The Definition of Metropolitan Areas in Japan and Analyses relating to them

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Abstract

In Japan, the definition of metropolitan areas has not been taken hold. Officially, Statistics Bureau, Ministry of Internal Affairs and Communications has defined Major Metropolitan Areas and Metropolitan Areas in Population Censuses. Also, "Urban and Regional Report 2005" by Ministry of Land, Infrastructure and Transport defined Metropolitan Areas. In the field of academics, Kanemoto and Tokuoka(2002) defined Urban Employment Area and the data of the areas have been provided by Center for Spatial Information Science, the University of Tokyo.

Each area consists of a core city or core cities and surrounding municipalities, although the area differs depending on the definition. Each definition and data provision has its own merits.

Then two analyses using Urban Employment Area (UEA) data are introduced. Policy Research Institute, Ministry of Land, Infrastructure and Transport (2006) performed an analysis relating to elasticity and marginal productivity of public capital stock in UEAs. As a result, for Metropolitan Employment Areas, total public capital stock was not significant. However, industrial infrastructure and infrastructure for daily life was significant when only their capital stock value was used in estimation.

The second is about the relation between concentration to Tokyo Metropolitan Employment Area in Japan and concentration to Sapporo(Sapporo-Otaru) Metropolitan Employment Area in Hokkaido Prefecture. Many big businesses in Japan have branch offices in Sapporo Area as a center of Hokkaido. The direction of acceleration in concentration seems similar. Those areas are not contiguous in spatial meaning, but still they seem to have operational connection.

Key words: Urban Employment Area, Sapporo Metropolitan Employment Area, operational connection

1. Introduction

In Japan, the definition of metropolitan areas has not taken hold. Officially, there are Major Metropolitan Areas and Metropolitan Areas defined in the Population Census by Statistics Bureau, Ministry of Internal Affairs and Communications. However, other definitions are used by another ministry or academics.

In Chapter 2, I will explain three definitions. First, I explain Major Metropolitan Areas and Metropolitan Areas described above. Second, I explain Metropolitan Areas defined in "Urban and Regional Report 2005" by Ministry of Land, Infrastructure and Transport. Then I explain Urban Employment Areas proposed by Kanemoto and Tokuoka(2002) ,of which data are provided by Center for Spatial Information Science, the University of Tokyo.

Using data relating to metropolitan areas provides quite interesting findings. In Chapter 3, I explain two research results. First, I introduce the research about the effect of public capital stock on productivity in Urban Employment Areas conducted by the Policy Research Institute, Ministry of Land, Infrastructure and Transport, which I belong to as a visiting research fellow. Then I make a comparison between concentration of population into Tokyo Metropolitan Employment Area in Japan and that into Sapporo Metropolitan Employment Area in Hokkaido.

Chapter 4 concludes the paper.

2. Definitions of Metropolitan Areas in Japan

Three definitions of Metropolitan Areas in Japan are introduced in this section.

(1) Major Metropolitan Areas and Metropolitan Areas in the Population Census

In the Population Census, conducted by Statistics Bureau, Ministry of Internal Affairs and Communications, Major Metropolitan Areas and Metropolitan Areas have been defined based on place of work or schooling tabulation in Population Census.

The following explanation is based on Statistics Bureau(2009).

Major Metropolitan Areas have been defined since 1960 and Metropolitan Areas have been defined since 1975.

Major Metropolitan Areas and Metropolitan Areas consist of a central city or central cities and surrounding municipalities. As regards Major Metropolitan Areas in 2005 Population Census, the central cities are Tokyo 23 wards ("Ku-area of Tokyo-to")and the cities designated by the Cabinet Order at the time, namely Sapporo, Sendai, Saitama, Chiba, Yokohama, Kawasaki, Shizuoka, Nagoya, Kyoto, Osaka, Kobe, Hiroshima, Kitakyushu and Fukuoka. The central city is not necessarily limited to one. Kanto Major Metropolitan Area includes Saitama, Chiba, Ku-are of Tokyo-to, Yokohama and

Kawasaki as central cities, Keihanshin Major Metropolitan Area includes Kyoto, Osaka and Kobe, Kitakyushu-Fukuoka Major Metropolitan Area includes Kitakyushu and Fukuoka. The central cities of "Metropolitan Areas" are cities whose population is 500,000 or over and which are not included in Major Metropolitan Areas.

The cities designated by the Cabinet are added time to time and the threshold of population for Metropolitan Areas are different among censuses. Thus, the areas are not common in every census.

The surrounding areas (cities, towns, or villages) are those which satisfy

1) The number of resident workers and students 15 years of age or more commuting to the central city accounts for 1.5% or more of total population.

2) The area of the municipality is contiguous to the central city (directly or via another surrounding municipality).

However a municipality enclosed by the Major Metropolitan Area or Metropolitan Area is included into the Area even if the condition 1) does not apply.

In 2005, Kanto Major Metropolitan Area has the largest population (35.68 million) and accounts for 27.9% of total population of Japan.

(2) Metropolitan Areas in "Urban and Regional Report 2005"

Ministry of Land, Infrastructure, Transport (2005) defines Metropolitan Areas.

A Metropolitan Area consists of a central city and surrounding municipalities.

A central city must have population of 100,000 or more and the ratio of its daytime occupants over nighttime occupants must be 1 or more.

Surrounding municipalities are municipalities at least 5% of whose employees and students or at least 500 of whose employees and students commute to the central city.

Ministry of Land, Infrastructure and Transport (2005) defines 85 Metropolitan Areas based on "Population Census 2000". Population in Metropolitan Areas accounts for 88.9% of total population. Land in Metropolitan Areas accounts for 44.8% of total land.

Tokyo Metropolitan Area has population of 31.58 million and is obviously the biggest metropolitan area in Japan.

(3)Urban Employment Area

Urban Employment Area (UEA) is defined by Kanemoto and ToKuoka(2002).The explanation in English on the Homepage of Center for Center for Spatial Information Science, the University of Tokyo as well as in Kanemoto and Kurima(2005). Here, UEA is explained based on Kanemoto and Kurima(2005).

Urban Employment Area consists of the core and outlying municipalities.

The building blocks of UEAs are municipalities, as many statistical data are available up to municipality level. “The core of a UEA is a collection of densely settled municipalities” whose DID (densely inhabited districts) population is at least 10,000 and that do not constitute the “outlying municipalities (suburbs) of any other core”. The core may consist of multiple municipalities.

“An outlying municipality is included in the core”, “if the employees - to-residents ratio (i.e., the ratio of the number of employees to the number of the residents) is at least unity” and “if DID population is at least 100,000 or one third of the core.” Through this definition, a city like Yokohama is included into the core of Tokyo UEA.

On the other hand, “a municipality is an outlying area of a core if at least 10% of its employed residents work in the core.” If a municipality belongs to more than one UEA according to this definition, it belongs to the UEA with the highest commuting ratio. “A second - order outlying municipality that is an outlying municipality is included as well.” The criterion for a second - order outlying municipality is that commuting tie to the first - order outlying municipality is the highest among other municipalities and satisfies 10% criterion. Higher - order municipalities are also defined in the same way. If candidates of a core city become multiple, the city with the strongest commuting tie becomes the core.

In fact, some iterative procedures are necessary in defining UEA.

UEAs are divided into Metropolitan Employment Areas and Micropolitan Employment Areas. The former areas are areas where DID population of the core is at least 50,000 and the latter areas are areas where DID population of the core is at least 10,000 and less than 50,000.

According to the Homepage of Center for Spatial Information Science, the University of Tokyo, 109 Metropolitan Employment Areas and 142 Micropolitan Employment Areas are defined based on 2005 standard. Of them, Tokyo Metropolitan Employment Area has the largest population (33,340,947).

(4)Merits

Each definition has its own merits.

For example, the areas defined by Statistics Bureau are easy to understand and it is easy to calculate figures relating to them. Urban Employment Areas are very rigid and scientific concept.

At the same time, continuous provision of data relating to areas is very important.

3. Analyses using Urban Employment Area (UEA) data

Two analyses using Urban Employment Area (UEA) data are introduced.

(1)Productivity of public capital stock in Urban Employment Areas

Policy Research Institute, Ministry of Land, Infrastructure and Transport (2006) performed an analysis relating to elasticity and marginal productivity of public capital stock in UEAs. "The stock effects of public capital stock often either extend beyond the administrative boundaries of prefectures or are limited to narrower areas." That is the reason UEA was chosen for analysis. UEAs are divided into Metropolitan Employment Areas and Micropolitan Employment Areas and panel data analyses are conducted for each of them. Elasticity and marginal productivity is estimated using Cobb-Doulas production function for total public capital stock and four sectors of it. They are industrial infrastructure (trunk roads, ports, airports etc.), infrastructure for daily life (roads for daily use, parks, sewerage, waste disposal, etc), infrastructure for disaster prevention, infrastructure for agriculture and fishery.

The estimation equation is

$$\ln(Y_{jt}/N_{jt})=A_0+a_1\ln(K_{jt}/N_{jt})+a_2\ln N_{jt}+a_3\ln(G_{jt}/N_{jt})+d_t+c_j+\underline{u}_{jt}.$$

Y_{jt}: gross products in an area

K_{jt}: stock value of private - sector capital

N_{jt}: number of employees

G_{jt}: stock value of public capital or infrastructures in 4 sectors

d_t: time series dummy

c_j: area dummy

The estimation period is from FY1974 to FY1998 (25 years). The estimation is conducted based on real price (1995 calendar year price).

Elasticity of public capital stock is a_3 and marginal productivity is $a_3 \times (Y_{jt}/G_{jt})$.

Main results are as follows.

1) Elasticity of public capital stock in Metropolitan Employment Area

In the estimation of elasticity, public capital stock is insignificant. However, industrial infrastructure and infrastructure for daily life is significant (See Table1).

Policy Research Institute (2006) concludes that "the productivity effects are observed for the industrial infrastructure and the daily life."

2) Marginal productivity of public capital stock in Metropolitan Employment Area

In the estimation of marginal productivity, public capital stock is insignificant. However, industrial infrastructure and infrastructure for daily life is significant. (See Table2)

Policy Research Institute (2006) notes that marginal productivity is the largest for industrial infrastructure.

As a problem, simultaneous bias is pointed out in the literature. That is, public capital investment may be allocated to areas with low gross products.

(2)The comparison of population between concentration into Tokyo Metropolitan Employment Area in Japan and concentration into Sapporo (Sapporo-Otaru) Metropolitan Employment Area in Hokkaido Prefecture

Sapporo is well known as "branch economy". Many big businesses in Japan have branch offices in Sapporo Area as a center of Hokkaido. And Sapporo is the center of service industries in Hokkaido. Thus, there may be a relation between the concentration into Sapporo (Sapporo-Otaru) Metropolitan Employment Area in Hokkaido and the concentration into Tokyo Metropolitan Employment Area in Japan.

Figure 1 shows concentration ratios in population in both Areas.

Though the level is different, concentration into both Areas is proceeding. Obviously both series have time trends, so first differences of both series are calculated in Figure2.

Here, the direction of acceleration in concentration seems similar.

However, to prove whether concentration to Tokyo has an effect on concentration to Sapporo thorough branch economy needs much more data accumulation.

4. Conclusion

In this paper, I introduce three definitions about Metropolitan Areas in Japan. Each has its own merits. For example, The Urban Employment Areas are very rigid and scientific concept. Maybe policy makers or researchers should decide the suitable definition owing to their purpose.

Then, I introduce two analyses using UEA data. The one is the analysis about productivity of public capital stock conducted by Policy Research Institute, Ministry of Land, Infrastructure and Transport (2006). The other is about concentration ratio of population towards two areas. Not only spatial connection but operational connection may be important. And at the same time, continuous data accumulation based on areas is very important for any analysis.

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Table1 Elasticity of public capital stock in Metropolitan Employment Area

	Elasticity
Public capital stock	0.013
Industrial infrastructure	0.015 ***
Infrastructure for daily life	0.033 **

*** 1% significant ** 5% significant

Source: Policy Research Institute (2006)

Table2 Marginal productivity of public capital stock in Metropolitan Employment Area

	Marginal productivity
Public capital stock	0.021
Industrial infrastructure	0.189 ***
Infrastructure for daily life	0.078 **

*** 1% significant ** 5% significant

Source: Policy Research Institute (2006)

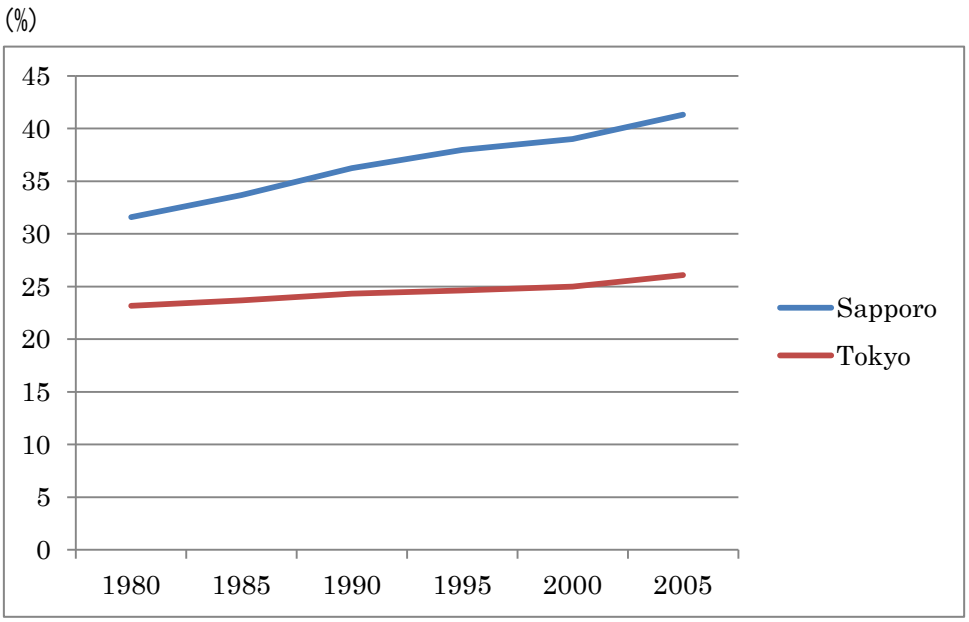

Figure1 Concentration Ratios into Metropolitan Employment Areas

Source: Author's calculation from the Homepage of Center for Spatial Information Science, the University of Tokyo and the Homepage of Statistics Bureau, Ministry of Internal Affairs and Communications

Note: Population in Metropolitan Employment Areas (Center for Spatial Information Science, the University of Tokyo) is divided by Population of Hokkaido or total Japan (Statistics Bureau, Ministry of Internal Affairs and Communications).

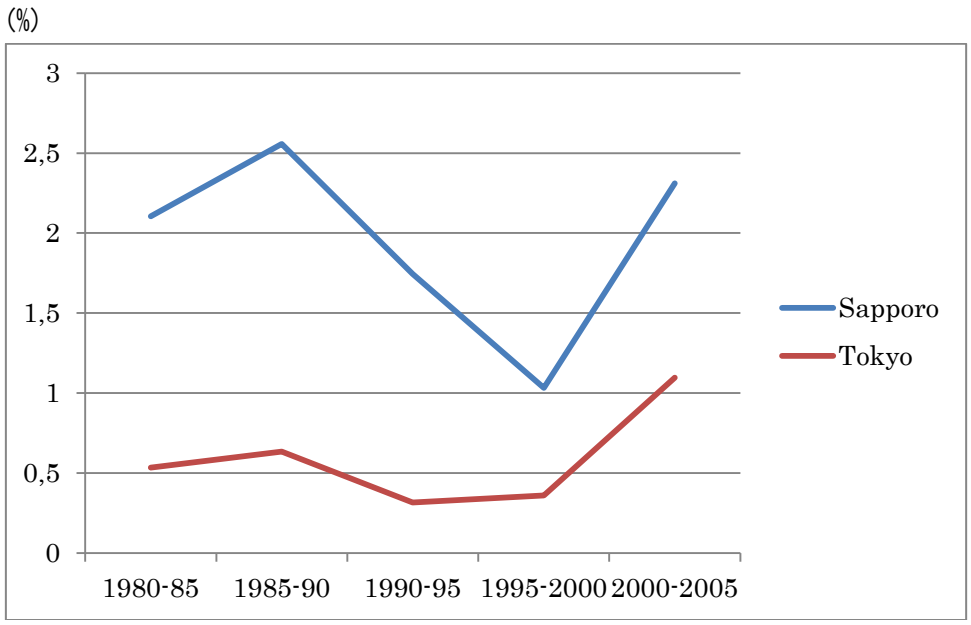

Figure 2 First Differences

Note: Author's calculation