$$g(C_{ht}) = \sum_s \sum_i \left\{ g(c^D_{htsi}) w_{htsi} + g(d^N_{htsi}) w_{htsi} + g(N_{hts}) w_{htsi} \right\}$$

$$c^N_{htsi} = \frac{C_{htsi}}{N_{hts}} = \frac{C_{htsi}}{D_{htsi}} \cdot \frac{D_{htsi}}{N_{hts}} = c^D_{htsi} d^N_{htsi}$$

Data

Medical Cost

b. "National Health Insurance Plan" by municipal regions

c. "Retiree Medical Care System"

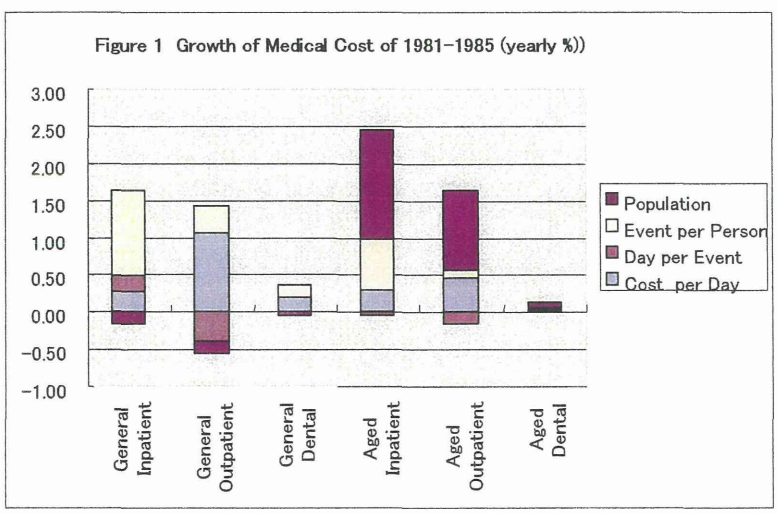
d. "Old-aged Health System"

"Annual Report of the National Health Insurance" (*Kokumin Kenkohoken Jigyo Nenpo*)

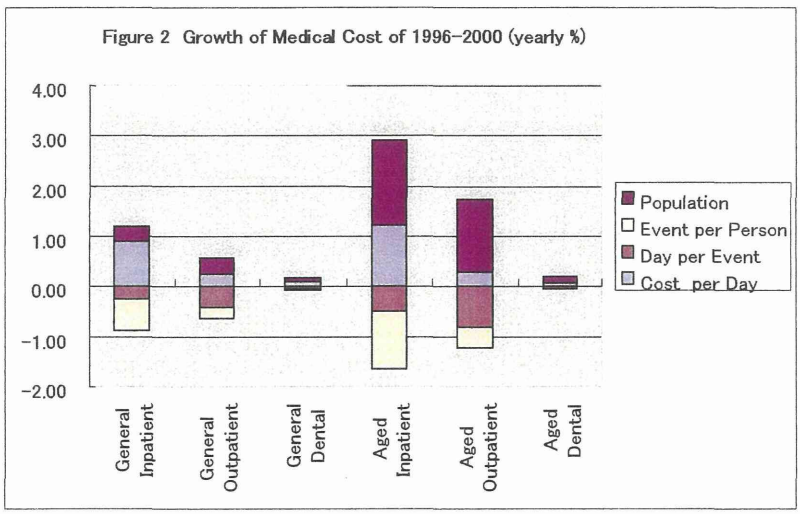
Table Share and Growth of Medical Cost of Japan (national average growth percentage per year) National Health Insurance (municipal data)

	General Hospital	General Outpatients	General Dental	Aged Hospital	Aged Outpatients	Aged Dental	General Sum	Aged Sum	Total
Share									
1981-1985	26.4	29.0	7.7	20.8	15.3	1.0	67.1	32.9	100.0
1986-1990	25.0	26.4	6.8	23.5	17.2	1.2	59.7	40.3	100.0
1991-1996	22.7	25.1	5.7	24.6	20.4	1.6	55.4	44.6	100.0
1996-2000	20.1	21.9	5.2	27.2	23.4	2.2	49.4	50.6	100.0
Growth %									
1981-1985	1.50	0.85	0.33	2.46	1.51	0.14	2.85	3.65	6.70
1986-1990	0.38	0.95	-0.03	1.08	1.30	0.09	1.34	2.38	3.78
1991-1996	0.53	0.61	0.15	1.59	1.71	0.20	1.34	3.34	4.81
1996-2000	0.58	0.37	0.14	1.64	1.33	0.22	1.14	3.06	4.26

Contribution Factors of the Growth of Medical Cost



Contribution Factors of the Growth of Medical Cost



Results

Growth of medical cost in 1996-2000

General Hospitalization	0.58%
Aged Hospitalization	1.64%
Aged Outpatient	1.33%

Mostly explained by
- the growth of the aged population
- Increase in "Cost per Day"

What are the policy responses for cost containment?

Geographical Convergence of the Aged Hospitalization Cost per Population

Method II. Convergence Theory

Growth theory with capital accumulation

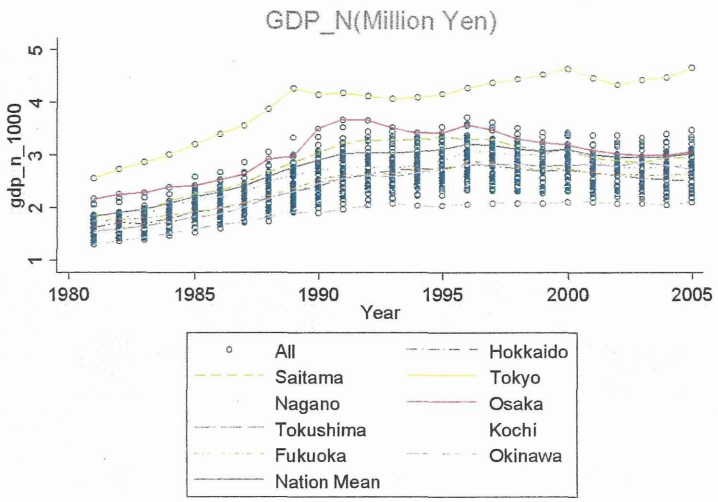
Barro and Sala-i-Martin (1995)

Shioji (2000)

absolute or conditional convergence of per capita GDP

Trivia question Which Asian country has the highest GDP per capita?

GDP per Capita



Digression

The answer is Singapore, Japan will be soon surpassed by Taiwan, Korea, and so on.

The real question of medical cost is the per capita GDP growth rate.

When it has been flattened over two decades with ever increasing population of the elderly, what would happen ?

This is an old and one of the most important question related to medical cost in Japan

Literatures: Social Common Capital

Theories behind existing literatures of geographical variance in medical cost are not clear

Importance of Physician Induced Demand or

Suppliers induced demand

They should be reinterpreted in geographical accumulation of medical resources or capital

To focus on social medical resources, capital accumulation process should be analyzed.

Physicians, nurses, beds, hospitals and others

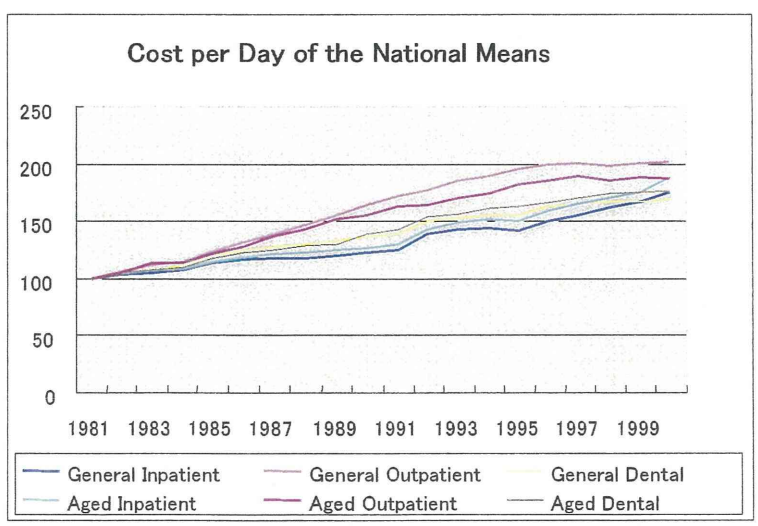
They are best regarded as measures for "Social overhead Capital" "Social Common Capital" as Uzawa(various)

Contribution factor of Growth of Medical Cost (average % per YR)

	General Inpatient	General Outpatient	General Dental	Aged Inpatient	Aged Outpatient	Aged Dental
Cost per Day						
1981-1985	0.28	1.06	0.20	0.30	0.46	0.02
1986-1990	-0.02	1.01	0.03	0.10	0.57	0.02
1991-1995	0.79	0.72	0.18	0.95	0.50	0.05
1996-2000	0.89	0.25	0.09	1.21	0.28	0.05
Day per Event						
1981-1985	0.21	-0.39	0.00	-0.05	-0.16	0.01
1986-1990	0.13	-0.23	-0.08	-0.14	-0.27	-0.01
1991-1995	-0.15	-0.29	-0.01	-0.33	-0.28	0.00
1996-2000	-0.26	-0.42	-0.05	-0.51	-0.83	-0.05
Event per Person						
1981-1985	1.15	0.36	0.16	0.68	0.11	0.03
1986-1990	0.95	0.89	0.20	0.19	0.31	0.04
1991-1995	0.13	0.46	0.05	-0.31	0.39	0.06
1996-2000	-0.33	0.23	0.03	-0.70	0.46	0.08

	General Inpatient	General Outpatient	General Dental	Aged Inpatient	Aged Outpatient	Aged Dental
Days per Person						
1981-1985	1.41	-0.03	0.18	0.55	-0.04	0.04
1986-1990	1.13	0.65	0.13	0.05	0.03	0.02
1991-1995	-0.02	0.16	0.04	-0.62	0.09	0.05
1996-2000	-0.60	-0.21	-0.02	-1.14	-0.38	0.02
Population Growth						
1981-1985	-0.16	-0.17	-0.05	1.46	1.07	0.07
1986-1990	-0.66	-0.69	-0.18	0.92	0.68	0.05
1991-1995	-0.24	-0.26	-0.06	1.28	1.07	0.08
1996-2000	0.30	0.32	0.08	1.70	1.46	0.14

Cost per Day of the National Means



Method of Estimation

Annual data of 47 prefectural regions 1981-2005

Types of medical services

the insured: Aged, General

services: Hospitalization, Outpatient, Dental Services

Decomposition of cost per capita C/N=(C/D)(D/E)(E/N)

$$c^N_{htsi} = \frac{C_{htsi}}{N_{hts}} = \frac{C_{htsi}}{D_{htsi}} \cdot \frac{D_{htsi}}{E_{htsi}} \frac{E_{htsi}}{N_{hts}} = c^D_{htsi} d^E_{htsi} e^N_{htsi}$$

h-th region, t-th period

C/N : Cost per capita, C/D: Cost per day

D/E: Days per event, E/N: Events per population

Method III. Accounting for the Variance Decomposition of the Variance

- C/N = (C/D)*(D/E)*(E/N)

- C/N : Cost/Person
- C/D : Cost/Day
- D/E : Days/Events
- E/N : Events/Population

Data is available for the NHI for the Municipal Residents which covers one half of total population

We can use aggregated data of level 1, 2, 3.

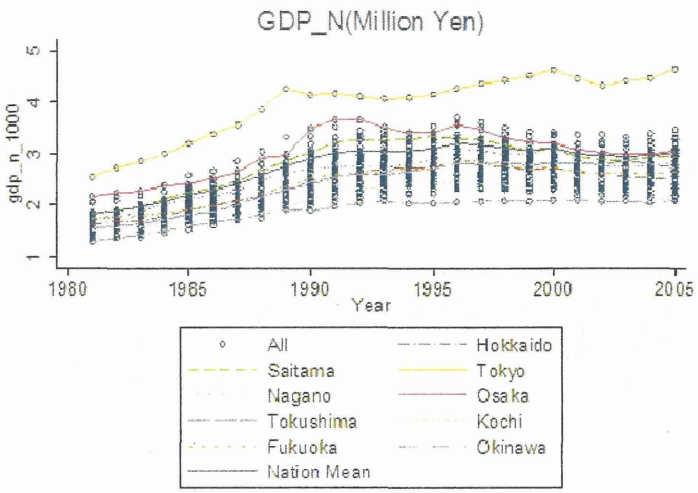
On LTC, Ikegami(1997)

- A public long-term care (LTC) insurance program was introduced to Japan in the year 2000. Half the costs will be paid by premiums that will be levied on all those older than 40 years, and half will be covered by general taxation. The insurer will be the municipalities with a pooling mechanism at the national level to balance the differences in their demographic structure. The benefits will include institutional care, respite care, day care, home help, visiting nurses, and loan of devices. Eligibility status will be classified into 6 levels that will be determined by assessment of functional and cognitive status.

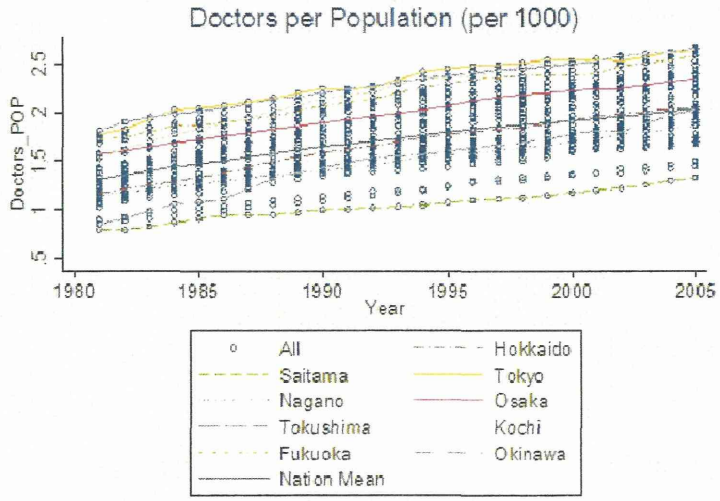
On LTC, Ikegami(1997)

- However, there are few mechanisms to limit benefits and contain costs. Problems also exist in the design of the eligibility classification and in the assessment instrument. The proposed LTC insurance system highlights the need for defining what should be included in a "basic package" of LTC as an entitlement for every citizen, for an organizational mechanism and an assessment instrument to deliver services efficiently and equitably, and for physicians to work outside the traditional medical model. To what degree the Japanese public in general, and physicians in particular, is willing to deal with these issues is a challenge for the 21st century

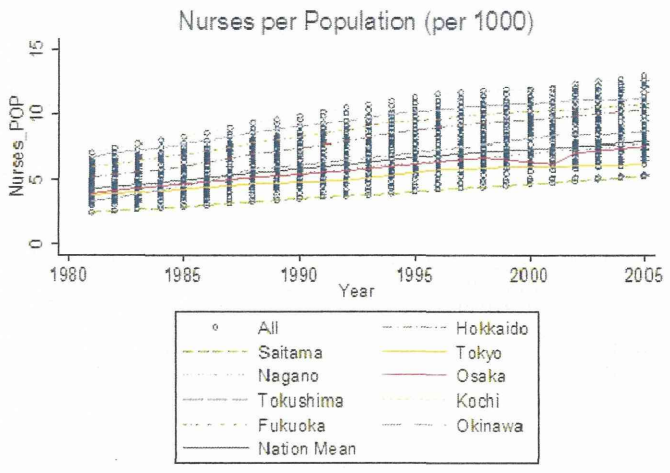
Geographical Variation of GDP



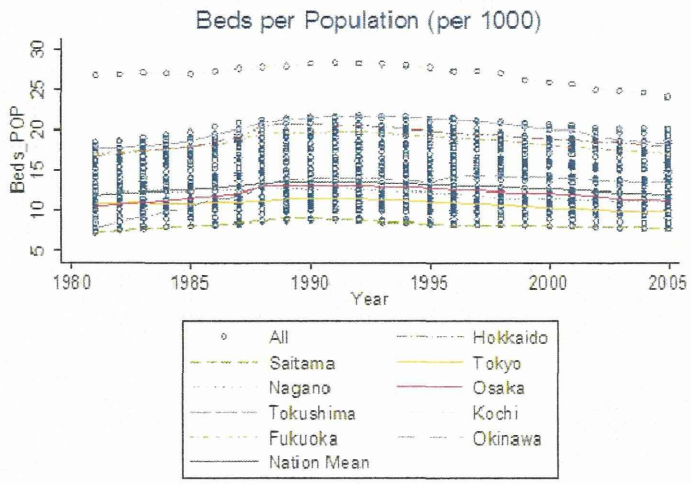
Doctors per Population(per 1,000)



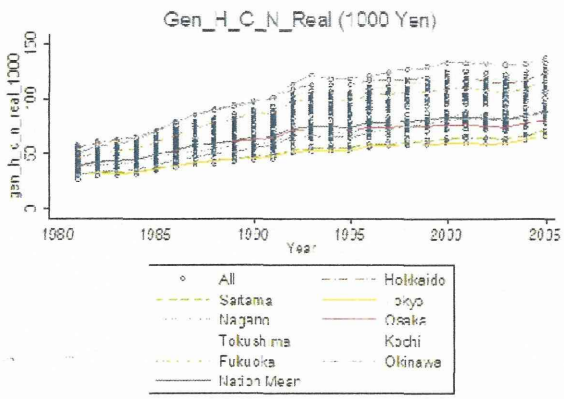
Nurses per Population(per 1,000)



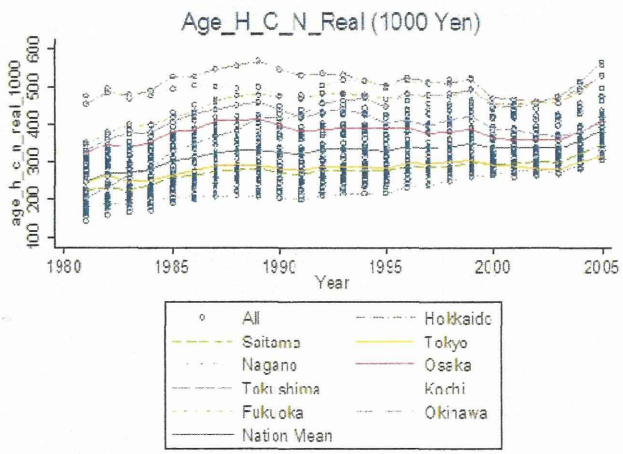
Beds per Population (per 1,000)



General Hospitalization Real Cost per Population (C/N)



Aged Hospitalization Real Cost per Population (C/N)



Method III. Accounting for the Variance Decomposition of the Variance

- C/N = (C/D)*(D/E)*(E/N)

- C/N : Cost/Person
- C/D : Cost/Day
- D/E : Days/Events
- E/N : Events/Population

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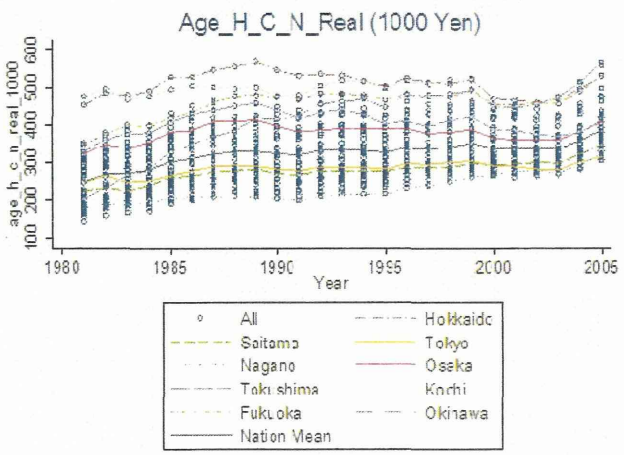
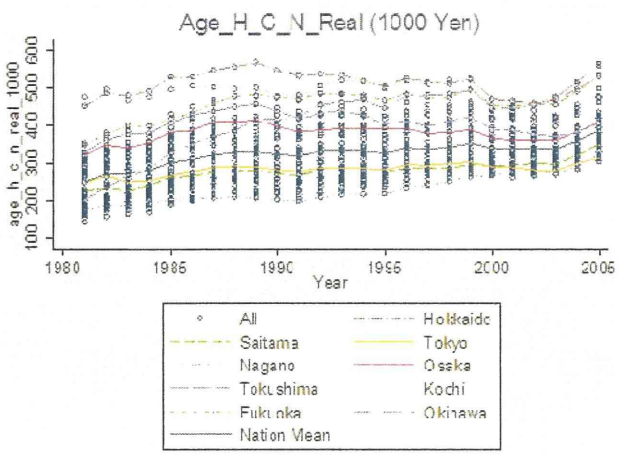
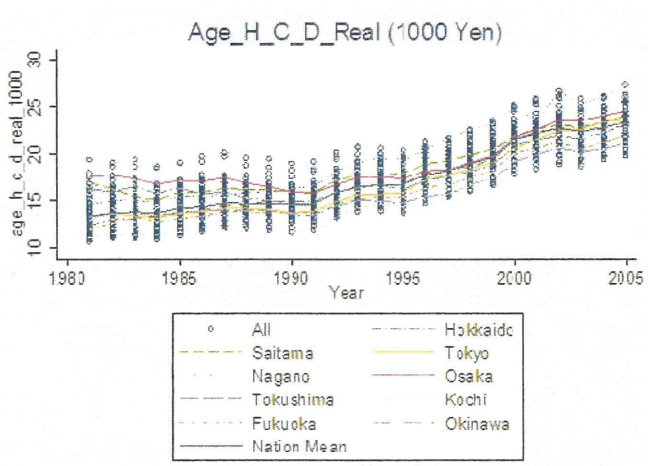
Aged Hospitalization Real Cost per Population (C/N)



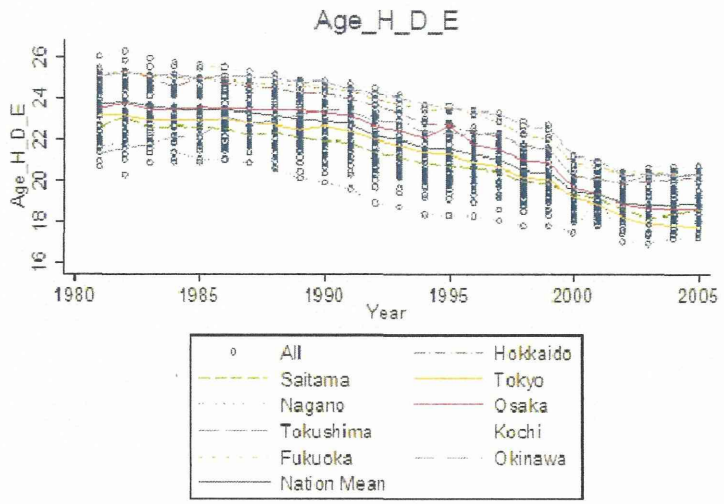
Aged Hospitalization Real Cost per Population (C/N)



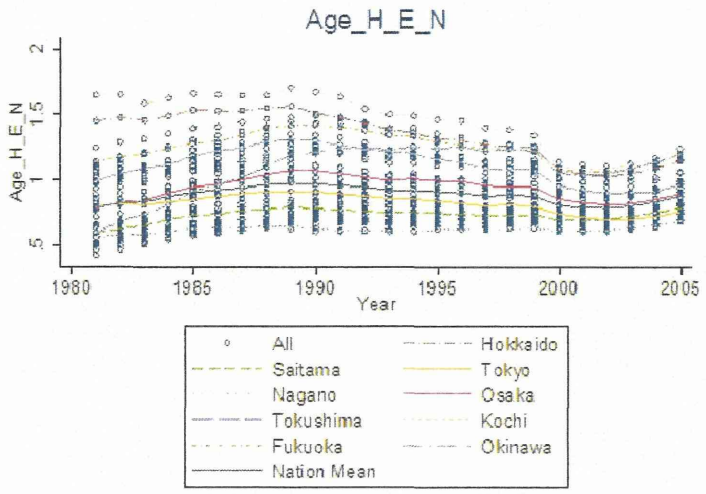
Aged Hospitalization Real Cost per Day (C/D)



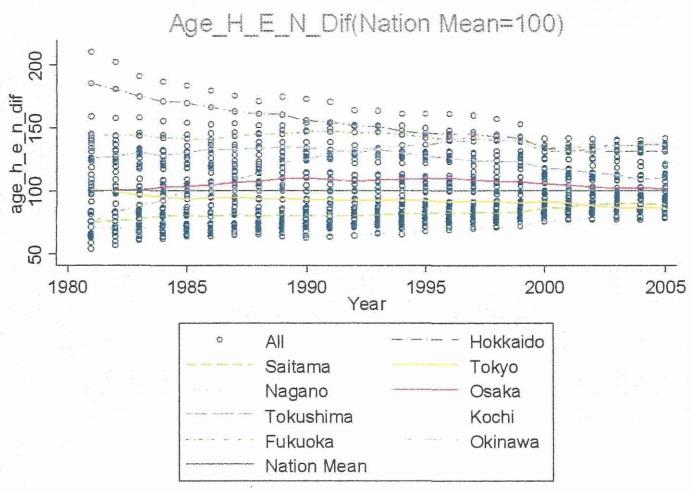
Aged Hospitalization Days per Event (D/E)



Aged Hospitalization Events per Population (E/N)



Variation of Aged Hospitalization (Events per Population : E/N)



Containment of the aged hospitalization cost?

- How has Japan tried to contain?
- C/N, C/D, D/E, E/N ?
- How is it related to geographical variations?

Method : Accounting for the Variance Decomposition of the Variance

Method of Asdrubali Sorensen, and Yosha (1996) and Nakakuki et al. (2005) for the regional variance of GDP in terms of risk absorption

$$Cov(\log z, \log x) = E(\log z \cdot \log x) - \overline{\log z} \cdot \overline{\log x}$$

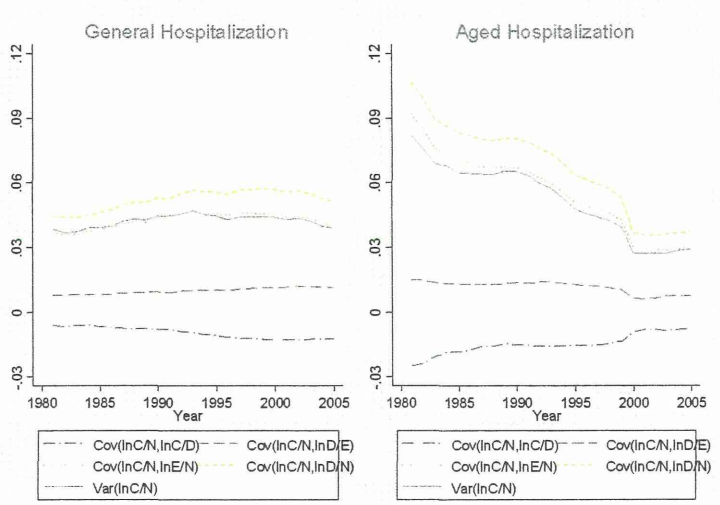
$$Var(\ln c^N_{htsi}) = Cov(\ln c^N_{htsi}, \ln c^D_{htsi}) + Cov(\ln c^N_{htsi}, \ln d^E_{htsi}) + Cov(\ln c^N_{htsi}, \ln e^N_{htsi})$$

$$Var(\ln c^N_{htsi}) = Cov(\ln c^N_{htsi}, \ln c^D_{htsi}) + Cov(\ln c^N_{htsi}, \ln d^N_{htsi})$$

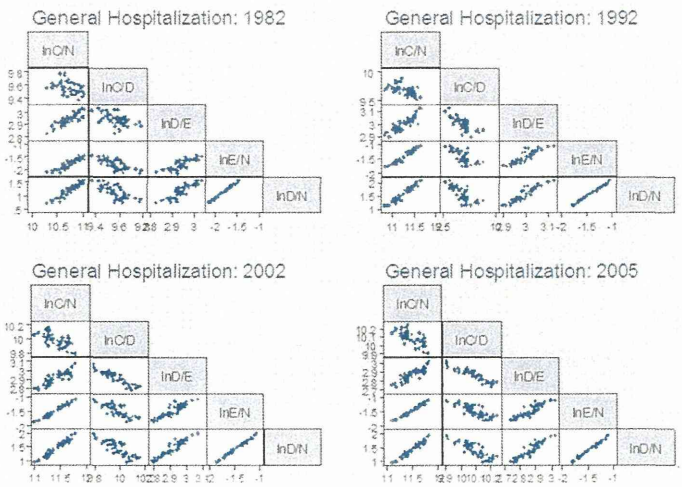
$$1 = \frac{Cov(\ln c^N_{htsi}, \ln c^D_{htsi})}{Var(\ln c^N_{htsi})} + \frac{Cov(\ln c^N_{htsi}, \ln d^E_{htsi})}{Var(\ln c^N_{htsi})} + \frac{Cov(\ln c^N_{htsi}, \ln e^N_{htsi})}{Var(\ln c^N_{htsi})}$$

$$= b_1 (\ln c^N_{htsi}, \ln c^D_{htsi}) + b_2 (\ln c^N_{htsi}, \ln d^E_{htsi}) + b_3 (\ln c^N_{htsi}, \ln e^N_{htsi})$$

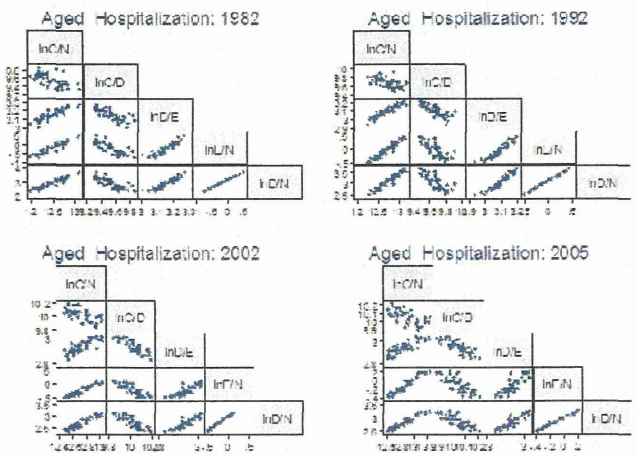
$$Var(\ln c^N_{htsi}) = Cov(\ln c^N_{htsi}, \ln c^D_{htsi}) + Cov(\ln c^N_{htsi}, \ln d^E_{htsi}) + Cov(\ln c^N_{htsi}, \ln e^N_{htsi})$$



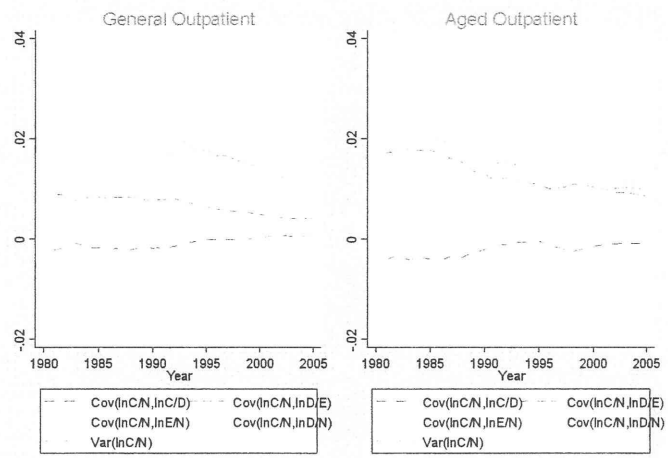
Relationship of C/N, C/D, D/E,E/N General Hospitalization



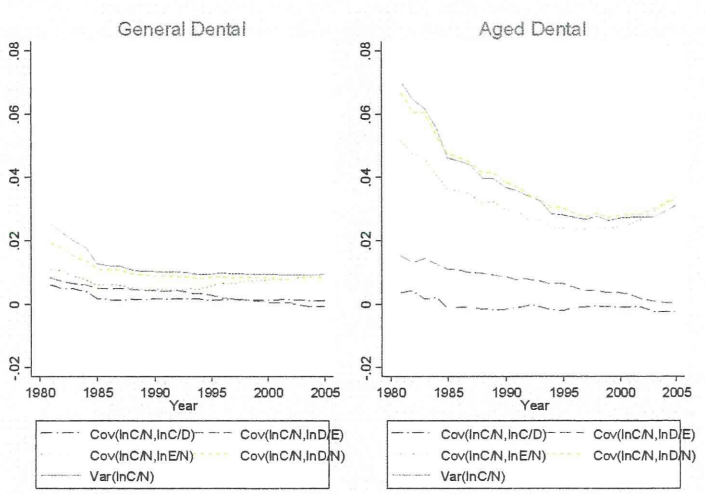
Relationship of C/N, C/D, D/E,E/N Aged Hospitalization



$$Var(\ln c^N_{htsi}) = Cov(\ln c^N_{htsi}, \ln c^D_{htsi}) + Cov(\ln c^N_{htsi}, \ln d^E_{htsi}) + Cov(\ln c^N_{htsi}, \ln e^N_{htsi})$$

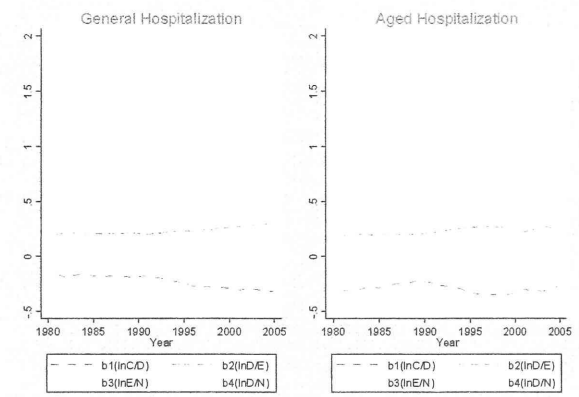


$$Var(\ln c^N_{htsi}) = Cov(\ln c^N_{htsi}, \ln c^D_{htsi}) + Cov(\ln c^N_{htsi}, \ln d^E_{htsi}) + Cov(\ln c^N_{htsi}, \ln e^N_{htsi})$$



$$1 = \frac{Cov(\ln c^N_{htsi}, \ln c^D_{htsi})}{Var(\ln c^N_{htsi})} + \frac{Cov(\ln c^N_{htsi}, \ln d^E_{htsi})}{Var(\ln c^N_{htsi})} + \frac{Cov(\ln c^N_{htsi}, \ln e^N_{htsi})}{Var(\ln c^N_{htsi})}$$

$$= b_1(\ln c^N_{htsi}, \ln c^D_{htsi}) + b_2(\ln c^N_{htsi}, \ln d^E_{htsi}) + b_3(\ln c^N_{htsi}, \ln e^N_{htsi})$$



$$1 = \frac{Cov(\ln c^N_{htsi}, \ln c^D_{htsi})}{Var(\ln c^N_{htsi})} + \frac{Cov(\ln c^N_{htsi}, \ln d^E_{htsi})}{Var(\ln c^N_{htsi})} + \frac{Cov(\ln c^N_{htsi}, \ln e^N_{htsi})}{Var(\ln c^N_{htsi})}$$

$$= b_1(\ln c^N_{htsi}, \ln c^D_{htsi}) + b_2(\ln c^N_{htsi}, \ln d^E_{htsi}) + b_3(\ln c^N_{htsi}, \ln e^N_{htsi})$$