Inefficient Municipal Boundaries

Evidence from Japan

Masayoshi Hayashi
University of Tokyo

Masashi Nishikawa
Aoyama Gakuin University

Eric G Weese
Yale University and CIFAR

24 November 2010

How Inefficient are Majority-rule Boundaries?

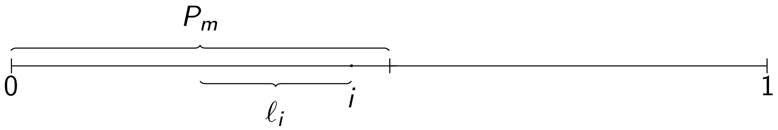
1. 2 dimensional variant of Alesina & Spolaore [1997] with sticky borders
2. Applicability of Japanese municipal data
3. Estimate parameters
4. Calculate differences between majority-rule boundaries and social optimum via simulation

One Dimensional Model

Alesina & Spolaore [1997]

One Dimensional Model

Alesina & Spolaore [1997]



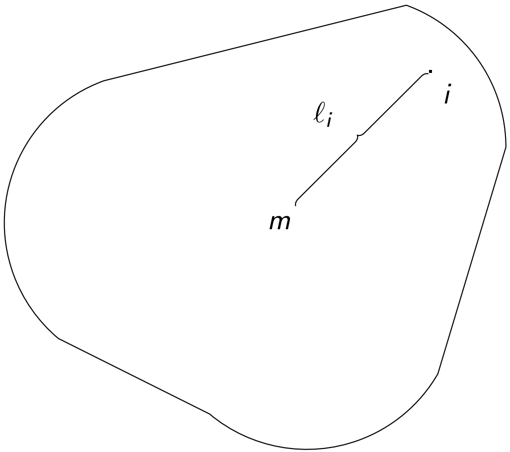
$$U_i = v(q_m) - \theta_1 \ell_i - \tau_m$$

$$= \theta_0 - \theta_1 \ell_i - \tau_m$$

$$\tau_m = (c(P_m) q_m - T_m)/P_m$$

$$= k/P_m$$

Two Dimensional Extension



Policy Choice

Banks & Duggan [2005]

1. Decision problem in R^n
2. Voters with Euclidean preferences
3. Two candidates, both office motivated
4. Vote probabilities are linear in utility difference

Then the (generalized) median voter's ideal point is the unique winning policy

This is also the social optimum

Estimation Strategy

$U_{im} = v(q_m) - \theta_1 \ell_{im} - \tau_m$
$\tau_m = (c(P_m)q_m - T_m)/P_m$

$c(P_m)$	cost of public services
$v(q_m)$	value of public services
θ_1	disutility of distance
T_m	transfers
P_m	population
ℓ_{im}	distance

Estimation Strategy

$U_{im} = v(q_m) - \theta_1 \ell_{im} - \tau_m$
$\tau_m = (c(P_m)q_m - T_m)/P_m$

$c(P_m)$	cost of public services	Ministry estimates
$v(q_m)$	value of public services	Optimality assumption
θ_1	disutility of distance	survey data (via GMM)
T_m	transfers	Ministry formulae
P_m	population	census data
ℓ_{im}	distance	grid square census data

Cost of Government Services

First, determine $c(P_m)$, as this does not require other parameters

Reiter & Weichenreider [2003] (19 papers, 83 estimates)

Median estimate: diseconomies of scale

Hypothesis

Estimation hard when observations endogenously disappear

In Japan, transfer scheme froze boundaries for 30+ years

- inefficient observations persisted

Direct approach: use central government estimates of costs

Cost of Government Services - Central Govt. Estimates

1. Why do they exist in the first place?

2. Why would they be correct?
   - lobbying...
   - other corruption...
   - empire building...
   - regression on spending...

Local Government Finance

LAT ("Local Allocation Tax")

$$\text{LAT}_m = \max(\text{SFN}_m - \text{SFR}_m, \quad 0)$$

SFN ("Standard Fiscal Need") is estimated cost of providing "national standard" level of service, less prefectural and national subsidies

SFN calculated based on a based on a per capita "unit cost"
unit cost higher for jurisdictions with smaller populations

LAT determined by SFN and SFR ("Standard Fiscal Revenue")

Government Responsibilities

	Municipality	Prefecture
Police:		all
Firefighting:	all	(exception: Tokyo)
Public Works:	parks	rivers
Education:	schools	teachers
Welfare:	sanitation	labour
Ag. & Industry:	forestry roads	forestry research
Administration:	resident registration	driver's licensing

Local Government Finance

Standard Fiscal Need - Municipalities

6 categories of government service, 21 subcategories (eg. Administration - Tax Collection)

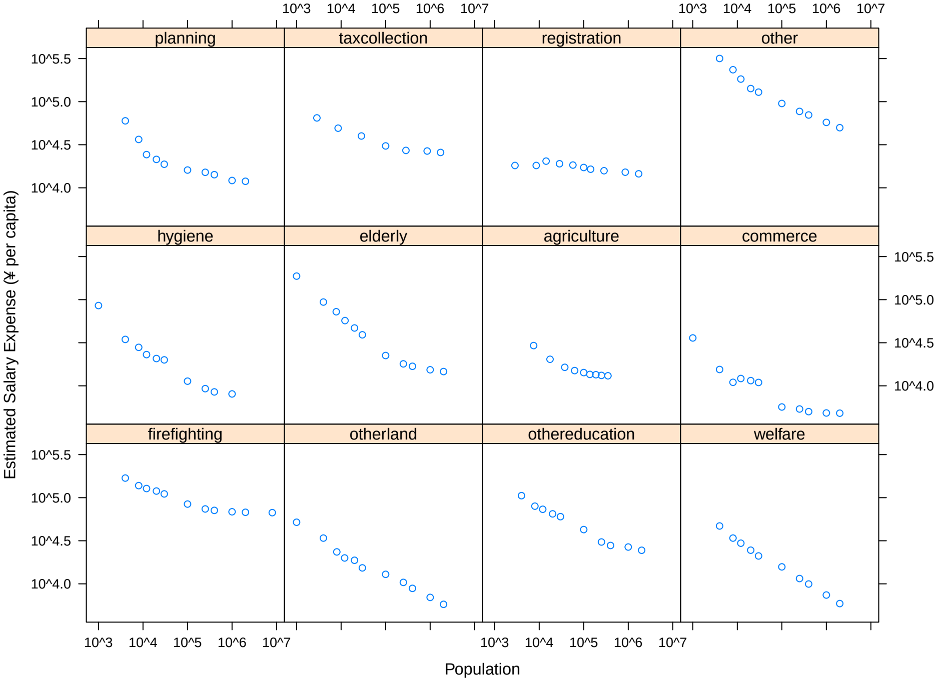
Each subcategory: general and capital expenses

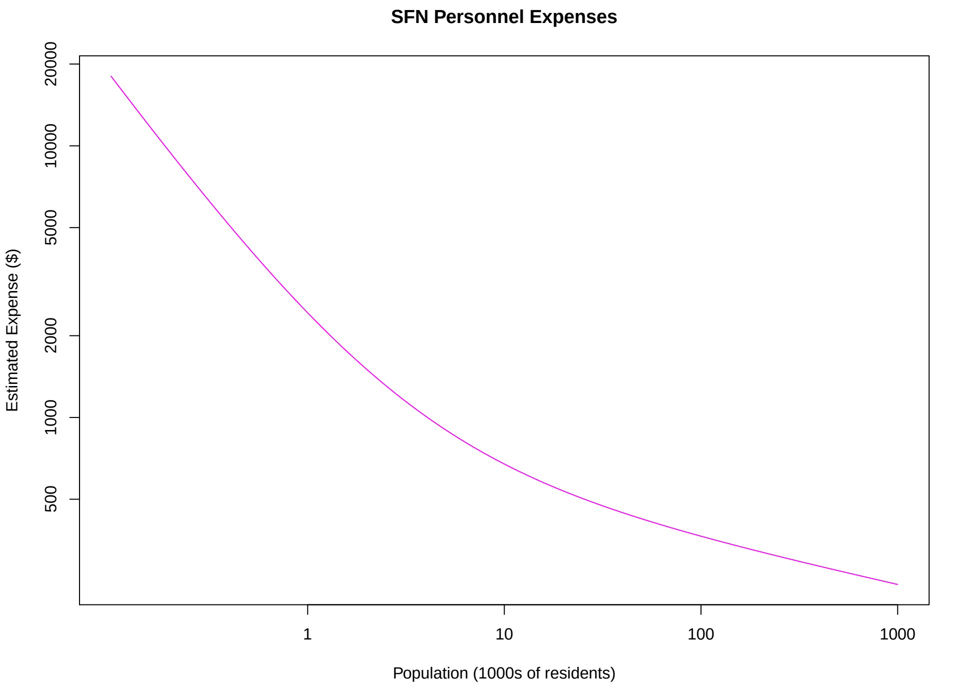
General expenses further subdivided:

- Personnel
- Contracted services
- Travel
- ...

SFN - Non-Personnel Expenses

- Other General Expenses
  - Sometimes reported only post-subsidy
  - Subsidy reporting not standardized
- Capital Expenses
  - Evidence of lobbying
  - Used to balance Ministry budget


planning
taxcollection
registration
other
hygiene
elderly
agriculture
commerce
firefighting
otherland
othereducation
welfare
10^3
10^4
10^5
10^6
10^7
10^4.0
10^4.5
10^5.0
10^5.5
Estimated Salary Expense (¥ per capita)
Population



SFN Personnel Expenses
Estimated Expense ($)
20000
10000
5000
2000
1000
500
1
10
100
1000
Population (1000s of residents)

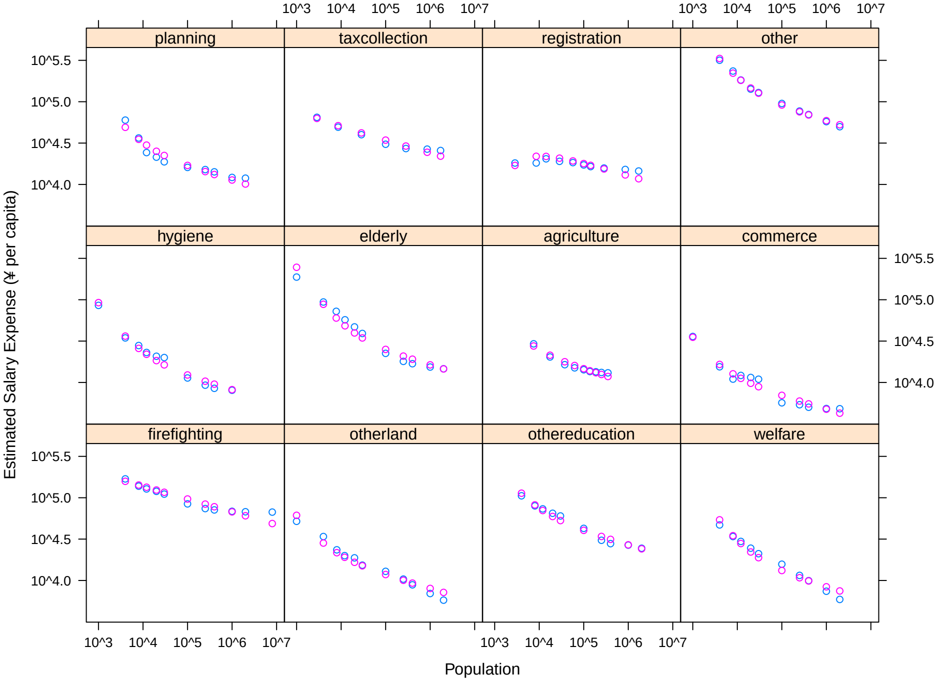
SFN - Personnel Expenses - Parametrization

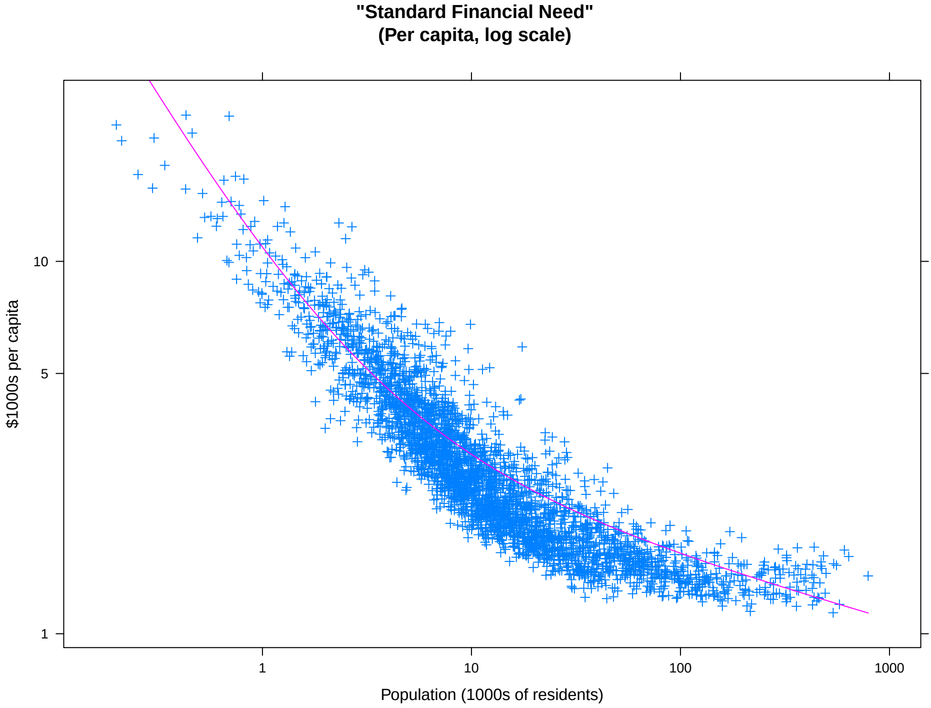
Let the personnel cost of providing the national standard level of service in subcategory n be

$$c_n(P) = \alpha_n + \beta_n P^\gamma$$

Then the personnel cost of providing the national standard level in all subcategories would be

$$c(P) = \sum_n \alpha_n + \left(\sum_n \beta_n\right) P^\gamma$$


planning
taxcollection
registration
other
hygiene
elderly
agriculture
commerce
firefighting
otherland
othereducation
welfare
10^3
10^4
10^5
10^6
10^7
10^4.0
10^4.5
10^5.0
10^5.5
Estimated Salary Expense (¥ per capita)
Population


"Standard Financial Need"
(Per capita, log scale)
$1000s per capita
10
5
1
1
10
100
1000
Population (1000s of residents)

SFN – Correctness

1. Separate system for pork
2. Plausible to outside experts
3. Consistent with observed mergers
4. Consistent with (lack of) capitalization

Value of Government Services

Given c (from SFN), $\tau_m = \bar{\tau}$, and assuming observed spending is optimal given municipal boundaries:

$$c(P_m)q_m^* = \bar{\tau}P_m + T_m$$

Local Government Finance

Local Allocation Tax

$$\text{LAT}_m = \max(\text{SFN}_m - 0.75\bar{\tau}P_m, \quad 0)$$

SFN ("Standard Fiscal Need") is estimated cost of providing "national standard" level of service, less prefectural and national subsidies

$$T_m = c(P_m) - 0.75\tau_m P_m$$

Value of Government Services

Given c (from SFN), $\tau_m = \bar{\tau}$, and assuming observed spending is optimal given municipal boundaries:

$$\begin{aligned} c(P_m)q_m^* &= \bar{\tau}P_m + T_m \\ &= \bar{\tau}P_m + c(P_m) - 0.75\bar{\tau}P_m \\ 0.25\bar{\tau}\frac{1}{q_m^* - 1} &= \frac{c(P_m)}{P_m} \end{aligned}$$

Thus $v(q) = 0.25\bar{\tau}\int_q \frac{1}{q-1} dq$

use $v(q) = 0.25\bar{\tau}\log(q-1)$

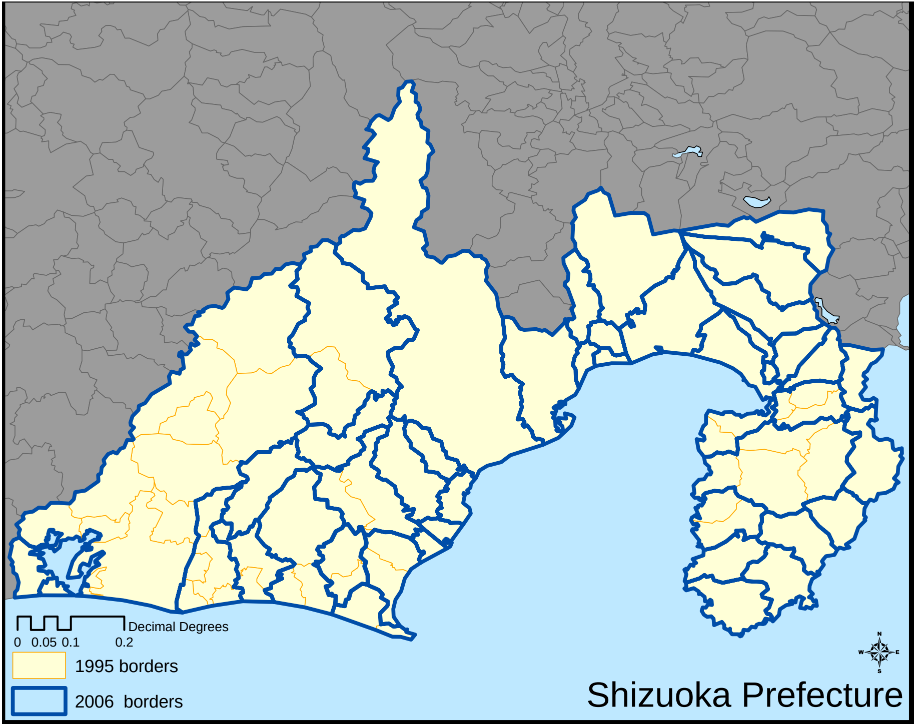
Disutility of Distance

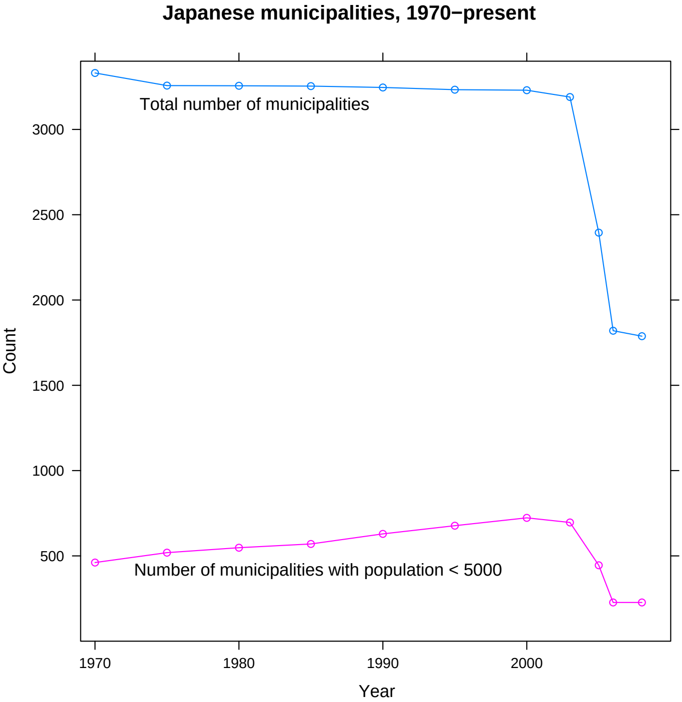
Estimate θ_1 via discrete choice model using stated preference data

$$U_i(m) = 0.25\bar{\tau} log(q_m - 1) - \theta_1 \ell_{im} - \tau_m + \epsilon_{im}$$

Data source:
surveys of residents over preferred merger partners, 1999-2009

Decimal Degrees
0 0.05 0.1 0.2
1995 borders
N
W
E
S
Shizuoka Prefecture


Decimal Degrees
0 0.05 0.1 0.2
1995 borders
2006 borders
Shizuoka Prefecture


Japanese municipalities, 1970−present
Total number of municipalities
Number of municipalities with population < 5000
Count
Year
3000
2500
2000
1500
1000
500
1970
1980
1990
2000

Heisei Municipal Mergers

- 3229 municipalities reduced to 1727 via about 700 mergers
- 500 proposed mergers abandoned, but generated activity
- Surveys conducted in at least 900 municipalities
- Data issues: only about 200 currently available for analysis

Survey Questions - Example

Hamamatsu City merger, Shizuoka Prefecture

Haruno Town - prefered merger structure

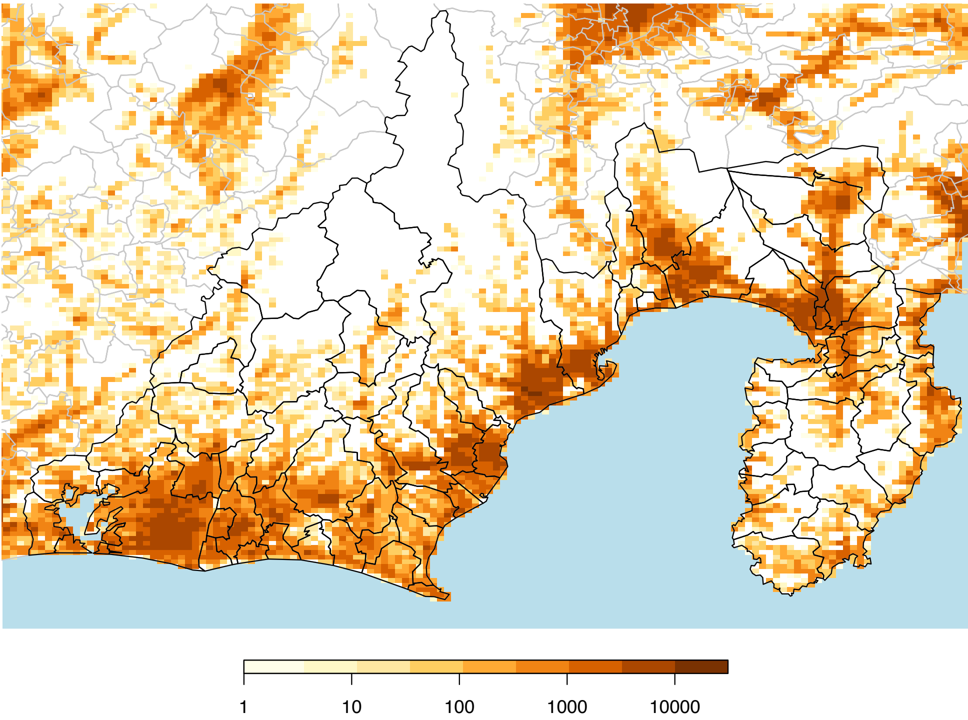
14 municipalities around Hamamatsu City	37.6%
Tenryuu, Tatsuyama, Sakuma, Misakubo	24.5%
Tenryuu, Tatsuyama	18.0%
Other	1.4%

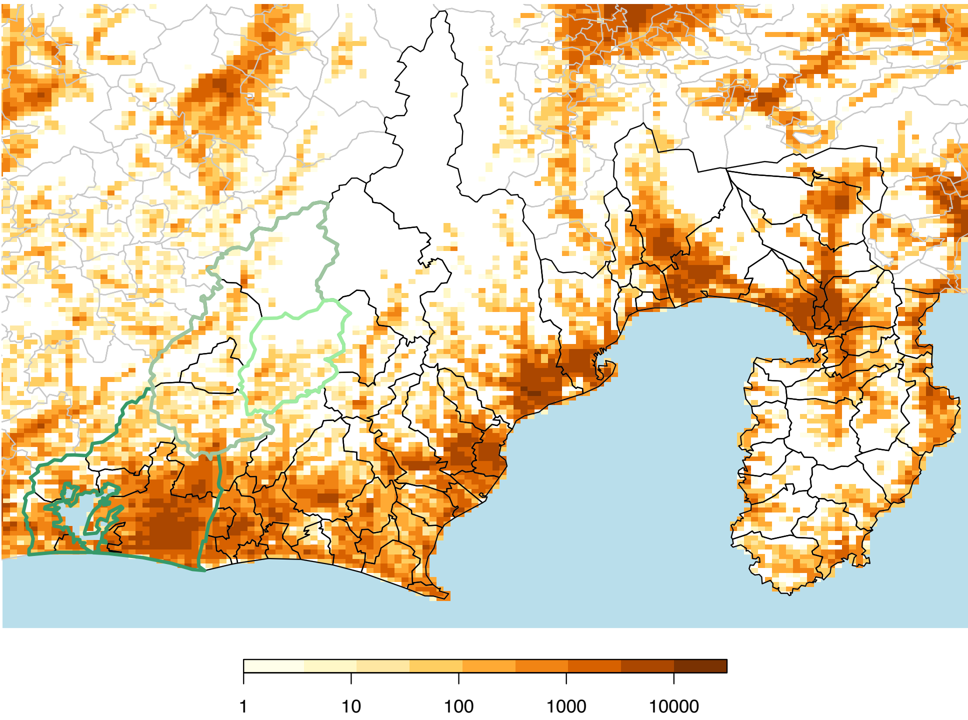
Tenryuu Town - necessity of some merger (N=7300)

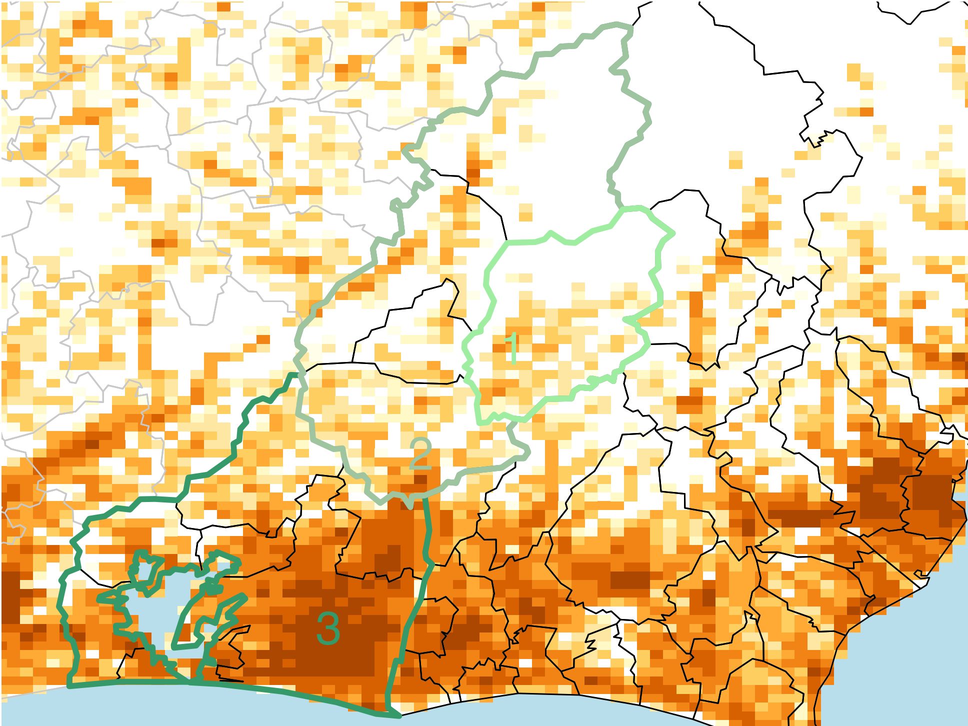
Necessary	30.6%	Probably necessary	31.8%
Unnecessary	7.8%	Probably unnecessary	10.3%
Don't know	17.2%		

Maisaka Town - approval of specific merger

Approve	67.9%	Disapprove	20.9%


1
10
100
1000
10000


1
10
100
1000
10000


1
2
3

Discrete Choice – Utility Function

Observed heterogeneity with aggregate-level data

Estimate directly off of theoretical model:

$$U_i(m) = v(q_m) - \theta_1 \ell_{im} - \tau_m + \epsilon_{im}$$

with fraction in m preferring m' to other options m'' being

$$\int_m f(i) \cdot Prob(U_i(m') > U_i(m'') \forall m'') di$$

where $f(i)$ is population density in mesh cell i

Discrete Choice - Utility Function

Results (GMM)

$$U_i(m) = v(q_m) - \theta_1 \ell_{im} - \tau_m + \epsilon_{im}$$

θ_1	9.43
	(2.78)
σ	0.45
	(0.07)
N	274

(θ_1 with respect to distance in kilometers)
units: $\bar{\tau}/1000$ (about \$1 - \$2)

Inefficiency of Majority Rule Boundaries

1. Approximate optimal partition
2. Generate sets of valid majority rule mergers
3. Compare predicted majority rule mergers to actual mergers
4. Compare optimal mergers to majority rule mergers

Inefficiency of Majority Rule Boundaries

Social Optimum

Using $U_i(m)$, $c(P_m)$, etc., calculate social optimum

Finding optimal partition is NP complete problem

Thus, use Hajiaghayi, Mahdian, Mirrokni [2003] approximation (for "production transportation problem")

Optimum number of municipalities: 300-500

Inefficiency of Majority Rule Boundaries

Decentralized mergers via majority-rule

Use simplification of Ray & Vohra [1997]:

V is set of all refinements and coarsenings
π is a partition of municipalities into mergers
S is a set of municipalities (i.e. a merger)

$$\Pi^* = \{\pi | \forall S' \in V_\pi, \exists m \in S' \text{ s.t. } U_m(\pi) > U_m(S')\}$$

Randomly generate elements from Π^*, and look at mean

Also look at "good" elements of Π^*

Conclusion - Results

Decentralized mergers lead to many more jurisdictions (1000+)

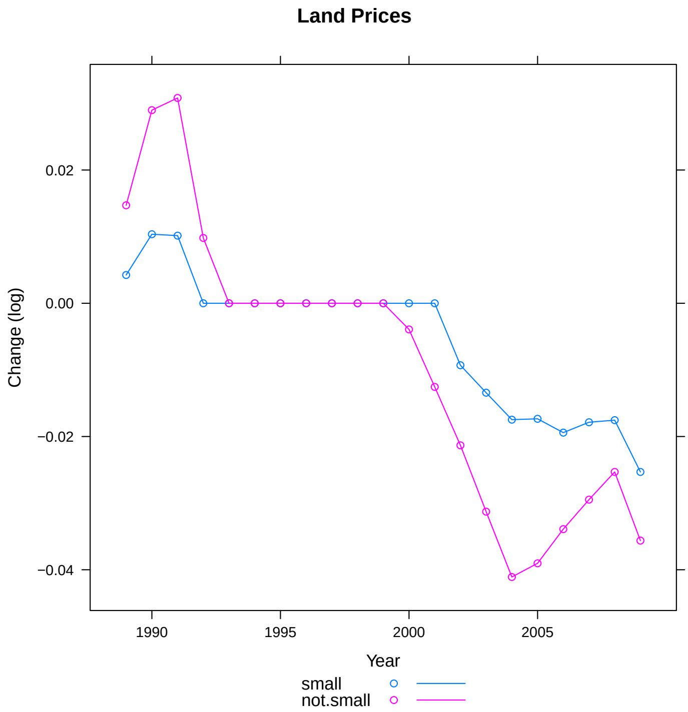
Inefficiency due to small scale: \$100 - \$200 per capita p.a.
(Results extremely preliminary)

- Is this also a potential explanation for reluctance to allow independence referenda etc.?

Number of Jurisdictions

	$\mathbb{R}^1$(AS 1997)	$\mathbb{R}^2$(This paper)
Stable:	$\tilde{N} = \left(\frac{1}{2}\cdot\frac{ga}{k}\right)^{1/2}$	$\tilde{N} = \left(\frac{\sqrt{2}}{\sqrt{5}}\cdot\frac{ga}{k}\right)^{2/3}\cdot\frac{1}{\sqrt{3}}$
Efficient:	$N^* = \left(\frac{1}{4}\cdot\frac{ga}{k}\right)^{1/2}$	$N^* = \left(\frac{\lambda}{2}\cdot\frac{ga}{k}\right)^{2/3}$
Ratio:	$\tilde{N}/N^* = \sqrt{2} \approx 1.41$	$\tilde{N}/N^* = \frac{2}{\sqrt{3}}\left(\frac{1}{\lambda\sqrt{5}}\right)^{2/3} \approx 1.29$

$$\lambda = \sqrt{\frac{2}{3\sqrt{3}}\left(\frac{1}{3}+\frac{1}{4}\log 3\right)} \approx 0.4$$


Land Prices
0.02
0.00
−0.02
−0.04
Change (log)
1990
1995
2000
2005
Year
small
not.small