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IS TOKYO TOO LARGE?

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Questions

Metropolitan Areas in Japan

City Size: Conceptual Foundation

Agglomeration and Deglomeration Economies

Estimation of Agglomeration Economies

Estimation of Total Land Values

Conclusion

Questions

- Is Tokyo too large?
  - Population of more than 30 million
    - Congestion, High land prices
    - Agglomeration economies: business interactions, variety in consumption
- What is the optimal city size?
  - The Henry George Theorem
- Can we empirically test it?

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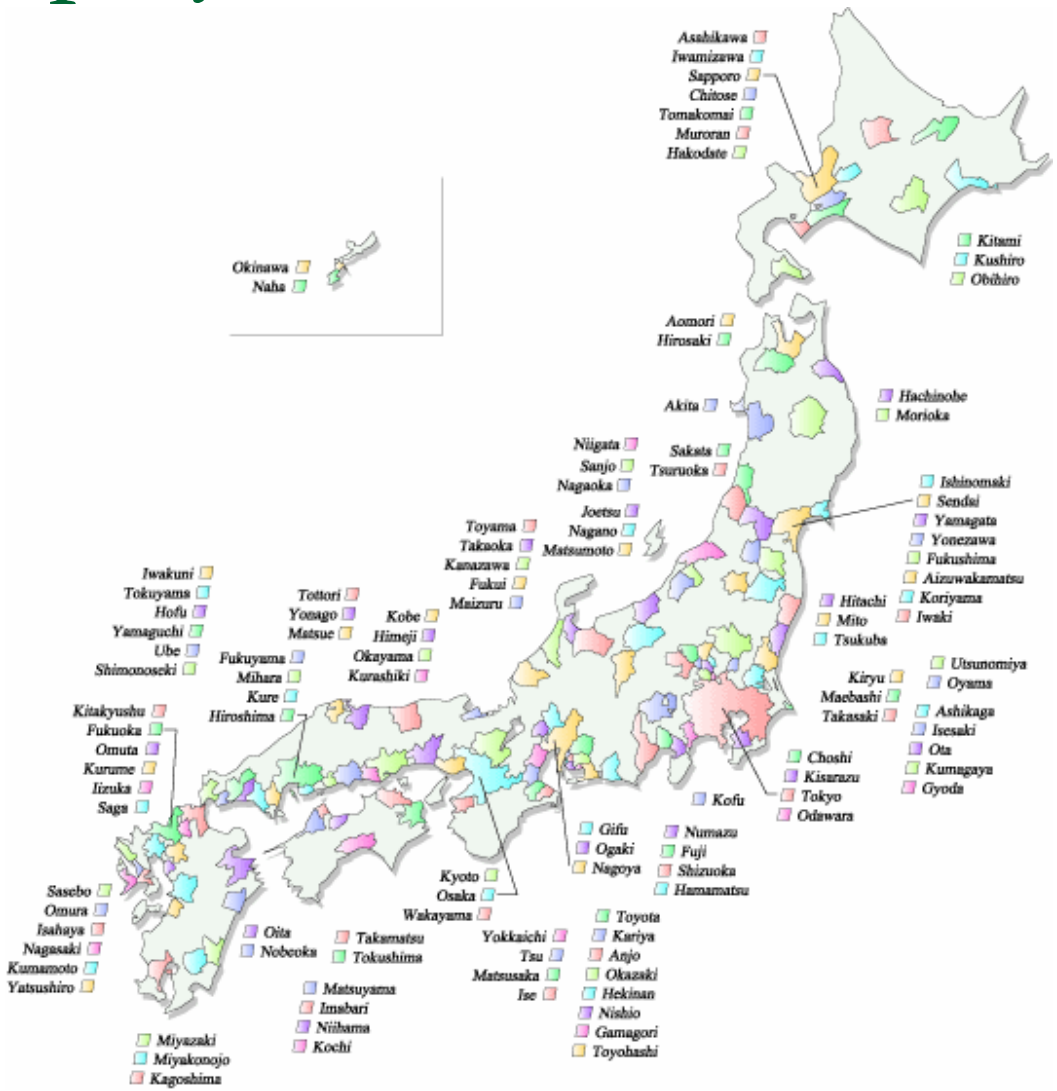
Metropolitan Employment Areas

- Need to define cities
- No official metropolitan area definition in Japan
- Metropolitan Employment Area by Tokuoka and Kanemoto



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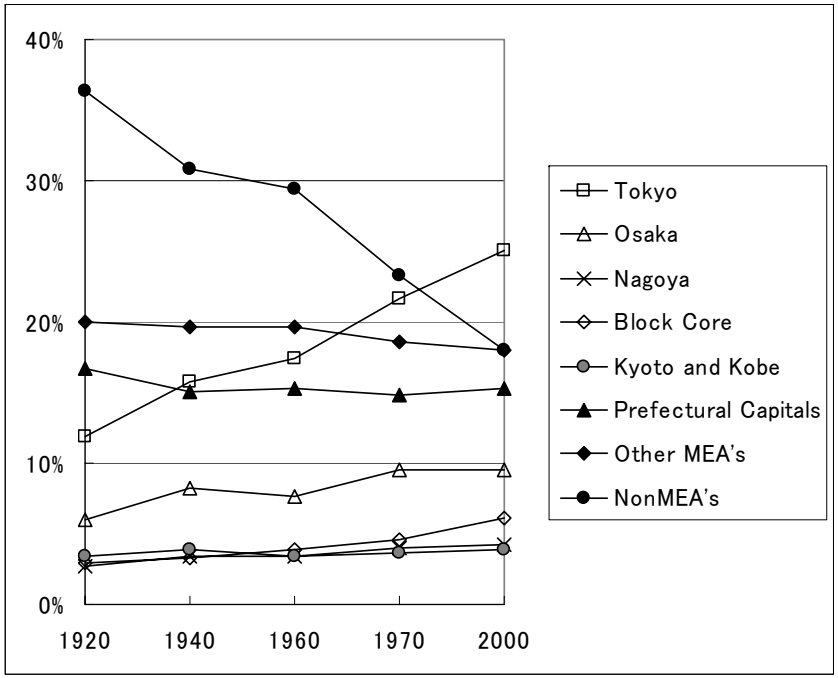
http://www.urban.e.u-tokyo.ac.jp/UEA/index.htm

Long-term trends in Japanese metropolitan areas

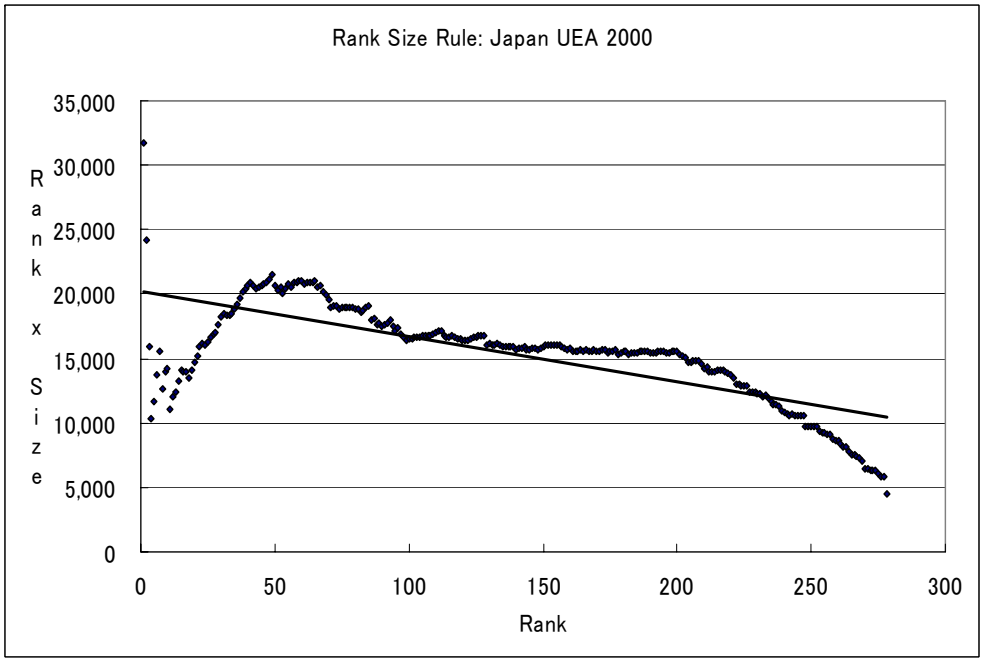
- Tokyo's population share has more than doubled from 12% in 1929 to 25% in 2000.

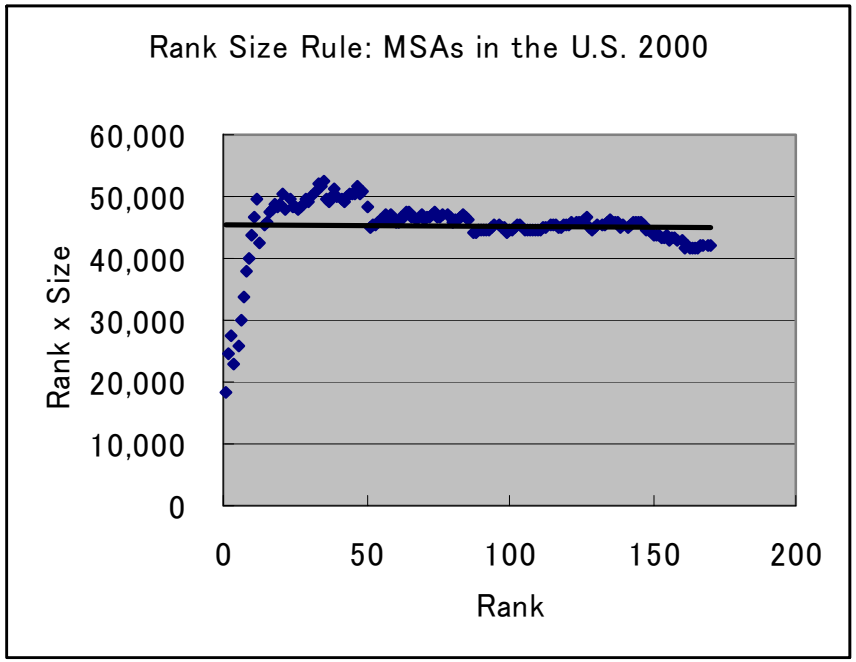


Japanese and U.S. Metropolitan Areas

MEA	Population 2000	MSA	Population 2000
Tokyo	31,874	New York	18,323
Osaka	12,139	Los Angeles	12,366
Nagoya	5,344	Chicago	9,098
Kyoto	2,598	Philadelphia	5,687
Fukuoka	2,336	Dallas	5,162
Kobe	2,298	Miami	5,008
Sapporo	2,243	Washington	4,796
Hiroshima	1,588	Houston	4,715
Sendai	1,550	Detroit	4,453
Kitakyushu	1,417	Boston	4,391
Kumamoto	1,007	Atlanta	4,248
Shizuoka	1,000	San Francisco	4,124
Niigata	950	Riverside	3,255
Okayama	949	Phoenix	3,252
Hamamatsu	939	Seattle	3,044
Utsunomiya	876	Minneapolis	2,969
Gifu	821	San Diego	2,814
Naha	754	St. Louis	2,699
Himeji	745	Baltimore	2,553
Kanazawa	738	Pittsburgh	2,431

Rank Size Rule in Japan and the U.S.





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Why cities?: Agglomeration and Deglomeration Forces

- Agglomeration Forces
  - Interaction among firms
  - Urban amenity: Variety in consumption
  - Public goods
- Deglomeration Forces
  - Transportation costs (commuting, etc.)⇔Housing Costs
  - Congestion externality
- The balance between agglomeration and deglomeration forces detemines the city size

A Hierarchy of Cities

- Cities with different product mixes have different city sizes
- A hierarchy of cities
  - National Core: Tokyo
  - West and Mid Japan Cores: Osaka and Nagoya
  - Regional Cores: Sapporo, Sendai, Hiroshima, Fukuoka
  - Prefectural Cores

Sources of Market Failure

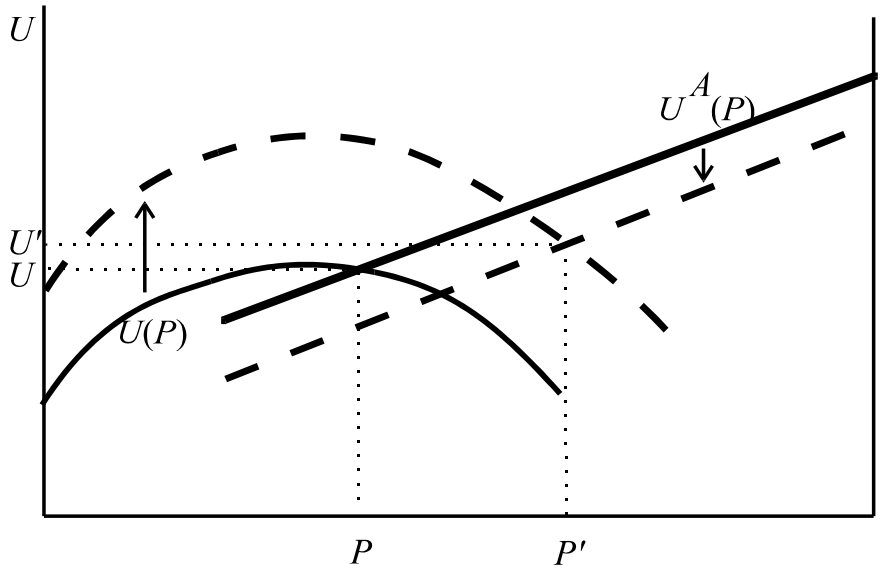
- Externalities and public goods
  - External benefits from agglomeration
    - Technological externalities: innovative ideas created by interactions
    - "Marshallian" externality in a spatial economy with non-convex technology: **Works like technological externality in a spatial economy**
  - External costs of agglomeration: Congestion costs
    - **Transport costs (the most important deglomeration force) are not externalities**
  - Public goods
- Difficulty in new city formation
  - Creating a new city large enough to compete with existing cities is difficult

Optimal City Size: Two Margins

- Optimal size of a city with a fixed number of cities
  - MSB=MSC of adding a person to a city
  - MSB-MSC>0 ⇒ Pigouvian subsidy to city residents
    - Commuting costs are not external costs ⇒ MSB tends to be larger than MSC
- Optimal number of cities
  - Net social benefit of adding a city = 0
  - The Henry George Theorem:
    - Total Rent =Total Pigouvian Subsidy + ...
  - The optimal number for each level of hierarchy
    - National Core, Regional Core, Prefectural Core

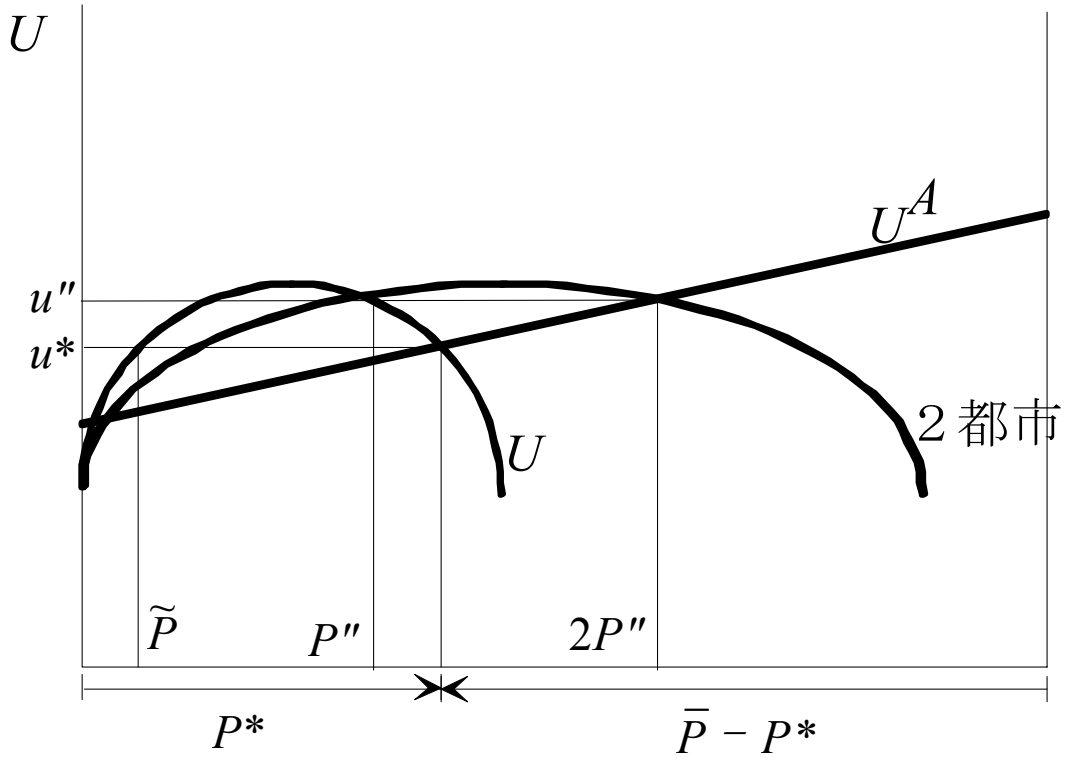
Too Small Cities With a Fixed Number of Cities

- MSB tends to be larger than MSC.
  - The difference is determined by the size of commuting costs.
  - The tendency to become too small is larger for larger cities.



Too Large Cities: Too Few Cities

- The number of cities can be increased only by creating a new city: Not easy.
- Cities in the highest hierarchy have greater tendency to become too big.



City sizes tend to be too big

- Fixed number of cities ⇒ too small cities with positive net agglomeration economies
- Difficulty to create a new city ⇒ too big cities
  - The difficulty is more serious for higher levels of hierarchy
- Hypothesis: Tokyo is too big ⇒ Tokyo has much higher land value/Pigouvian subsidy ratio than other MEAs

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Externalities

- Agglomeration economies
  - **production side**
  - consumption side
- Congestion externalities
  - Commuting costs per se & Urban differential land rent are not externalities
- Public goods
  - **social overhead capital**
  - local public services

Previous estimates of agglomeration economies

- Nakamura (1985)
  - manufacturing industries only, Jurisdictional data
  - augments a translog production function with a cost-share equations
  - Production side agglomeration economies: Large variation between industries
- Kanemoto-Okawara-Suzuki JJIE 1996
  - IMAs by S. Takeuchi, 1985 Data
  - Production side: 7% for IMAs with over 1 million population
- Kanemoto-Saito (住宅土地経済1998)
  - 119SMEAs, 1985 Data
  - Production side: 4.5%
- Tabuchi and Yoshida (2000)
  - SMEA data
  - Dual
  - Instrument variables
  - Production-side: 10%
  - Consumption-side: 7 to 12%

Production Functions

- Firm-level production function

$$f(n, k, G, N)$$

- Metropolitan production function

$$Y = AK^{\alpha} N^{\beta} G^{\gamma}$$

$$\ln(Y/N) = A_0 + a_1 \ln(K/N) + a_2 \ln N + a_3 \ln(G/N)$$

Lack of land rent data

- Land value data only
  - Enormous variation in value-rent ratio: 600 trillion yen (1980) ⇒ 1,800 trillion yen (1990) ⇒ 1,000 trillion yen (2000)
- Cross-sectional variation in TDV/TPS (or (TDV-SOC)/TPS)
  - TDV: Total Differential Land Value
  - Cities at a higher level hierarchy have greater tendency to be too big
    - More difficulty in creating a new city at the top of the hierarchy
  - Does Tokyo have a higher TDV/TPS ratio than other cities?

How to test the optimality of city size?

- Private good case

$$\frac{TDV}{TPS} \qquad TPS = a_2 Y$$

- Local public good case

$$\frac{TDV - SOC}{TPS} \qquad TPS = (a_2 - a_3) Y$$

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Estimation Results: Cross-Section

- All MEA's

Parameter	1980	1985	1990	1995
A_0	0.422**	0.440**	0.632***	0.718***
	(0.153)	(0.18)	(0.201)	(0.182)
a_1	0.404***	0.469***	0.528***	0.449***
	(0.031)	(0.039)	(0.043)	(0.037)
a_2	0.031***	0.026***	0.021**	0.020**
	(0.009)	(0.009)	(0.009)	(0.007)
a_3	0.015	-0..031	-0.124***	-0.086**
	(0.045)	(0.041)	(0.040)	(0.032)
$\overline{R}^2$	0.608	0.568	0.644	0.653

Note: Numbers in parentheses are standard errors. *** significant at 1% level. ** significant at 1% level. * significant at 10% level.

Panel Estimates

	ALL MEAs		Small MEAs		Medium MEAs		Large MEAs	
	FE	RE	FE	RE	FE	RE	FE	RE
a_1	0.279***	0.310***	0.354***	0.376***	0.281***	0.325***	0.170***	0.194***
	(0.015)	(0.014)	(0.030)	(0.027)	(0.021)	(0.020)	(0.029)	(0.026)
a_2	0.101***	0.031***	-0.016	-0.044	0.416***	0.096***	-0.044	0.059***
	(0.023)	(0.007)	(0.037)	(0.030)	(0.040)	(0.026)	(0.058)	(0.010)
a_3	-0.084***	-0.108***	-0.147***	-0.132***	0.145***	-0.061*	-0.151***	-0.113***
	(0.020)	(0.017)	(0.034)	(0.029)	(0.040)	(0.031)	(0.030)	(0.026)
R^2	0.623	0.770	0.741	0.761	0.311	0.721	0.502	0.862
Hausman	39.6		11.3		132.5		21.3	
chi (5%)	28.9		28.9		28.9		28.9	
Sample size	1888		528		896		464	

Note: Numbers in parentheses are standard errors. *** significant at 1% level. * significant at 10% level.

GMM 3SLS estimates

	All MEAs	Small MEAs	Medium MEAs	Large MEAs
a_1	0.518***	0.601***	0.479***	0.344***
	(0.030)	(0.066)	(0.047)	(0.048)
a_2	0.044***	0.027	0.053***	0.068***
	(0.005)	(0.018)	(0.013)	(0.007)
a_3	0.047	0.077	0.023	0.056
	(0.033)	(0.081)	(0.069)	(0.045)
J-statistics (D.F.)	16.28 (4)	5.73 (4)	24.57 (4)	3.78 (4)
chi (5%)	9.49	9.49	9.49	9.49
1st stage *F*-statistics	216.85	81.10	105.19	91.73
Sample size	1888	528	896	464

Note: *** significant at 1% level.

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Construction of Total Land Value Data for MEAs

- Land Value data
  - Prefecture data in Annual Report on National Accounts
- Allocation to MEAs
  - Allocate prefecture aggregates to MEAs according to employment shares
  - Adjustment to account for higher average land prices in larger cities

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The Land Value and the Pigouvian Subsidy

MEA	Population	Land Value (a)	Pigouvian Subsidy 1 (b)	(a) (b)	Social overhead capital (c)	Pigouvian Subsidy 2 (d)	(a)-(c) (d)
Tokyo	30,938,445	518,810	9,493	55	133,310	1,613	239
Osaka	12,007,663	176,168	3,216	55	53,654	546	224
Nagoya	5,213,519	62,517	1,594	39	20,774	271	154
Kyoto	2,539,639	27,851	637	44	10.075	108	164
Kobe	2,218,986	21,913	575	38	12,345	98	98
Fukuoka	2,208,245	19,810	532	37	8,890	90	121
Sapporo	2,162,000	12,645	508	25	14,670	86	-23
Hiroshima	1,562,695	14,708	421	35	8,481	72	87
Sendai	1,492,610	12,529	377	33	7,604	64	77
Kitakyushu	1,428,266	11,059	311	36	6,719	53	82
Shizuoka	1,002,032	12,740	258	49	3,715	44	206
Kumamoto	982,326	6,505	206	32	4,892	35	46
Okayama	940,208	7,637	230	33	5,370	39	58
Niigata	936,750	7,519	231	33	5,698	39	46
Hamamatsu	912,642	11,489	242	47	3,707	41	189
Utsunomiya	859,178	8,021	223	36	3,551	38	118
Gifu	818,302	6,709	187	36	3,800	32	92
Himeji	741,089	6,143	205	30	4,640	35	43
Fukuyama	729,472	5,367	174	31	4,433	29	32
Kanazawa	723,866	7,412	182	41	3,957	31	112
Average		47,878	990	38	16,014	168	108

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Note: Land value, Pigouvian subsidy, and social overhead capital are in billion yen.

Conclusion

- Estimation of MEA production function
  - Simple OLS: Serious simultaneity bias. Negative productivity of SOC.
  - Panel Estimation: Does not solve the problem.
  - GMM 3SLS with instrumental variables: Positive but insignificant productivity of SOC.
- The magnitudes of agglomeration economies
  - 7.0% for Large MEAs, 5.3% for Medium, 2.7% for Small
- Tokyo and Osaka have significantly higher land value/Pigouvian subsidy ratios than other MEAs
  - 53 for the two, 37 for the average for 20 MEAs

Extensions

- Land value estimates
- Better instruments and better estimation techniques
- Agglomeration economies on the consumption side and congestion externalities
- The Henry George Theorem in a second best situation.
- Other private inputs than capital and labor