

# SIMULTANEOUS COMPETITION IN PUBLIC PROCUREMENT AND IN THE PRIVATE MARKET: PHYSIOTHERAPY SERVICES

JAN JÄÄSKELÄINEN

Aalto U, FCCA & Helsinki GSE

OTTO TOIVANEN

Aalto U, Helsinki GSE & KU Leuven

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# MOTIVATION

- ▶ The large literature on PP almost (Kroft et al. 2021) without exception studies it in isolation from private markets.
- ▶  $\implies$  we do not know what the trade-offs are.
- ▶ For example:
  - ▶ why organize a PP instead of buying directly from the private market?
  - ▶ are the firms participating in PP more or less efficient than those competing only in the private market?
  - ▶ what if any is the correlation in quality in the private market and in PP?
  - ▶ how does the existence of the public market affect prices in the private market?

# OBJECTIVES

- ▶ Build a structural model which incorporates
  1. firms' pricing decisions in the private market
  2. firms' participation and pricing decisions in PP market(s).
  3. customer choices in private and public markets
  
- ▶ With the help of the model, we uncover
  1. utility parameters of customers
  2. the relationship between firm quality in the different markets
  3. participation costs in PP and their correlation
  
- ▶ After having estimated the model, we can perform counterfactuals, e.g.:
  1. what if participation costs in PP were  $\tau\%$  lower?
  2. what if instead of PP, the public sector gave vouchers of  $z \in$  to eligible customers?
  3. what if there was consolidation in the market (some evidence of this taking place)?

# REST OF THE PRESENTATION

2. Institutional background
3. Data
4. Model
5. Estimation

## 2. INSTITUTIONAL BACKGROUND

# INSTITUTIONAL SET-UP

- ▶ One can divide the market for physiotherapy services in Finland into
  1. the private market (inclusive occupational health)
  2. the services procured by municipalities on behalf of their population
  3. the services procured by Kela, the National Social Insurance Institute

## INSTITUTIONAL SET-UP

- ▶ Public procurement in physiotherapy services uses so-called **framework agreements**.
- ▶ With regular intervals (4 years), a scoring auction is held.
- ▶ Elements in the scoring vector are
  1. price
  2. education of the physiotherapists
  3. ...
- ▶ "Winning" in a such an auction means that a firm enters into the framework agreement.
- ▶ This means that the agency in question may or may not purchase from the firm at the price the firm bid during the lifetime of the framework agreement.

## INSTITUTIONAL SET-UP

- ▶ Both municipal and Kela services offered only to customers with heavy needs for physiotherapy & paid for by the public sector  $\implies$  these are channels that dominate the private channel.
- ▶ Given the nature of the product, physiotherapy service markets are also delineated geographically.
- ▶ An important difference between the municipalities and Kela:
  1. municipalities choose the provider for each eligible patient
  2. Kela-eligible patients choose independently; choice set is firms in the Kela framework agreement.

# 3. DATA

## DATA SOURCES

- ▶ Our period of observation is 2014 - 2018 and we cover Helsinki, Espoo, Vantaa, Tampere and Oulu.
- ▶ Our data come from multiple sources:
  1. the private market (inclusive occupational health)
    - ▶ 2014 price data collected using Internet Archive and contacting firms
    - ▶ yearly sales from Statistic Finland (sales = revenue - municipal sales - Kela sales)
  2. the services procured by municipalities on behalf of their population
    - ▶ 2014 bid data from procurement documents
    - ▶ 2014 - 2018 sales from publicly available municipal purchase data
  3. the services procured by the Kela, the National Social Insurance Institute
    - ▶ 2014 bid data from procurement documents
    - ▶ 2017 and 2018 sales from Kela
  4. firm and employee characteristics from Statistics Finland

## DATA: CHOICE OF MARKET

- ▶ Over half of firms within each municipality have participated in either Kela or municipal framework agreements.
  - ▶ Within Greater Helsinki Area (Helsinki, Espoo and Vantaa) approximately 20% of firms participate in framework agreements in multiple municipalities.
  - ▶ Our current knowledge suggests that all firms participate in the private market.
- ▶ Table below assumes that Greater Helsinki Area shares the pool of firms.

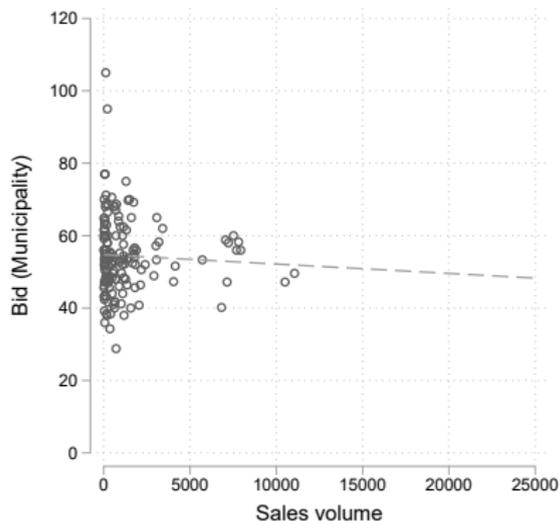
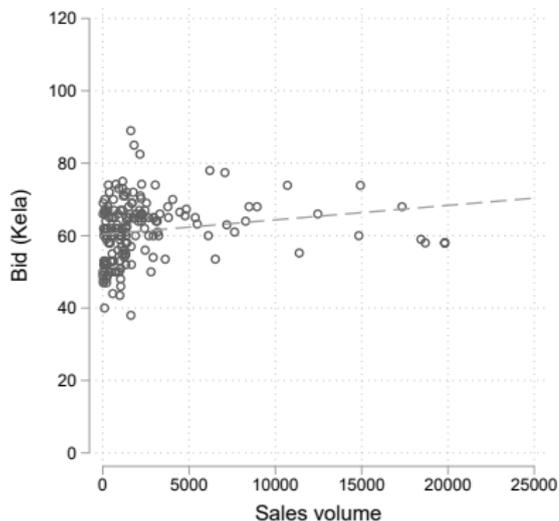
# DATA ON # FIRMS AND PARTICIPATION

Table. Participation of firms in different markets

Municipality	Private only	Municipality		Kela		Municipality & Kela	
		Bid	Sold	Bid	Sold	Bid	Sold
Helsinki	43 %	21 %	16 %	20 %	16 %	9 %	7 %
Espoo	43 %	14 %	6 %	14 %	11 %	7 %	4 %
Vantaa	43 %	18 %	10 %	15 %	11 %	6 %	4 %
Tampere	29 %	45 %	26 %	43 %	28 %	16 %	9 %
Oulu	31 %	42 %	36 %	51 %	36 %	24 %	18 %

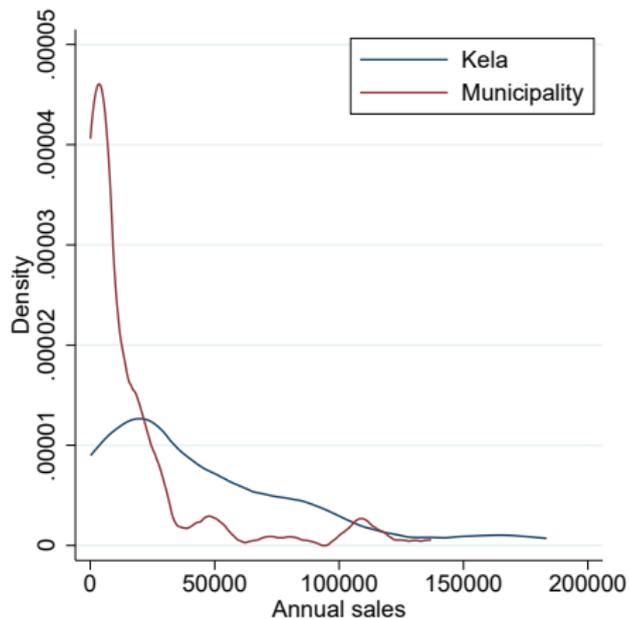
# PRICE-QUANTITY CORRELATION IN PP

Correlation between bid (=price) and quantity for Kela (LHS) and municipal (RHS) markets.



# FIRM-LEVEL SALES DISTRIBUTION IN PP

Distribution of average annual sales



2014

# 4. MODEL

# MODEL

- ▶ 3 simultaneous markets.
- ▶ We assume (in line with data) that:
  1. all firms participate in the private market and
  2. all firms make decisions to (not) participate in the municipal and Kela procurements.
- ▶ Pricing and participation decisions are simultaneous.
- ▶ Participation in a procurement is costly.

## MODEL: TIMING & INFORMATION

- ▶ We assume that:
  - ▶ in **Stage 1**, firms make simultaneous pricing and entry decisions in each market;
  - ▶ in **Stage 2**, after seeing the bids, the municipality and Kela choose which firms to buy from;
  - ▶ note: we abstract from the municipal / Kela decision of which firms to include in the framework agreement;
  - ▶ there is incomplete information on the fixed costs of participating in a procurement, but otherwise complete information; and
  - ▶ in **Stage 3**, customers make purchasing decisions

## MODEL: DEMAND

- ▶ Demand in each market based on discrete choice demand models.
- ▶ Indirect utility of consumer  $i$  from product  $j$  in market  $m \in \{P, M, K\}$ :

$$u_{ijm} = \mathbf{x}_{jm}\boldsymbol{\beta}_m + \xi_{jm} - \alpha_{im}f(y_i, p_{jm}) + \epsilon_{ijm} \quad (1)$$

- ▶ where
  1.  $x_{jm}$  are characteristics of firm  $j$ 's product in market  $m$  and  $\beta_m$  the associated vector of parameters;
  2.  $\xi_{jm}$  is the vertical quality of firm  $j$ 's product in market  $m$ , observed by the firm and buyer but not the econometrician;
  3.  $\alpha_{im}$  is the (random) price coefficient in market  $m$ ; and
  4.  $f(\cdot)$  is a function that allows to use both a **unit demand** and a **constant expenditures** approach.

## MODEL: PRICE SETTING

- ▶ We assume Bertrand competition in prices in each market  $m$ .
- ▶ Profits of firm  $j$  are given by

$$\Pi_j = \sum_m \mathbb{1}_{jm} [(p_{jm} - c_{jm}) q_{jm}(\mathbf{p}_m) - F_{jm}] \quad (2)$$

- ▶ where
  1.  $\mathbb{1}_{jm}$  is an indicator fcn taking value 1 if firm  $j$  enters market  $m$ ;
  2.  $c_{jm}$  is the marginal cost of firm  $j$  in market  $m$ ;
  3.  $F_{jm}$  is the fixed cost of participating in the procurement auction of market  $m$ ; and
  4.  $q_{jm}(\mathbf{p}_m)$  is the equilibrium quantity of firm  $j$  in market  $m$ .
- ▶  $F_{jP} = 0$  by assumption, i.e., all firms participate in the private market.

# 5. ESTIMATION

# ESTIMATION ALGORITHM

- ▶ We need to estimate
  1. 3 demand functions, but only observe the outside good in one market (private market);
  2. 2 participation decisions; and
  3. supply side parameters.
  
- ▶ We proceed as follows: we
  1. estimate demand in the private market;
  2. use engineering estimate of  $c_{jm}$ ;
  3. estimate demand in the two PP markets; and
  4. estimate the two PP participation decisions

## DEMAND ESTIMATION: PRIVATE MARKET

- ▶ Given Logit demand, we can use the traditional (e.g. Berry 1994) estimation equation for the private market:

$$\log(s_{jP}) - \log(s_{0P}) = x_{jP}\beta_m - \alpha(y_i - p_{jP}) + \xi_{jm} \quad (3)$$

- ▶ Construction of outside good: based on knowledge of what fraction (5%) of population in need of physiotherapy services in a given year.
- ▶ Potential instruments:
  - ▶ Hausman - style instruments based on prices in other municipalities and
  - ▶ BLP - style instruments based on characteristics of competing products.

## DEMAND ESTIMATION: PP MARKETS

- ▶ There is no outside good for the municipal and Kela markets as all customers "buy" an inside good  $\implies$  cannot use the "Berry" inversion trick.
- ▶  $\implies$  we assume that

$$\xi_{jm} = g_m(\xi_{jP}) \quad \forall m \in \{M, K\} \quad (4)$$

- ▶ Armed with  $\hat{\xi}_{jP}$ , we can write demand in market  $m \in \{M, K\}$  for firm / product  $j$  as

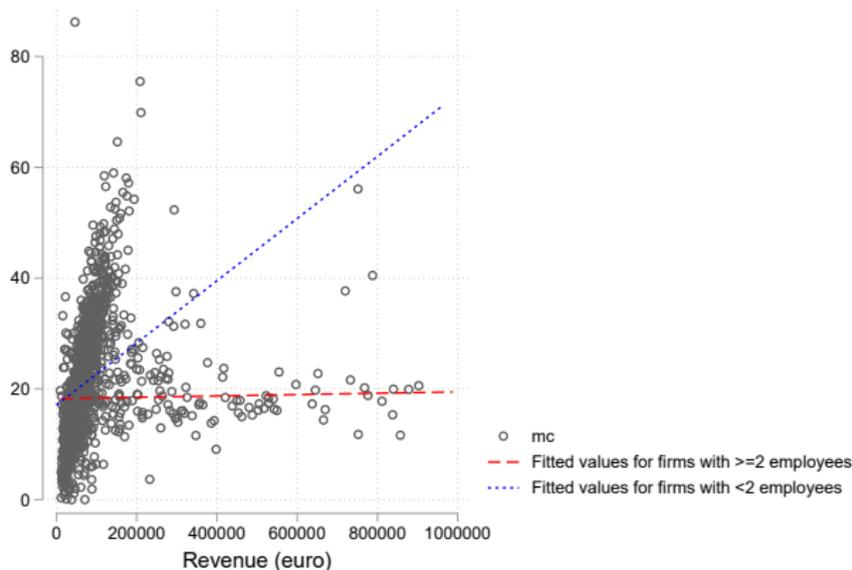
$$s_{jm} = \frac{\exp(x_{jm}\beta_m - \alpha(y_i - p_{jm}) + g_m(\hat{\xi}_{jP}))}{\sum_f (\exp(x_{fm}\beta_m - \alpha(y_i - p_{fm}) + g_m(\hat{\xi}_{fP})))} \quad (5)$$

## SUPPLY SIDE: ESTIMATING MARGINAL COST

- ▶ Salary distributions vary greatly for entrepreneurs and very little for firms with multiple physiotherapists
- ▶ Solution: Use the salary distribution for "large" ( $\geq 2$  employees) firms
- ▶  $c_{jm} = \tilde{c}_m + \omega_{jm}$ , where  $\tilde{c}$  is common to all firms
- ▶ The intuition is to capture the cost of hiring a physiotherapist to take on another patient
  - ▶ This omits all other costs of hiring

# SUPPLY SIDE: ESTIMATING MARGINAL COST

Correlation between  $\tilde{c}_m$  and firms' revenue



# PARTICIPATION DECISIONS IN PROCUREMENT MARKETS

- ▶ Given that we have estimates of all the demand and supply parameters, we can construct ( $g = \text{gross}$ )

$$\mathbb{E}[\Pi_{jm}^g] = (p_{jm} - \hat{c}_{jm})\hat{q}_{jm}(\mathbf{p}_m) \quad (6)$$

using the FOC - based expression

$$p_{jm} = c_{jm} + \frac{s_{jm}}{|\partial s_{jm} / \partial p_{jm}|} \quad (7)$$

- ▶ Notice that we can construct  $\Pi_{jm}^g$  for all firms, even those who did not bid.

# PARTICIPATION DECISIONS IN PROCUREMENT MARKETS

- ▶ The participation decision of firm  $j$  in market  $m$  is then given by

$$\mathbb{E}[\pi_{jm}^g] - F_{jm} \geq 0 \quad (8)$$

- ▶ Moving  $F_{jm}$  to the RHS, taking logs and moving  $F_{jm}$  back to the LHS yields

$$\mathbb{1}[\log(\hat{\pi}_{jm}^g) - (z_{jm}\gamma + \nu_{jm}) \geq 0] \quad (9)$$

- ▶ We follow Seim (2005) and Bajari et al (2010) and possibly Ciliberto, Murry Tamer (2021), and model the entry decision as a Bayesian equilibrium (fixed point) of an incomplete information game.