

Cutting the Queue to the Dentist: Waiting Times, Public-Private Interaction and Consumer Surplus

Tuomas Markkula

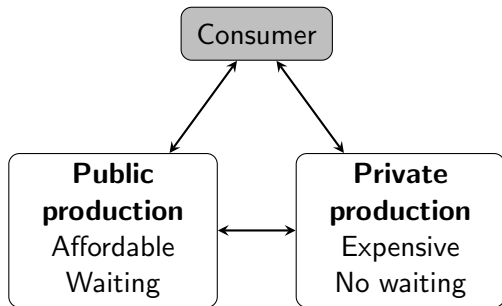
Aalto University and Helsinki GSE

3rd Health Economics Conference

June 18, 2025

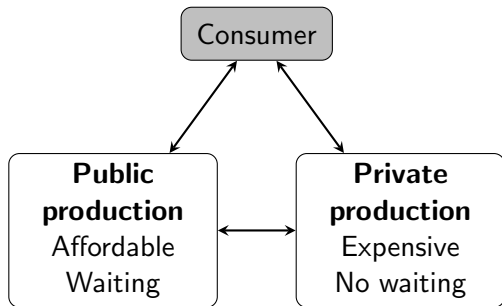
Having both public and private production is common in health care

- The UK, Australia, Austria, US veterans, Nordics
- Public production
 - ▶ Ensures access to basic necessities for all
 - ▶ Limits market power



Having both public and private production is common in health care

- The UK, Australia, Austria, US veterans, Nordics
- Public production
 - ▶ Ensures access to basic necessities for all
 - ▶ Limits market power
- The length of the wait is a key issue!
 - ▶ Equity concerns, disciplining market power, deadweight loss



Research question

- What are the equilibrium effects of increasing the production capacity of public health care?

Research question

- What are the equilibrium effects of increasing the production capacity of public health care?
 - ▶ How much do the waiting times change?

Research question

- What are the equilibrium effects of increasing the production capacity of public health care?
 - ▶ How much do the waiting times change?
 - ▶ Does the increase in the capacity limit private producers' market power?

Research question

- What are the equilibrium effects of increasing the production capacity of public health care?
 - ▶ How much do the waiting times change?
 - ▶ Does the increase in the capacity limit private producers' market power?
 - ▶ How is the distribution of consumer surplus affected?

This paper

- The Finnish dental care industry provides an excellent setting
 - ▶ Affordable (€117), but congested (32 days) public production and expensive (€178) private production
 - ▶ Practically no insurance and high-quality public production
- I build and estimate a model of the industry
 - ▶ Eq. objects: consumers' choices, private prices, and public waiting times
- Quantify the equilibrium effects of public production capacity increase

My main contribution

- How do markets with public and private production work?
 - ▶ Dinerstein and Smith (2021); Jimenez-Hernandez and Seira (2022); Saltzman (2023); Atal et al. (2024)
 - ▶ I study markets where public production is congested

Preview of the findings

- Counterfactual: a 20% increase in the number of public practice dentists

Preview of the findings

- Counterfactual: a 20% increase in the number of public practice dentists
 - ▶ Public practices' waiting times decrease by 5% or 1.5 days

Preview of the findings

- Counterfactual: a 20% increase in the number of public practice dentists
 - ▶ Public practices' waiting times decrease by 5% or 1.5 days
 - ▶ Private practice prices do not change

Preview of the findings

- Counterfactual: a 20% increase in the number of public practice dentists
 - ▶ Public practices' waiting times decrease by 5% or 1.5 days
 - ▶ Private practice prices do not change
 - ▶ Consumer surplus and the use of dental care services increase
 - ★ but the increase is less for the lowest income decile

Preview of the findings

- Counterfactual: a 20% increase in the number of public practice dentists
 - ▶ Public practices' waiting times decrease by 5% or 1.5 days
 - ▶ Private practice prices do not change
 - ▶ Consumer surplus and the use of dental care services increase
 - ★ but the increase is less for the lowest income decile
 - ▶ Total welfare might improve if public production is not costlier than private production

Data, market definition, and product definition

Data

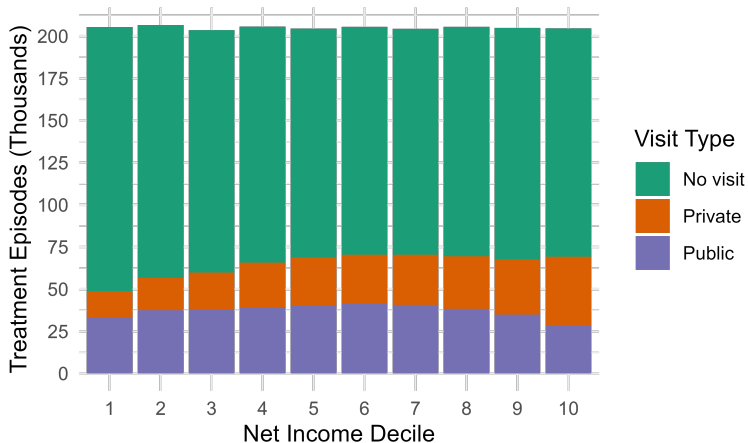
- Consumer level panel of all Finnish residents, visiting a dentist or not 2014-2017
 - ▶ Visit level information contains date, procedures performed, prices, and waiting times
 - ▶ Consumer characteristics, and consumers' and practices' locations
- I focus on non-emergency patients

Market and product

- Market is a municipality-year combination
 - ▶ Drop the ten most populous municipalities and their neighboring municipalities
- A product is a dental care treatment episode

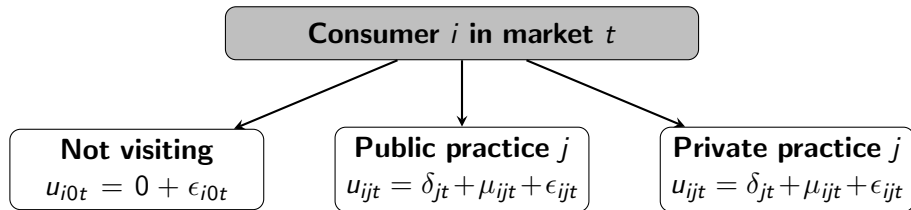
All income groups in the sample use public dental care, but private dental care is common for high earners

Figure 1: Sample's Consumers' Choices by Net Income



Model and estimation

Consumers' choice of dental practice is a random utility model



$$u_{ijt} = \underbrace{\delta_{jt}}_{\text{mean utility for } jt} + \underbrace{\mu_{ijt}}_{i\text{'s deviation from } \delta_{jt}} + \epsilon_{ijt}$$

Public practices' waiting times are determined in the equilibrium

- Public practices waiting times

- ▶ $s_{jt}l_t = q_{jt}$

$$\underbrace{b_{jt}}_{\text{waiting time (days)}} = \underbrace{\psi_1}_{\text{service time}} \times \underbrace{\frac{s_{jt}l_t}{d_{jt}}}_{\substack{\text{demand per} \\ \text{dentists}}} + \underbrace{\omega_{jt}}_{\text{error term}}$$

- Equilibrium condition

- ▶ Number of dentists $d_{jt} \uparrow$
 - Waiting times $b_{jt} \downarrow$
 - Demand $s_{jt} \uparrow$
 - Waiting times $b_{jt} \uparrow$
 - Demand $s_{jt} \downarrow$

$$s_{jt} = \frac{1}{l_t} \sum_{i \in l_t} \frac{\exp(\delta_{jt}(b_{jt}(s_{jt})) + \mu_{ijt})}{1 + \sum_{k=1}^J \exp(\delta_{kt} + \mu_{ikt})}, j \in J_t^{pub}$$

Private practices set prices to maximize profits

- Differentiated Nash-Bertrand

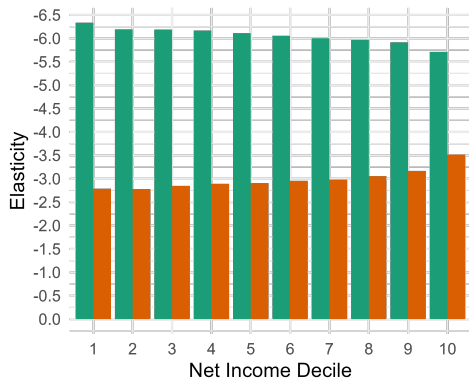
$$p_{jt} = mc_{jt} + \underbrace{q_{jt}(p_t, b_t) \left[- \frac{\partial q_{jt}(p_t, b_t)}{\partial p_{jt}} \right]^{-1}}_{\text{inverse of the price semi-elasticity}}$$

- Demand depends on waiting times!
 - ▶ Congestion externality arises

Elasticities and markups

Elasticities and markups

Figure 2: Own-elasticities by Net Income



Variable



Price

Waiting Time

• Average markup: €25.21 (11%)

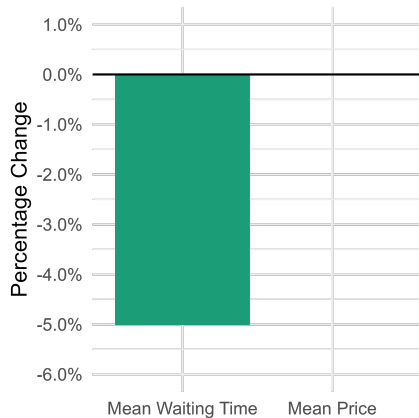
Counterfactual

Counterfactual

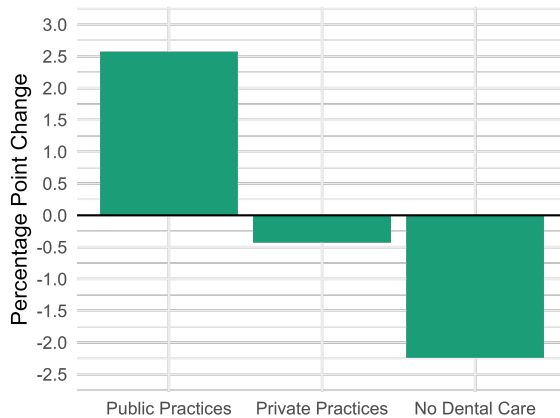
- Increase the number of dentists at the public practices by 20% $\approx$ 250 FTE dentists
 - ▶ Increase evening/weekend work, reform dental school, or recruit retired dentists
- Using data for 2015

Equilibrium prices, waiting times and market shares

(a) % Change in Waiting Times and Prices



(b) P.P. Change in Average Market Shares

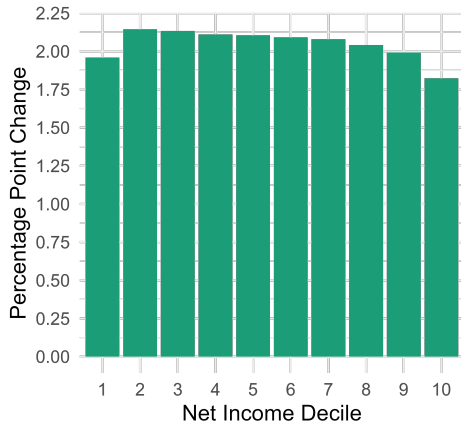


Which income decile benefits the most?

Figure 4: Change in CS by Net Income



Figure 5: P.P. Change in the Use of Dental Care



Does increasing the capacity improve welfare?

- The change in total welfare is

$$\underbrace{\Delta\pi + \Delta CS}_{\text{profits and consumer surplus}} - \underbrace{\Delta Q^{Pri} r_y g}_{\text{private practice price subsidy}} + \underbrace{\Delta Q^{pub} g \times (p^{pub} - mc^{pub})}_{\text{net loss public practices make}} > 0$$

- Use the equation to get an upper bound for public practices' marginal costs!

If $mc^{pub} < \text{€}197$, then the policy is welfare improving

- Private practices' marginal costs are a natural benchmark
 - ▶ €197 is the 43th percentile

Conclusions

- Public practice waiting times decrease slightly
 - ▶ Difficult to reduce waiting times by just increasing supply!
- Public production's ability to encourage private competition is limited
 - ▶ Public and private practices cater to different consumers!
- Consumers who dislike waiting but still visit a public practice benefit the most

Appendix 1

Table 1: Results: Preference Heterogeneity

Variable	Estimate	Standard Errors
Price $\times$ Income (Thousands)	1.009e-04	6.190e-06
Price $\times$ Income ²	-2.960e-07	5.430e-08
Price $\times$ Woman	1.098e-03	7.900e-05
Price $\times$ College	1.851e-03	8.760e-05
Waiting Time $\times$ Income	-1.672e-04	1.530e-05
Waiting Time $\times$ Income ²	-1.190e-06	1.590e-07
Waiting Time $\times$ Woman	1.351e-03	1.766e-04
Waiting Time $\times$ College	4.326e-04	1.985e-04
Income	9.958e-03	1.151e-03
Income ²	-9.750e-05	1.050e-05
Age	8.081e-02	8.441e-04
Age ²	-6.803e-04	8.790e-06
Woman	1.677e-01	1.439e-02
College	-1.830e-01	1.621e-02
Old Age Pension	1.447e-02	6.648e-03
Distance	-9.576e-02	3.438e-04
Distance ²	3.652e-04	7.830e-06

Note: 2.3 million consumer-year observations and 18,4 million consumer-year-alternative observations. The estimates are from a conditional logit model with 1,484 alternative specific constants or δ_{jt} s.

► Back

Demand model: Mean utility

Table 2: Mean Utility Parameter Estimates

Dependent Variable:	$\hat{\delta}_{jt}$					
Sample:	Private Practices			Public Practices		
Estimator:	OLS	OLS	IV	OLS	OLS	IV
Constant	-4.568*** (0.1390)			-3.639*** (0.0738)		
Price	-0.0055*** (0.0008)	-0.0062*** (0.0007)	-0.0464*** (0.0008)			
Waiting Time (days)				-0.0150*** (0.0021)	-0.0155** (0.0038)	-0.0895*** (0.0066)
N	771	771	771	713	713	713
Year FE	No	Yes	Yes	No	Yes	Yes
F-test (1st stage)			80.973			124.39

Notes: With year FEs the SEs are clustered at the yearly level. Signif. Codes: ***: 0.01, **: 0.05, *: 0.1.

Queuing model

Table 3: Queuing Model Parameter Estimates

Dependent Variables: Estimator:	OLS	Yearly Average Waiting Time		
		IV	IV	IV
Constant	33.63*** (0.9252)	-132.1 (214.1)		
Demand Per Dentists	-0.0043*** (0.0016)	0.3697 (0.4830)	0.0660 (0.0608)	0.0659** (0.0202)
N	713	713	713	713
Year FE	No	No	No	Yes
Municipality Type FE	No	No	Yes	Yes
IV: Distance to the Nearest Competitor				
F-test (1st stage)		0.60804	4.2913	4.2913

Notes: With FEs the SEs are clustered at the level of FEs. Signif. Codes: ***: 0.01, **: 0.05, *: 0.1.

Consumer surplus and private practices' profits

Figure 6: Percentage Change in CS and Profits

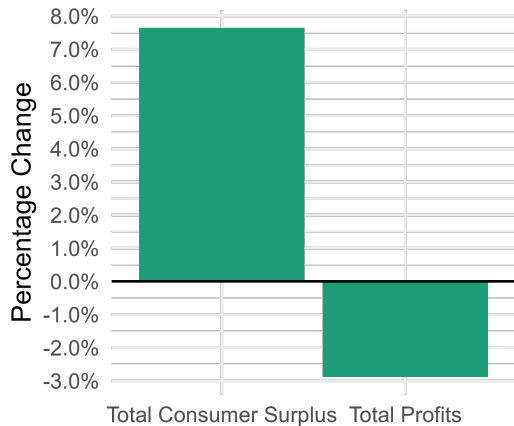
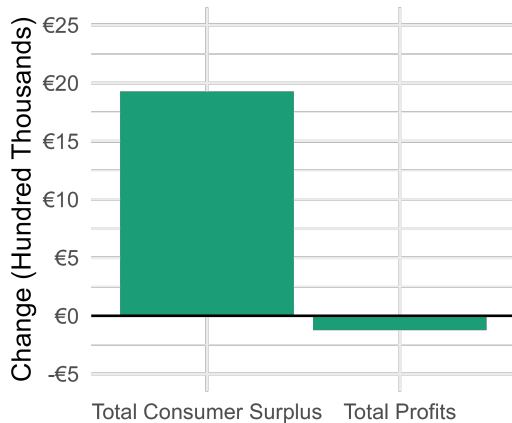


Figure 7: Absolute Change in CS and Profits



References I

- Atal, J. P., J. I. Cuesta, F. González, and C. Otero (2024). The Economics of the Public Option: Evidence from Local Pharmaceutical Markets. *American Economic Review* 114(3), 615–644.
- Dinerstein, M. and T. Smith (2021). Quantifying the Supply Response of Private Schools to Public Policies. *American Economic Review* 111(10), 3376–3417.
- Jimenez-Hernandez, D. and E. Seira (2022). Should the Government Sell You Goods? Evidence from the Milk Market in Mexico. Technical report, Federal Reserve Bank of Chicago.
- Saltzman, E. (2023). What Does a Public Option Do? Evidence from California. Working paper.