How elastic is capacity choice of welfare facilities? Evidence from notches in childcare subsidy scheme*

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Overview

Increasing demands for public welfare services

- e.g. childcare and elderly care

How can we provide these services efficiently?

- need knowledge of market structure
- supply responses to the (de)regulation, subsidy scheme and so on

Using subsidy design for childcare centers in Japan, we investigate the supply elasticity of childcare subsidy

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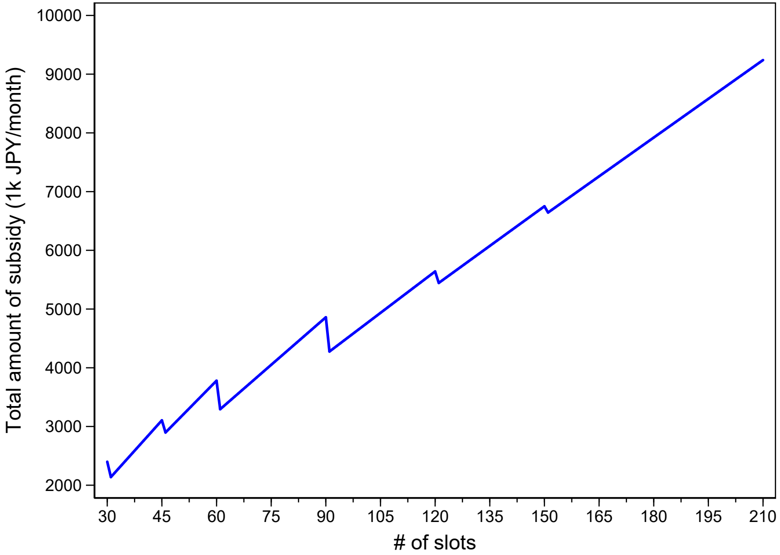
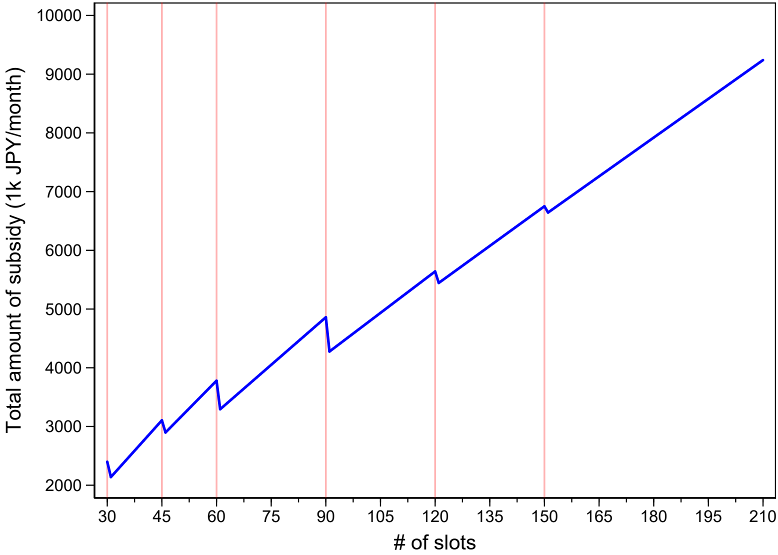
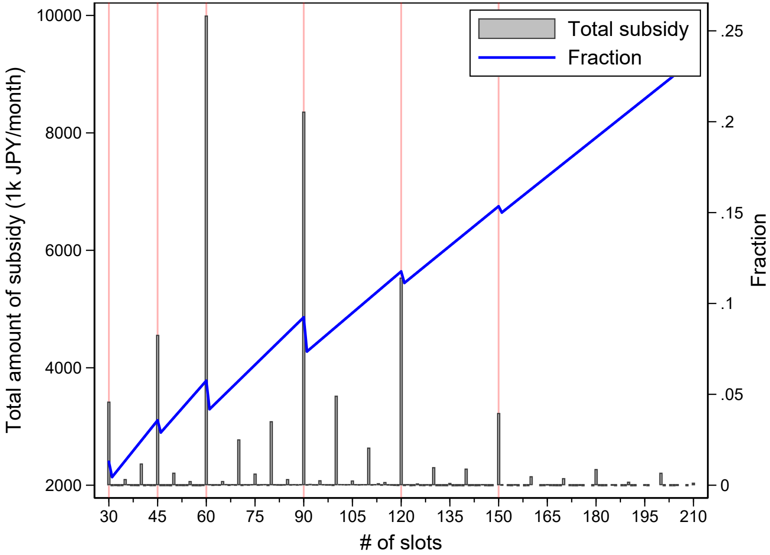
Childcare subsidy scheme in Japan



Childcare subsidy scheme in Japan



Childcare subsidy scheme and supply



Outline

Motivation (specifically)

There have been supply shortages of public welfare services in Japan

- long waiting lists (Yamaguchi, Asai and Kambayashi, 2018; Nishimura and Oikawa, 2018)
- Japanese government has mainly aimed to build new facilities
- inattention to the operation subsidy design

Importance of focusing on the effect of policy design on capacity of childcare services

- possibility to become a silver bullet to mitigate the problem of childcare waiting lists
- due to aging population, it would be somewhat hard to build new facilities

Summary

In this paper, using subsidy schedule for childcare centers in Japan, we investigate the supply elasticity of childcare subsidy

- childcare subsidy scheme has notches at some cutoff points
- observed bunches at these cutoff points enable us to uncover structural parameters

Main results

- estimated elasticity is about $\mathbf{0.18}$
- policy experiment shows that we may reduce the current costs of childcare centers by 20%
- another way to mitigate the waiting lists

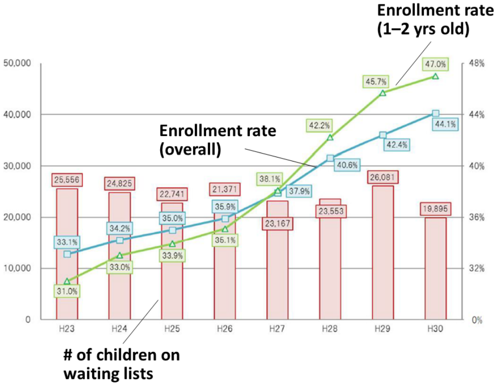
Institutional background

In this paper, we focus on accredited childcare center

- about 90% of childcare services in Japan
- provided by municipal government or by private operators such as social welfare institutions
- financed by the subsidy and fee :
  1. central and prefectural government (37.5%)
  2. municipal budget (12.5%)
  3. user-charge (50%)
- quality regulations such as **building area** and **pupil-staff ratio**

Current situation

1. N. of centers : 34,763
2. N. of slots : 280 million
3. N. of enrollments : 261 million
4. N. of waiting lists : 19,895



Annual report on childcare facilities (MHLW, 2018)

Childcare subsidy scheme

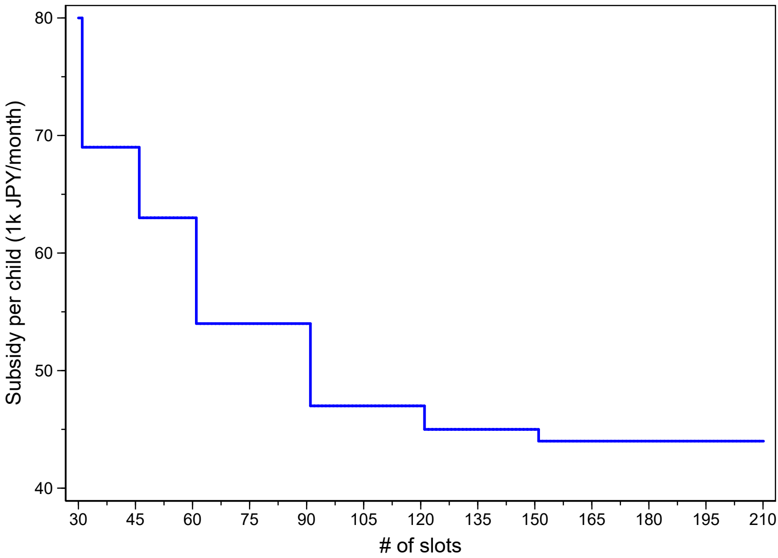
In order to determine the amount of subsidy, central government set price schedule every year

- central government estimates average cost per child and makes price schedule
- each childcare center receives estimated costs as operation fees
- subsidy discontinuously decreases at some points (notch)

Each center submits its slots to the municipal government

- amounts of subsidy per child are determined
- need to comply with submitted slots

Childcare subsidy scheme



Setup 1

Consider the problem that each childcare center chooses the number of childcare slot, q

- Cobb-Douglas production function
  - $q = AL^{\alpha}K^{\beta}$, $\alpha > 0$ and $\beta > 0$
  - L: input of childcare workers
  - K: building area of each childcare center
  - A: productivity parameter, smoothly distributed
- No entry and exit
- No interactions across childcare centers

Setup 1 (cont.)

Each childcare center knows its **short-run** cost function

- size of building area K is fixed in the short-run, $K = \overline{K}$
- assume decreasing return to scale, $\gamma > 1$

$$c(q;\theta) = \theta q^{\gamma}, \tag{1}$$

$$\theta \equiv w A^{-\gamma} \overline{K}^{-\beta\gamma} \;\; and \;\; A \sim F(A) \tag{2}$$

Setup 2

For simplicity, we assume that each childcare center maximizes profit in the short-run：

$$\max_{q} \ \pi(p,q;\theta) = pq - \theta q^{\gamma} \tag{3}$$

- p: amount of subsidies

By solving f.o.c., we get：

$$p - \theta\gamma\hat{q}^{\gamma-1} = 0 \tag{4}$$

$$\Leftrightarrow \hat{q} = \left(\frac{p}{\theta\gamma}\right)^{\frac{1}{\gamma-1}}. \tag{5}$$

- $\theta \uparrow \rightarrow \hat{q} \downarrow$

Notch in subsidy at $\bar{q}$

Now, the government introduces subsidy jump at $\bar{q}$:

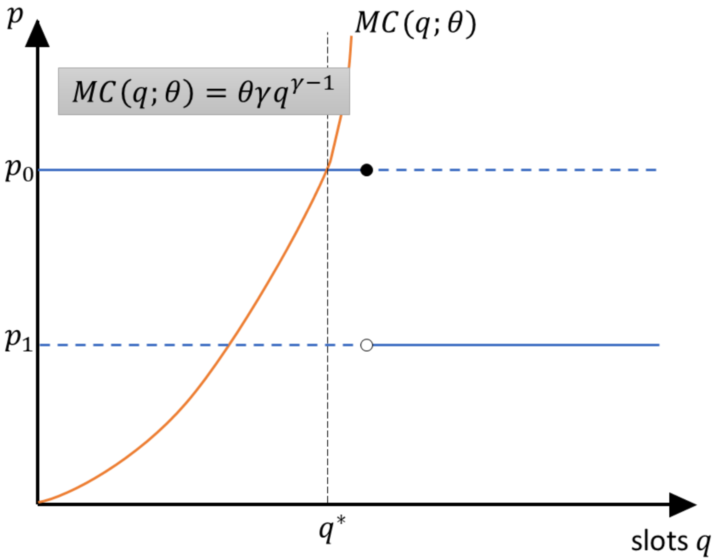
$$p = \begin{cases} p_0 & if\ q \leq \bar{q} \\ p_1 & if\ q > \bar{q} \end{cases}$$

where $p_1 < p_0$.

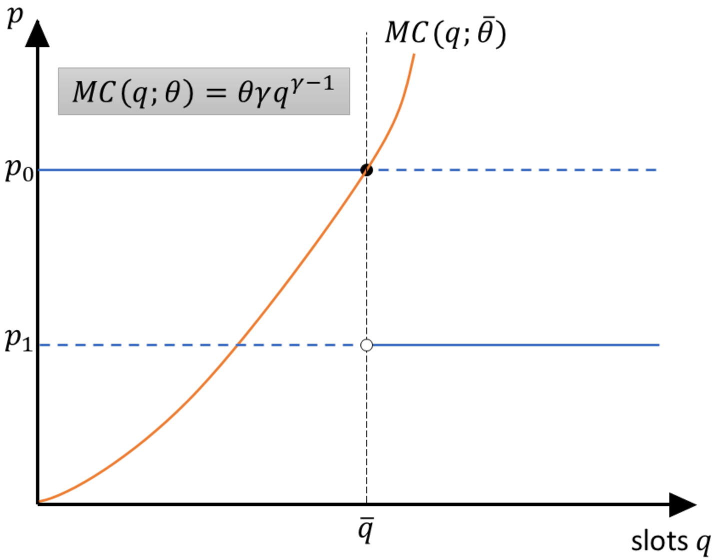
Then profit maximization problem becomes :

$$\max_q \ \pi(p, q; \theta) = p_0 q + (p_1 - p_0) q \cdot 1\{\bar{q} < q\} - c(q; \theta). \tag{6}$$

Optimization with subsidy notch



Optimization with subsidy notch



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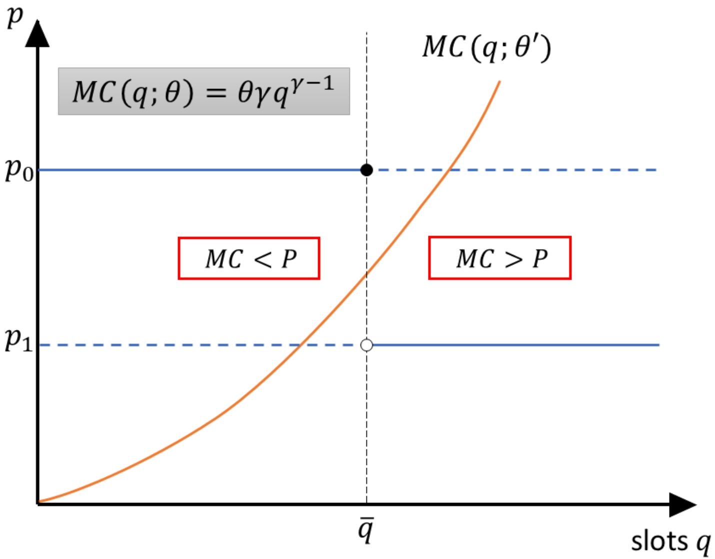

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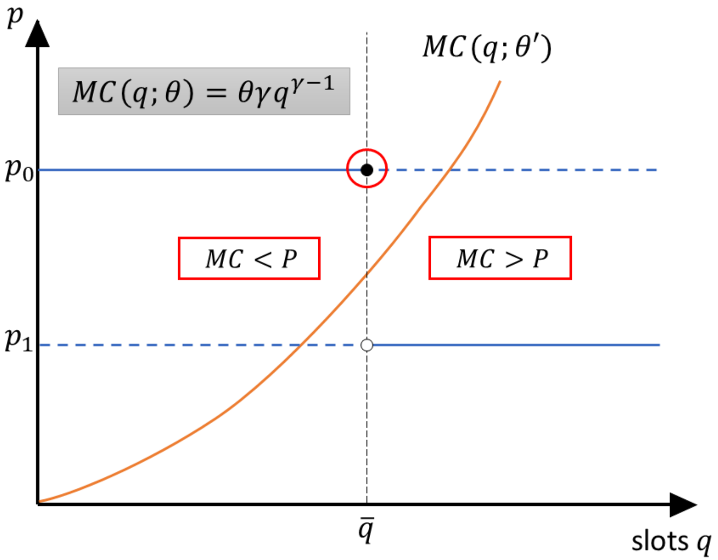
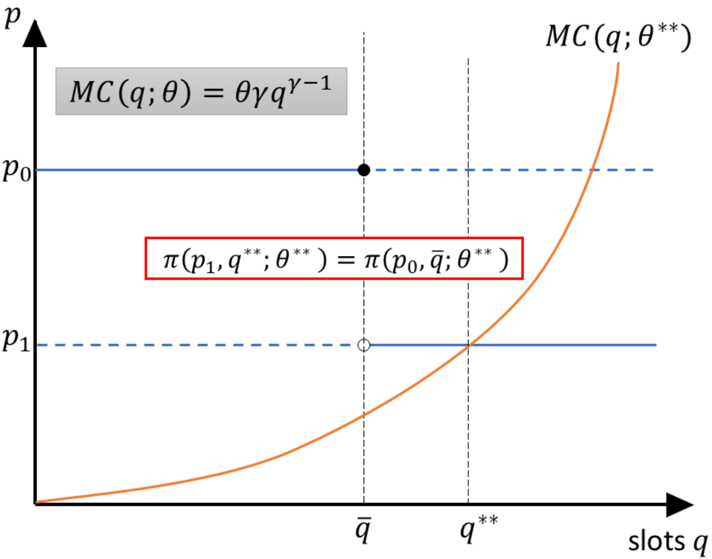


Optimization with subsidy notch



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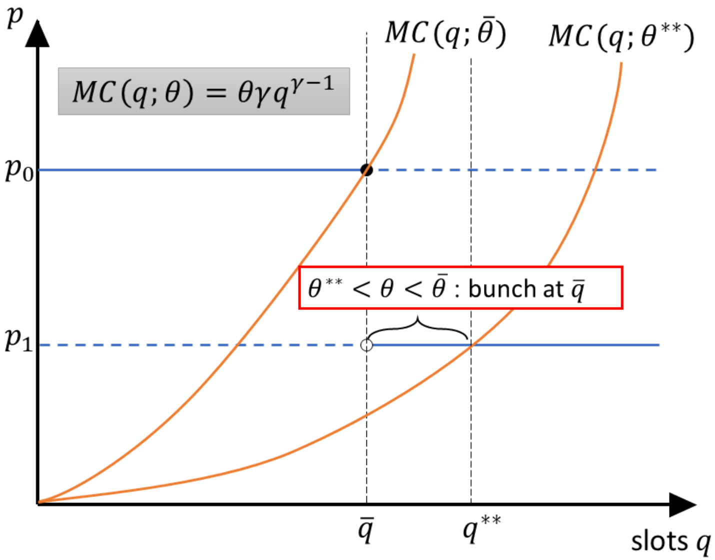
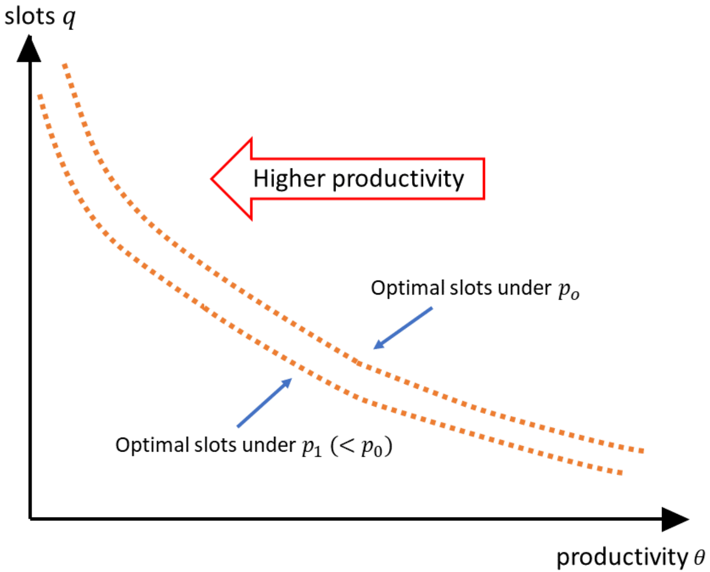


Implication for efficiency



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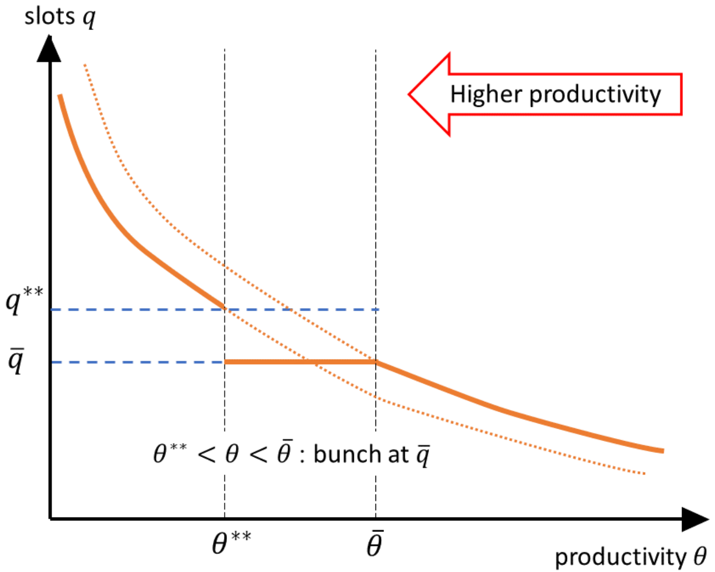
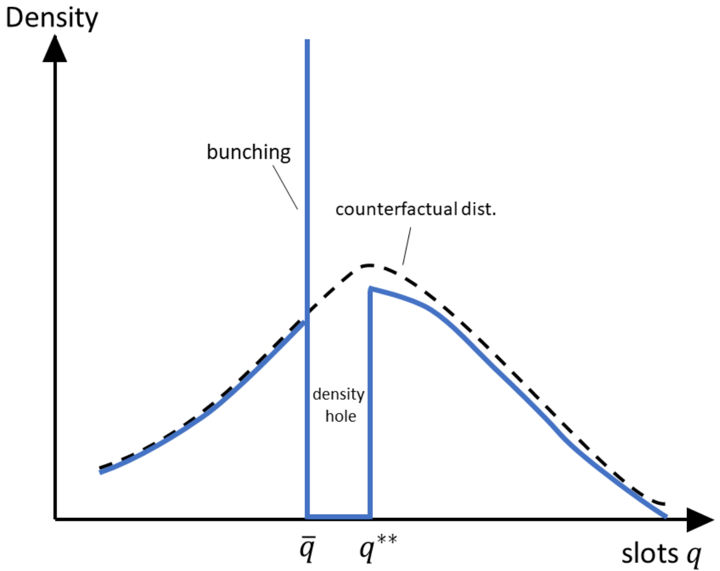


Density hole created by notch in subsidy

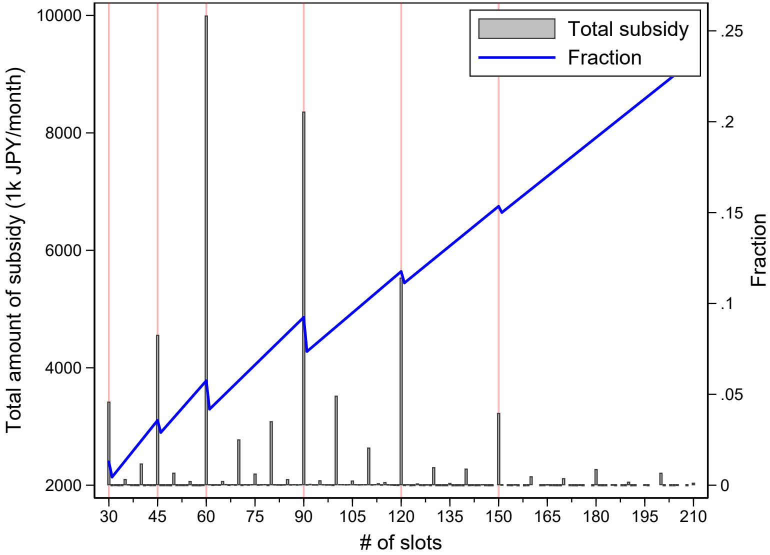


Data

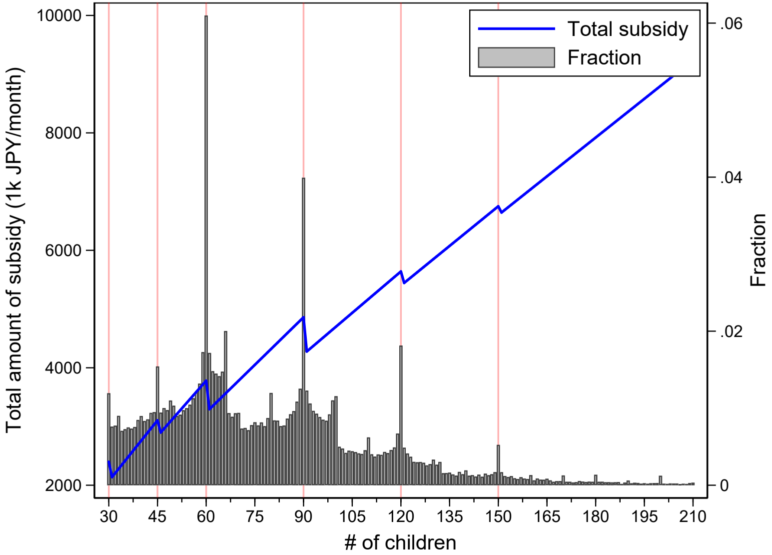
Survey of Social Welfare Institutions (MHLW)

- census for social welfare institutions
  - take place in every October
  - response rate was 99.9% until 2008
- we use the data from 1993 to 1997 in the analysis
- number of slots, childcare workers, building floor and some more variables are available

Graphical evidence: Number of slots



Graphical evidence: Number of children



Method of simulated moments

Estimate the model using simulated moments （Einav, Finkelstein and Schrimpf, 2017）

$$c(q;\theta) = \theta q^{\gamma},$$
$$\theta \equiv wA^{-\gamma}\overline{K}^{-\beta\gamma} \ \ and \ \ A \sim LogN(\mu,\sigma)$$

Moments we use...

- probability masses of the cutoff points
  $\Rightarrow$ childcare slots：30, 45, 60, 90, 120, 150
- mean and variance of childcare slots
- using these 8 moments, we estimated 4 parameters
- Over-identified model
  $\Rightarrow$ using variance-covariance matrix of the moments obtained by bootstrap as weight

Estimation results

$$c(q;\theta) = \theta q^{\gamma}, \ \ where \ \ \theta \equiv wA^{-\gamma}\overline{K}^{-\beta\gamma} \ and \ A \sim LogN(\mu, \sigma)$$

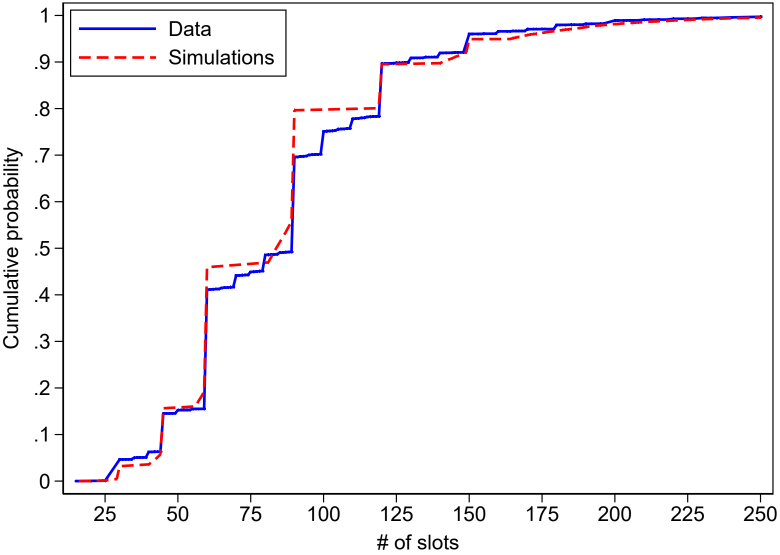
Table: Estimated parameters

Parameter	Variable	Estimate	S.E.
γ	Determinant of elasticity	6.406	0.097
β	Parameter w.r.t. K	0.370	0.006
μ	Mean of productivity	0.026($\times 10^{-3}$)	0.010($\times 10^{-3}$)
σ	Std. of productivity	2.132	0.031

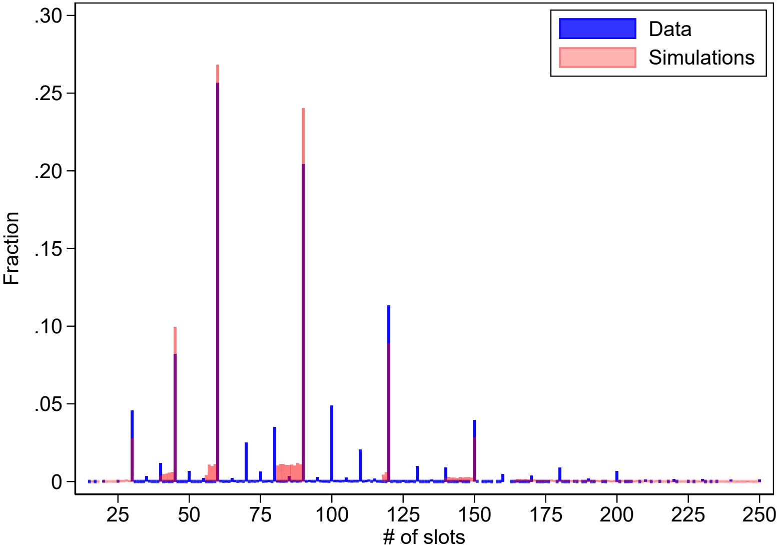
standard errors are obtained by bootstrap

- estimated supply elasticity is **0.18**
- relatively smaller than the U.S. childcare centers, 0.44–0.66 (Blau and Mocan, 2001)

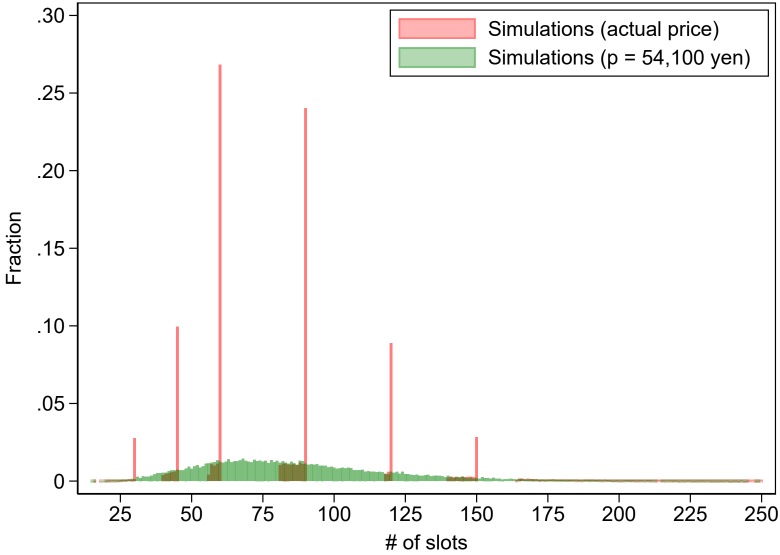
Data vs. Simulations



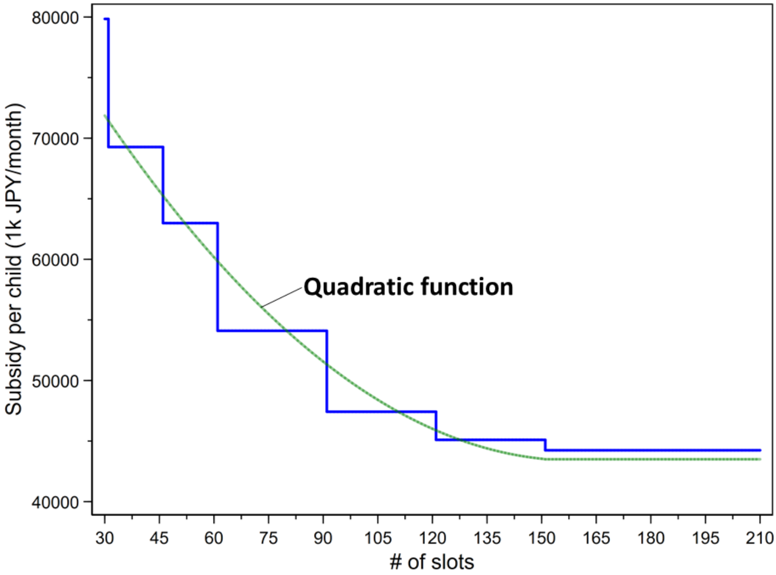
Data vs. Simulations (cont.)



Counterfactual distribution



Policy experiments 1: Smooth schedule



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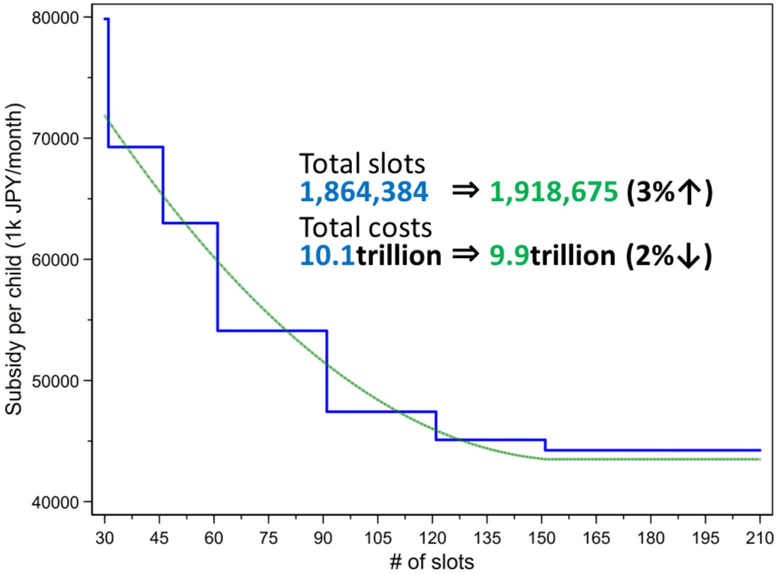


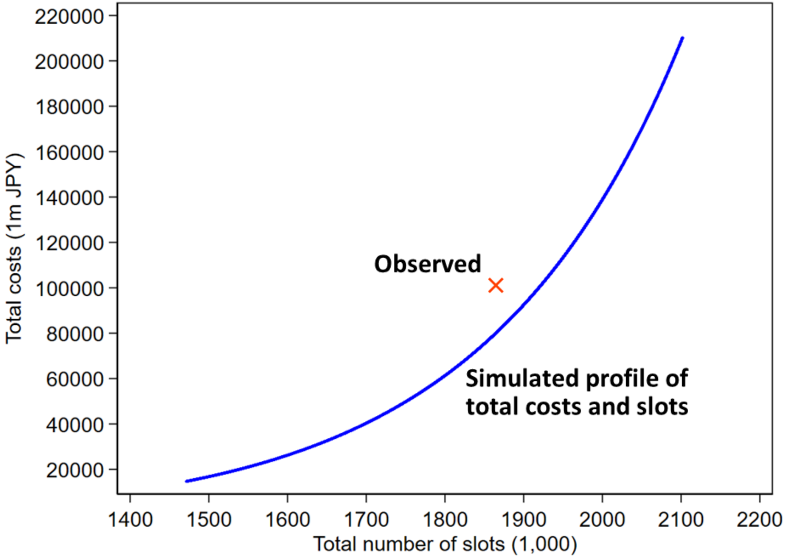
Policy experiments 2: Flat schedule

Next, we consider flat subsidy schedule:

- $\#$ of slots doesn't matter, $p \in \{10,000, \ldots, 100,000\}$
  1. calculate optimal childcare slots
  2. obtain aggregate slots and costs
  3. investigate the relationship b/w total childcare **slots** and **costs** for each subsidy setting
- incorporate the building area regulation
  - $5m^2$ per child

Q. How many costs can we reduce by changing subsidy scheme?
Q. Similarly, how many slots can we increase under the current costs?

Policy experiments 2: total cost and slots



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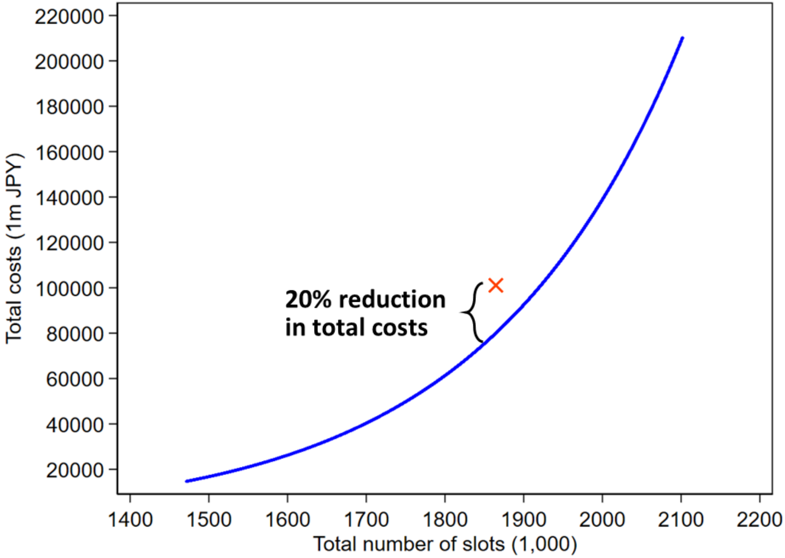

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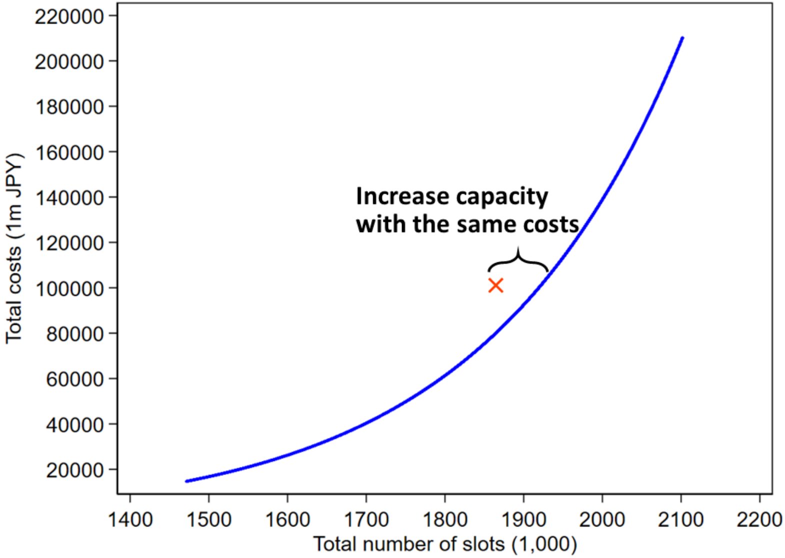


Policy experiments: summary

Q. How many costs can we reduce by only changing subsidy scheme?

- by introducing **flat subsidy schedule**, we can reduce about 20% of total costs
- possibility to mitigate the problem of waiting lists without increasing total amount of subsidy

Caveats

- responses of childcare labor market (w), and of service demand are ignored
- need to focus on the regions with supply shortage

Conclusion

In this paper, using exogenous subsidy schedule for childcare centers in Japan, we investigate the supply elasticity of childcare subsidy

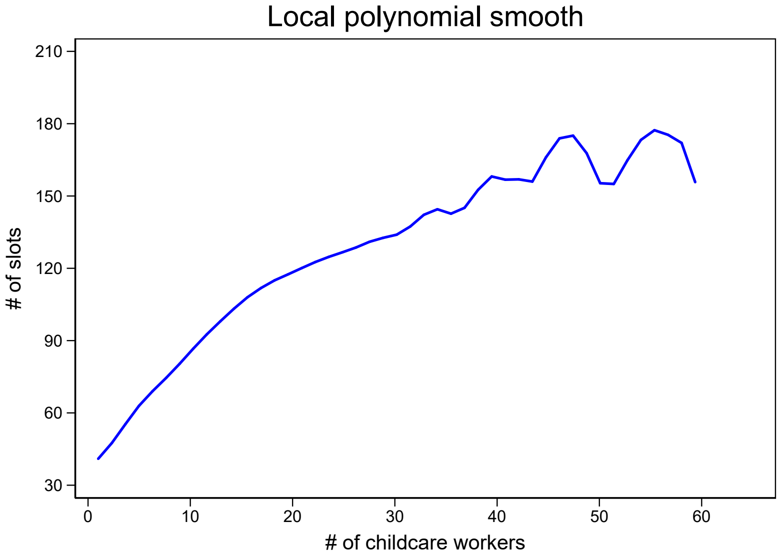
- childcare subsidy scheme has notches at some cutoff points
- observed bunches at these cutoff points enable us to uncover structural parameters

Main results

- estimated elasticity is about **0.18**
- policy experiment shows that we may reduce the current costs of childcare centers by 20%
- another way to mitigate the waiting lists
  - female labor supply (Yamaguchi, Asai and Kambayashi, 2018), fertility (Fukai, 2018), child development (Yamaguchi, Asai and Kambayashi, 2018)

Thank you for your attention !!

Childcare slots and childcare workers



Responses to nonlinear constraints

Recently, several studies have exploited behavioral responses created by nonlinear constraints:

Tax

- Kink: Saez (2010), Chetty, Friedman, Olsen and Pistaferri (2011)
- Notch: Kleven and Waseem (2013), Best and Kleven (2017)

Health

- Kink: Einav, Finkelstein and Schrimpf (2017)

Environment

- Notch: Ito and Sallee (2018)

following these studies, we first sort out theoretical responses to the subsidy notches in our case

Optimization with subsidy notch

Since $\pi(q;\theta)$ is monotonically increasing in θ, we can find θ^{**} such that,

$$\pi(p_1, \hat{q}; \theta^{**}) = \pi(p_0, \bar{q}; \theta^{**}). \tag{7}$$

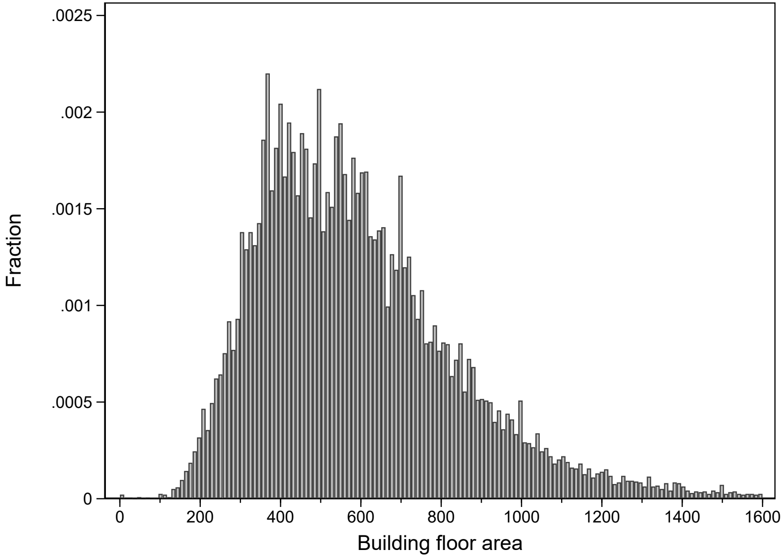
Also, we can find $\bar{\theta}$ such that,

$$\hat{q} = (\frac{p_0}{\bar{\theta}\gamma})^{\frac{1}{\gamma-1}} = \bar{q}. \tag{8}$$

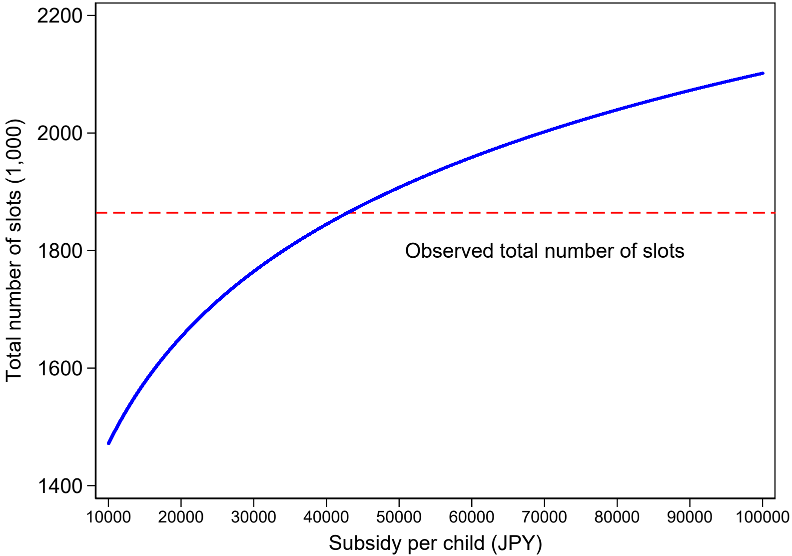
Then, we can find optimal slots $\hat{\hat{q}}$,

$$\hat{\hat{q}} = \begin{cases} (\frac{p_1}{\theta\gamma})^{\frac{1}{\gamma-1}} & if \quad \theta \leq \theta^{**} \\ \bar{q} & if \quad \theta^{**} < \theta < \bar{\theta} \\ (\frac{p_0}{\theta\gamma})^{\frac{1}{\gamma-1}} & if \quad \bar{\theta} \leq \theta. \end{cases}$$

Distribution of the building floor area



Policy experiments 2: total number of slots



Policy experiments 2: total cost