}$$

Aggregate market shares are given by integrating over the mass of consumers. The mixed logit market share of product $j \in \mathcal{J}_t$ is

$$s_{jt} = \sum_s w_{st} \cdot s_{jts} \tag{3}$$

where $w_{st}$ is the share of agencies of type $s$ in market $t$

The vector of parameters to estimate is $\theta = (\beta, \Pi, \Sigma)$

Moments

# Supply

- Firm's ($z$) profits, in market $t$ are:

$$\pi_{zt} = \sum_{j \in P_z} N_t s_{jt} \left( p_{jt} - MC_{jt} \right) \tag{4}$$

  Where $N_t$ is the number of buyers in market $t$ and $MC_{jt}$ is the marginal cost.

- Assuming single product firms, $p^*_{jt}$ is the price that satisfies the FOC:

$$p^*_{jt} = MC_{jt} - s_{jt} \left[ \frac{\partial s_{jt}}{\partial p_{jt}} \right]^{-1} \tag{5}$$

- Hence the observed price ($p_{jt}$) will satisfy

$$p_{jt} = \min\{\bar{P}_{jt}, p^*_{jt}\} = \min \left( \bar{P}_{jt}, MC_{jt} - s_{jt} \left[ \frac{\partial s_{jt}}{\partial p_{jt}} \right]^{-1} \right)$$

- Cost point identified if the price ceiling is not binding

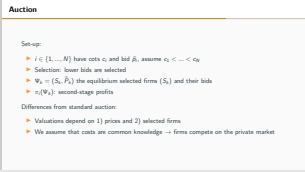
# Auction

Set-up:

- $i \in \{1, ..., N\}$ have cots $c_i$ and bid $\bar{p}_i$, assume $c_1 < ... < c_N$
- Selection: lower bids are selected
- $\Psi_k = (S_k, \bar{P}_k)$ the equilibrium selected firms $(S_k)$ and their bids
- $\pi_i(\Psi_k)$: second-stage profits

Differences from standard auction:

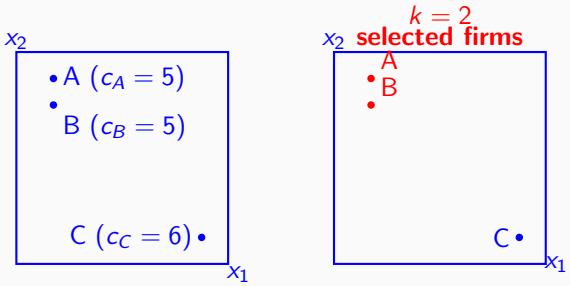
- Valuations depend on 1) prices and 2) selected firms
- We assume that costs are common knowledge $\rightarrow$ firms compete on the private market



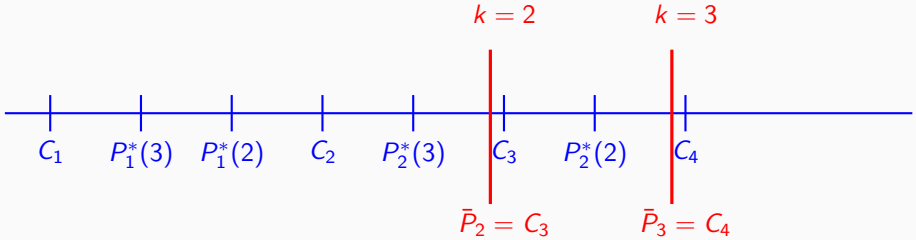

Mention that we are assuming that firms are selected only on price, which is consistent with the 2021 FA but not with 2017 and 2023 FA. We are not sure how to model the two different types of auctions (discount over list price and prices) in a same framework

For estimation we want to retrieve the joint distribution of product characteristics and costs. We are not sure how to use the different auctions (with different formats) in the estimation. Moreover there is selection, in case we only use the demand from the marketplace for estimation

# Auction(2)




- Selection is purely based on costs. The unique equilibrium is $S_k = \{1, ..., K\}$



# Optimal design

- No random coefficients, with decreasing $\delta_j - \alpha c_j$
- Firms know rivals' costs, designer does not
- Take the case of designer constrained by K
- Consider the scoring rule (why this rule?)

$$S_k(\bar{P}, \delta) \equiv \underset{S \subseteq N, |S|=k}{\text{argmax}} \sum_{j \in S} \delta_j - \alpha \bar{p}_j$$

# Optimal design(2)

- In equilibrium the K firs firms are selected, and in the first auction they bid:

$$\bar{P}_j = \max\left\{c_j, \frac{\delta_j - \delta_{k+1} + \alpha c_{k+1}}{\alpha}\right\},$$

- Buyers' welfare given by:

$$\log\left(\sum_{j=1}^{k} \exp\left(\delta_j - \alpha p_j^*\left(\{1,\ldots,k\}, \frac{\delta_j - \delta_{k+1} + \alpha c_{k+1}}{\alpha}\right)\right)\right)$$

# What lies ahead

- Obtain list prices (or assume there are no discounts)
- Estimate the model
- Counterfactuals, estimate the impact of:
  1. Choose the optimal number of sellers in the auction stage
  2. Allow the selection criteria to depend on product characteristics

# Appendix

# Acquisition process

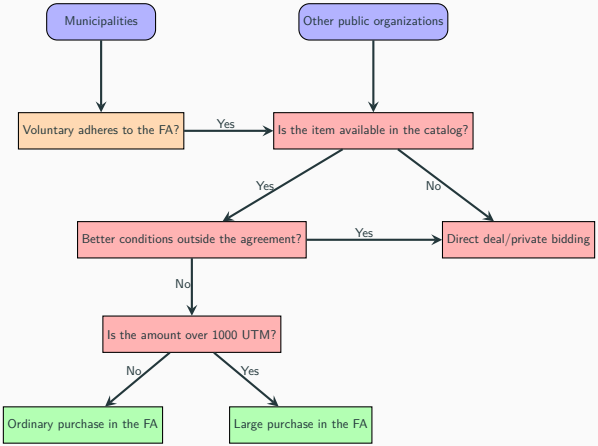



**Figure 2:** Procurement decision process (Castro et al. 2020)



Back

# Moments

- Aggregate moments: $\mathbb{E}[\xi_{jt} \cdot z_{jt}] = 0$ with sample moment:

$$\hat{g}_A(\theta) = \frac{1}{N_A} \sum_{t \in \mathcal{T}} \sum_{j \in \mathcal{J}_t} \left( \hat{\delta}_{jt}(\Pi, \Sigma) - x'_{jt}\beta \right) \cdot z_{jt}, \tag{6}$$

- Micro-moments: target 1) buying a certain type of vehicle $\lambda$ given the type of the state agency and 2) the average price of the vehicles bought by each state agency type. Denote by $n$ a state agency, by $i(n)$ its type, $N = \sum_{n \in \mathcal{N}} 1$ and $p_{j_n}$ the price of the good bought by $n$. Then the in sample moments are:

$$\bar{v}_{ip} = \frac{\frac{1}{N} \sum_{n \in \mathcal{N}} 1\{(i(n) = i)\} 1\{j_n \in \mathcal{J}_\lambda\}}{\frac{1}{N} \sum_{n \in \mathcal{N}} 1\{(i(n) = i)\}} \equiv f_1(\bar{v}) \tag{6}$$

$$\bar{v}_{i\lambda} = \frac{\frac{1}{N} \sum_{n \in \mathcal{N}} 1\{(i(n) = i)\} p_{j_n}}{\frac{1}{N} \sum_{n \in \mathcal{N}} 1\{(i(n) = i)\}} \equiv f_2(\bar{v}) \tag{7}$$

Back