A hypothesis and an inspection
on location polarization of economic activity
and population due to economic globalization

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Abstract

In response to the globalization manufacturing firms fragment their production processes into small blocs. The fragmented blocs are shifted to sites suitable to their characteristics in processing. Location changes of the factories and management facilities which govern the spatially separated factories alter not only economic composition of a city but also spatial organization in urban system. This paper, first, proposes a theoretical hypothesis which sheds light on the location mechanism of the globalization in altering urban systems. This hypothesis explains from the perspective of the location theory that a few major cities of which economic activities is adequately diversified attract more and more workers and consumers; some middle-sized cities from which the fragmented processes and relatively large retail stores outflow decrease in volume of economic activity and population; and many small cities entering the fragmented processes are characterized by a single industry. The globalization changes the location patterns of economic activities in regions so that it generates many urban systems that are composed of a large and diversified city and many small and simplified cities. Secondly, the present paper tests the hypothesis described above by analyzing the distributions of the employees of manufacturing, retail, finance sectors, and population of all cities in Japan and Sweden. It is shown in the inspection that the medium scale cities lose their vitality in the production and retail activities; due to the decay of these cities, location distributions of production and retail activities are divided into a large city and many small cities. It is also elucidated in this analysis that the distribution of production activity in the urban systems in existing industrial area has a tendency to be relatively leveled, while the distribution in the urban systems in rural area is relatively converged toward a large city. The results obtained in the inspection are not inconsistent with the essence of the theoretical hypothesis.

Key words: Globalization, Fragmentation, Market area, Urban system, Spatial organization

Ⅰ Introduction

Deregulation, tariff reductions and declining transport costs have been promoting integration of many local markets to establish a large spatial market. The unified market covers almost the entire continent so that the term of globalization has becomes a common word. Naturally, the globalization influences the economic composition of individual cities but also spatial organization of urban systems in many countries: It induces a harsher price competition among manufacturing firms and raises in turn a cost competition between strong manufacturing firms survived the competition. To correspond with the cost competition these firms fragment their production processes into small blocs to reduce total production costs. These fragmented production blocs are shifted from the existing industrial places to other sites suitable to their production nature. Meanwhile, these fragmented processes are governed by the supervising function in order for them to successfully operate in the firm's production streams. This function involves various kinds of the supporting facilities which are concerned with the information, logistics, and finance activity. These management and supporting facilities concentrate at a few large cities in order to employ various kinds of labors.

Similarly, the retailing firms also arrange the locations of the sales facilities in response to a new emerging sales environment and changing taste of consumers which have been accelerated by the globalization. Many Large and medium scale retailing firms in major cities have trend to expand the selling area in order to cope with consumers who attach importance to variety of goods. Some of medium scale stores in the middle-sized cities are likely to reduce their goods assortment to deal with more daily commodities than high-grade goods since these cities cannot attract adequate potential consumers from surrounding area. While small retailing firms in small cities keep their operations by providing daily goods in small market area in regions.

These location changes in both the manufacturing and retailing sector contribute to alter the spatial economic structure in urban system: A few major cities which become larger and more diversified in the economic organization: Some middle-sized cities from which production processes and relatively large retail stores outflow decline the volume and vitality in both production and retail sector. Many small cities dealing with daily commodities do keep status quo, and small cities entering production processes are characterized by a single industry. The spatial economic structure of in the urban system[1] is greatly changed by the globalization.

On the one hand, the globalization contributes to alleviate economic disparity among workers and cities by widely diffusing production processes across regions. Many of the cities entering production processes have an opportunity to vitalize their economic activity. On the other hand,

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[1] The importance of the urban system in regional economy is pointed out many scholars, for example, see Capello (2007).

it widens the disparity among workers and cities because the kind of employment is polarized into two groups, simple and complicated, and wage rates largely relay on the group; in addition, location of the two kinds of employment is determined by the cities' economic characteristics. The globalization makes the spatial economic organization in regions complex and often creates a cause of social problems. It is thus the first step for the improving the regional society to know the mechanism in which the globalization changes the spatial economic structure in the urban systems.

The paper is organized as follows. Section II explains the location sifts of factories and the retail stores in response to the globalization, and it proposes a hypothesis that elucidates the mechanism in which the distribution of economic activities in region is divided into a large city and many small cities. In Section III the attempts to verify the hypothesis are conducted by the empirical analysis of cities in Japan and Sweden. These attempts reach the evaluation that the results obtained from the inspection are not inconsistent with the essential contents of the hypothesis. Section IV summarizes discussion.

II A hypothesis of location distribution of economic activities and population
1 Distribution of production activity in urban system
1-1 Location change of production processes due to globalization

If the economic barriers separating a local market from other markets are taken down, manufacturing firms have a chance to sell their goods to other local markets, while the firms are exposed to the risk that similar goods produced by the outside are sold in their own markets. Demolition of the barriers induces a mega-competition among the firms in the large market. This competition expels frail firms from the market, and then, it raises a new harsh competition between the survived firms. Under this competition the price of goods plays a crucial role, the manufacturing firms lay a stress on the strategies to reduce the total production costs in order to cope with the price competition. A primary the strategy is to subdivide the production process into several small blocs. Because this subdivision simplifies the operation of each production bloc, it is easy to enjoy economies of scale in the production by introducing machineries. And the subdivision facilitates usage of a number of unskilled labors with low wage rates in the production process. The manufacturing firms, therefore, fragment the production processes to achieve the lower total production costs.

Furthermore, since each fragmented production process becomes small and simple, they are easily moved in the long distance. The manufacturing firms can shift many of processes from the existing site to other location places with low-wage labor or low land rent. As a result, many fragmented production processes are scattered across

regions and countries. It implies that the globalization changes the existing location patterns of the factories by the subdivision of the production processes.

Meanwhile, the fragmented processes spread over regions and countries must be linked by the supervising and management functions. These functions are managed by many high-skilled workers able to use advanced knowledge and familiar with the contents of the entire production processes. These supervising and managements' facilities are located at a few large cities in the existing industrial area. The supervising function needs various kinds of supporting businesses which employ many kinds of experts with high-wage rates. They also are concentrated in the same large cities.

Since various kinds of workers are concentrated at a large city, the large city becomes not only a larger labor market but also a larger consumer-goods market. Hence, the large cities attract many diverse and market-oriented industries so that these are likely to be larger and more diverse city.

1-2 Change of spatial production structure in urban system

Traditionally, the manufacturing firms located their production processes in large and medium scale cities in the existing industrial area where the processes could enjoy a variety of scale economies. By the progressing globalization some fragmented production processes move out of the large and medium scale cities to small cities and /or to cities in rural areas. Corresponding to this location change, urban systems are altered: Although large cities lose some fragmented production processes, as explained above, it can maintain or increase in its economic volume and diversity since it attracts the supervising functions and the market-oriented industries. Meanwhile, the medium scale cities lose some fragmented production processes to other areas and reduce the production activity if these cities do not have any attractiveness specific to them. Small cities in which the fragmented processes flow have an opportunity to vitalize their economy, and their industrial structure is characterized by almost a single industry. It is thus said that the globalization reduces the level of the production activities in medium scale cities so that a few large cities and many small cities become to play a more important role in supporting the production activity in the urban systems.

2 Distribution of retail activity in urban system
2-1 Location change of retail firms due to globalization

In order to examine the effects of the globalization on the urban system from the viewpoint of the retailers' location, it is useful to classify the retailing firms into three groups according to the selling style and goods dealt with in store. Based on this

criterion, the retailing firms can be classified into the convenience store, the supermarket store, and the medium scale department store. Each kind of store is characterized as follows. Convenience stores usually sell low-price goods, and these stores are primarily visited by consumers for convenience. Supermarket stores are available to consumers for the purpose of purchasing daily necessities where the criterion of purchases is the price as well as customary preferences. Middle-sized department stores attach importance to supplying full good assortments to consumers who focus on the preference, quality and design of goods rather than the price level.

Now, the globalization makes it easy to move goods in the long distance so that much more diversified goods can be supplied to consumers. Naturally, consumers have a trend to purchase more variety of goods. This trend affects the retail firms' inventory strategy. Especially, the medium scale department stores make efforts to increase in the level of verity of goods as much as possible. And the trend which consumers prefer to variety of goods leads consumers to a large city where consumers enjoy more variety of goods in their shopping. The medium scale department stores in large cities easily expand their selling area in order to cope with the consumers' taste, while some of the medium scale stores in the middle-sized cities face the risk to reduce their retail functions to deal with daily commodities like supermarket stores. Because the middle-sized cities cannot absorb potential consumers which are needed to sustain the department store. Many convenience stores continue to operate retailing activity by providing consumers with daily goods[2]. The globalization alters location pattern of retailing firms as well as that of manufacturing firms.

It is, therefore, said that the globalization reduces the retail activity level in medium scale cities so that a few large cities and many small cities become to play a more important role in supporting the retail activity in the urban systems.

2-2 Location change of the retail firms due to expanding market area

Because the decay of the retail sector in the middle-sized cities plays crucially important role to change the spatial economic structure in the urban systems. It is surely worth to inquire the mechanism in which the retail firms in these cities reduce their activity level. In this context, the analysis of the effect of reducing transport costs on the market area size of the retail firms may contribute to understand the mechanism. This subsection thus analyzes the change of the equilibrium market area of the retailers by the reduction of transport costs, and it shows that the expansion of the market area of the medium

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[2] If consumer density in a market area falls, some stores in small cities also disappear since they cannot maintain the necessary market size.

scale department stores is a cause to decline the retail activity of the middle-sized cities.

2-2-1 Framework of analysis of the market area size

A market area size of a retail firm under spatial monopolistic competition is firstly examined, and then, the examination will be expanded to cover three kinds of the retailers, convenience store, supermarket store, and medium sized department store.

The analysis of the retailers' markets is implemented under following assumptions.

(I）Consumers live evenly in area with density D. They have liner demand function:

$$q=a-p_r-tu \tag{1}$$

where q is quantity demanded, a is the maximum reservation price. p_r is price of goods. t is the transportation cost per mile, u is distance from a consumer to a retailer.

(II）All consumers should be supplied with goods and the profits of the retailers should be equal. The retailers must have the same market area: Hexagonal market area is assumed. Under the assumptions of (I) and (II), quantity sold by a retailer in a market is expressed DQr, and Qr is derived by equation (2),

$$Qr=12\int_0^{\pi/6}\int_0^{U/\cos\theta^*}(a-p_r-tu)udud\theta \tag{2}$$

where U is the radius of the inscribed circle of market in question.

(III）Retailer's cost function is given by equation (4),

$$C= k\ DQr + Fr\ . \tag{3}$$

where C is total cost, k and F_r are marginal cost and fixed cost, respectively. Profit of a retailer Y_r, therefore, is given by equation (4),

$$Y_r=(p_r - k)\ DQr - Fr. \tag{4}$$

(IV）Retailer sets price to maximize its profit. The price is obtained by equation (5),

$$\partial Y_r/\partial p_r=(p_r -k)(d\ Qr\ /d\ p_r +\partial Qr\ /\partial U \cdot dU/d\ p_r)+ Qr =0 \tag{5}$$

(V) Since market is under free-entry, new retailer enters the market until the retailer's

profit becomes zero. Thus equation (6) should be satisfied in free-entry equilibrium,

$$Y_r = (p_r - k) Qr - Fr /D = 0 \qquad (6)$$

The free-entry equilibrium conditions are shown by equations (5) and (6). Solving simultaneous equations (5) and (6) with respective to U and p_r gives an equilibrium market size and price. The value of dU/dp_r in equation (5) is depend on the relationship between the retailers: the value is determined by equation (7),

$$dU/dp = (dp'/dp_r - 1)/2tRh, \qquad Rh = 2/3^{0.5} \qquad (7)$$

where p' is the price of the most distant firm among the neighboring rival firms. dp'/dp_r is the conjectural variation of price. When the value of dp'/dp_r is equal to zero, the Nash equilibrium solution is derived, while the value is 1and -1, so-called Lösch and Greenhut-Ohta equilibrium are obtained[3]. According to the competition style among retailers, the equilibrium values vary.

2-2-2 Relationship between the retailer's form and competition style

The value of the conjectural variation of price can be linked with the completion style among retailers: In the competition between the convenience stores, the difference in the retail prices is easy known to every retailer and the difference is quickly broken down by the retailers. Thus, the completion can be corresponded to the Lösch completion type. In the competition between the supermarket stores, it takes some time for them to arrange the price difference. Therefore, when the retailers change their price, they usually infer that the rivals' price would remain the same level. This completion is linked to Nash competition. In the case of the medium scale department stores, they do not immediately response the price difference from the rivals since the customers of the departments are not sensitive to the price difference, but they relatively lay stress on preference and the brand of goods. If the department stores seek for maximizing profits, it is consistent for them to infer that rivals raise the price by a unit when the store lowers its price by a unit. This completion is linked with Greenhut-Ohta completion style[4].

2-2-3   Change of the price and market area due to reducing transport costs

As shown by Ishikawa-Toda (1998), the market size of the retailers varies quite

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[3] See Capozza and Van Order (1978) and Ishikawa-Toda (1998).
[4] See Schöler(1993).

differently according to the three competition style when transport costs fall. Figure 1 shows the three paths of the change of the equilibrium values when the transport costs falls from 1.47 to 0.4, assuming that $F=0.05a^4$, $k=0$, $D=1$.

In Figure 1 point Z indicates the equilibrium values p=0.25a, U=0.4431a when the transport costs reaches at the upper bound of 1.47. If the Lösch competition style prevails in the market, lower transport costs imply smaller market area and higher price. The path of their changes is shown by the line Z-L. In the Nash competition lower transport costs imply, first, smaller market area before leading to larger market. The path of the change is shown by the line Z-N.　The line Z – G-O illustrates the change of the equilibrium values in Greenhut-Ohta competition. Table 1 shows the accurate equilibrium market area size for the five levels in the range from1.4 to 0.2.

Figure 1 Changes of the equilibrium values due to reducing freight rates
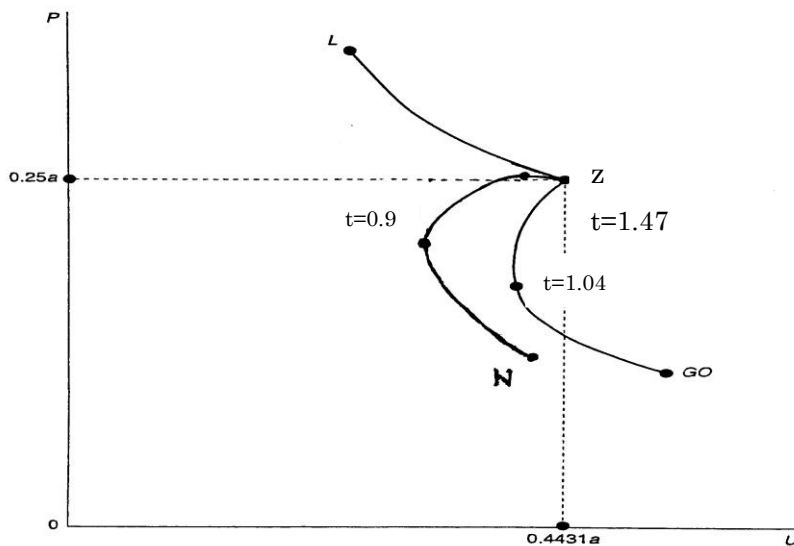

Table 1　Changes of market area size U due to reducing freight rates

t	Lösch	Nash	Greenhut-Ohta
1.4	0.3891a	0.3945a	0.4095a
1.2	0.3346a	0.3499a	0.3798a
0.4	0.2591a	0.3633a	0.4382a
0.3	0.2539a	0.3878a	0.4723a
0.2	0.2490a	0.4304a	0.5293a

Because the fixed costs and the maximum reservation price are different between convenience store and department store, their equilibrium prices and market area sizes become much more different than those shown in Figure 1 and Table 1.

Meanwhile, it is interesting to know the effect of reducing population density on the retailers' price and market area size. It is shown from the term of F/D in the equation (7) that as the population density lowers, the retailer's market area becomes larger irrelative to the competition style prevailing in goods market.

2-2-4　Characteristics of the competition styles

According to the above analysis of the changes of the market size of the competition styles, the characteristics of these styles are summarized as follows:
 (1) Lösch competition is the style to induce the new competitor to the market. Because this style makes the necessary market size smaller, it gives the market space to new retailers in the goods market area.
 (2) Greenhut-Ohta competition is the style to expel the existing competitor from the goods market. Because this style makes the necessary market size larger, it does not provide the space for the existing retailers to operate in the market.
 (3) Nash competition style has the both characteristics which the Lösch and Greenhut-Ohta competition possesses, respectively.

2-2-5　Polarization of the location distribution of the retailing firms

As transport costs fall, the market areas of medium scale department stores, which belong to the Greenhut-Ohta competition style, become larger. The expansion of these market areas decisively alters the location pattern of these stores, and gives a crucially important impact on the retail structure of the urban system. If the market areas of these stores must be expanded to maintain their operation, the stores at large cities are relatively ease to expand the market areas since large cities have some ways to attract potential customers. But, since middle-sized cities do not have the same attraction power as large cities, departments in the middle-sized cities cannot easily expand their market areas. Some of them are forced to reduce the retail function to deal with more daily commodities than high-grade goods, and others disappear from these cities. Because medium scale department stores often have played a crucial role in the tertiary sector of the middle-sized cities, the decay of the stores seriously damages the retail activity in these cities, Due to this decay, the location distribution of the retail firms becomes divided into a few large city and many small cities. It thus can be said from the viewpoint of the location of the retailing activity that the globalization generates many

urban systems which are composed with a large city providing a variety of goods and many small cities dealing with daily goods.

3 Hypothesis on change of distribution of economic activity in urban system

It is possible to establish a hypothesis that the globalization leads the manufacturing and the retailing activities in the medium-sized cities to decline: Due to decay of these cities, the distribution of economic actives and population in urban systems is divided into two parts, a large city and many small cities: As a result, a many urban systems are composed with a large and diversified city and many small and simple cities.

It is worth to notice the following facts: The globalization moves the locations of the production processes and the retail stores. In this case, the geographical removal distances of these locations are considerably different between the two industries; the distance of the production processes can be much longer than that of the retail facilities. Hence, while the effects of the change of the retail stores on the economic structure go in an urban system, those of the production processes go beyond the several urban systems. The globalization alters the organization in urban system in different ways.

III An inspection of the hypothesis
1 A test of the hypothesis by empirical analysis

In order to test the hypothesis the following two objects are inquired by using the data of Japan and Sweden during 1990s in which the globalization made greatly progressed.

1) Assuming that the country as a whole is covered by an urban system, it is inquired how the middle-sized cities' shares of labors and population decline during 1990s. In this examination the data of the employees of the manufacturing sector, the retailing, and the finance/insurance are used[5].

2) Even if it would be shown the fact that the distributions of labors and population are divided into a large city and many small scale cities, it is not clear whether these distributions in a region are biased to a large city or they are leveled between cities. This question is examined by using the quotient of convergence (the derivation method of the quotient is shown in Appendix.).

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[5] The data of Japan are provided by the data book (Toyo keizai, 2002) and the census of Japan (Statistics Bureau, Ministry of Public Management in Japan1990and 2000).The data of Sweden are cited from Statistics Sweden.

1-1 Reduction of economic activity in middle sized cities in Japan

1-1-1 Reduction of middle-sized cities' shares of manufacturing labors

Let us examine the reduction of the middle-sized cities' shares of the manufacturing labors in Japan. This analysis is conducted as follows. There are cities of 659 in Japan as of 1990. The share of the number of labors in the manufacturing sector is derived for 659 cities. In turn, the ranking of the city is carried out at order with large share.   The same procedures are taken as of 2002. And then, the variation or the percentage of the variation of the share of the each ranked city between 1991 and 2002 are derived.

Table 2A illustrates the variation of the share of each ranked city in the range from the 15th to the 240th. The rank of cities which decrease the share is converged to between the 28th and the 97th.   It is obvious that the medium scale cities, which are in the second rank in the urban system, decrease in the share of the manufacturing labors.

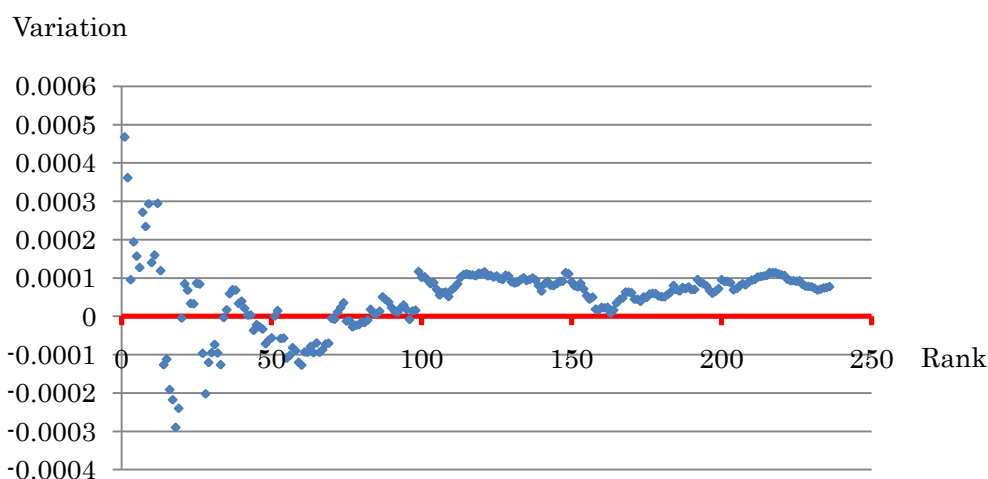**Figure 2A   Decrease in the medium cities' shares of manufacturing workers**

Variation

Figure 2A$_1$ covers all cities in Japan. It shows the percentage of the share variation of each ranked city. In the rank lower than the 98th, there is no city which decreases in the share, and, lower rank city leads to higher positive percentage of the variation. It is obvious that all small cities less than 98th raise the activity standard in the manufacturing industry[6].

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[6] Herfindahl index is derived as 0.0092 and 0.0061 for 1992 and 2002, respectively. The distribution of the share in Japan becomes to be leveled in1990s.

Figure 2A$_1$ Percentage of the variation of shares of manufacturing workers

Percentage of variation
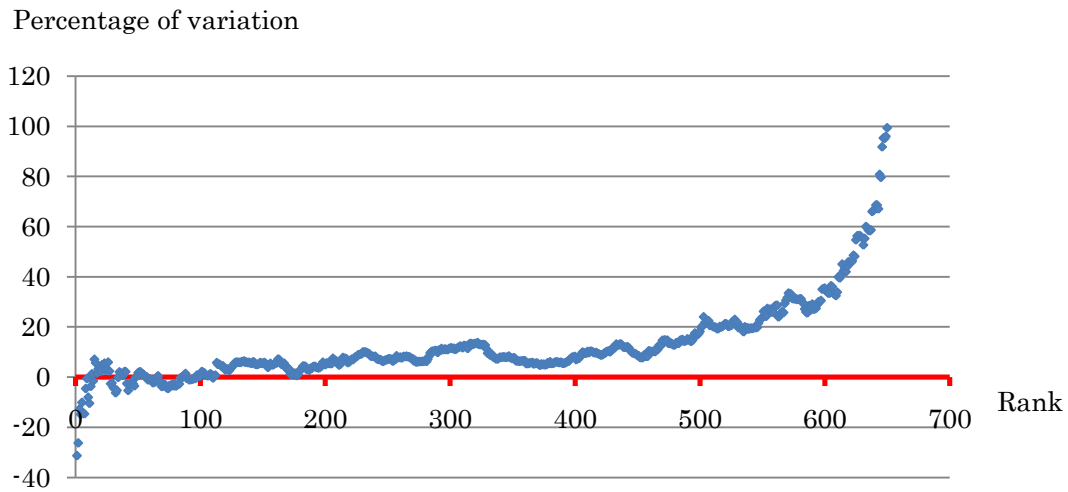
1-1-2 Reduction of middle-sized cities' shares of retailing workers

The percentage of the variation of each ranked city's share of the retailing workers is shown by Figure 2B. It illustrates that the many cities of which share decreases are in between the 23 and the 120th; there is no city which decreases the share in the range lower than the 238th. It can be said that the medium scale cities lose the activity volume in the retail sector as well as the manufacturing.

Figure 2B Decrease in the middle size cities' shares of retailing workers
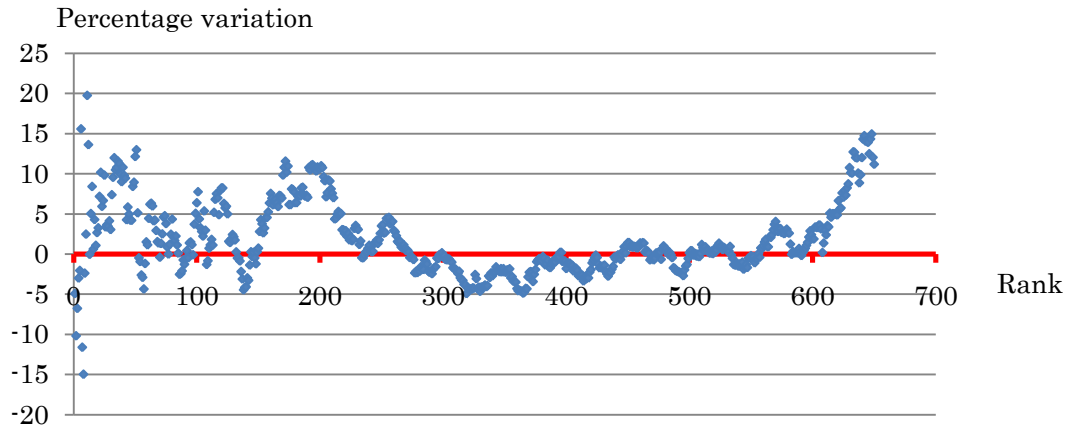
Percentage of variation
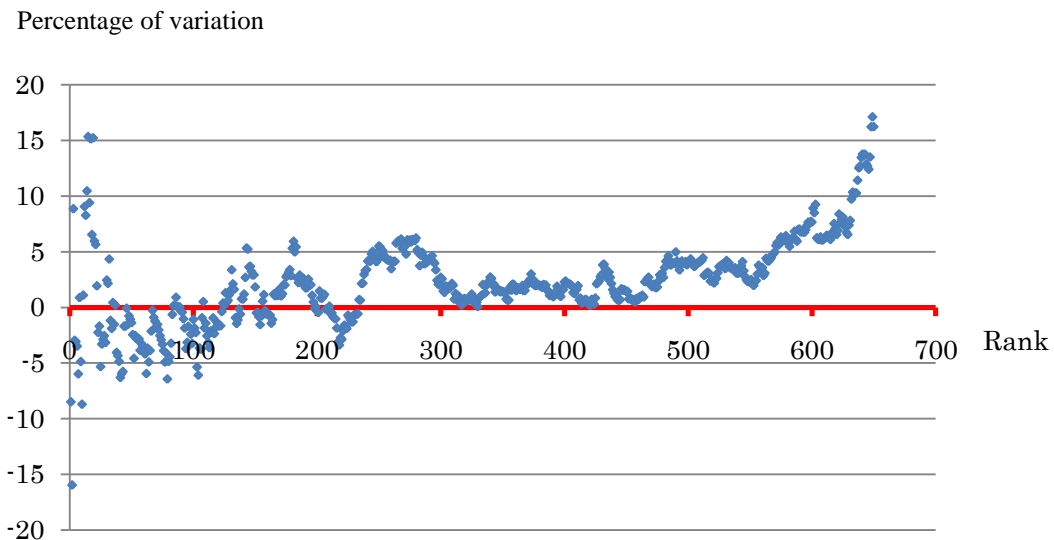
1-1-3 Reduction of the middle cities' shares of finance/insurance workers

Figure 2C shows the percentage of the increase and decrease of the share of the cities. As shown in this figure, the cities of which shares decrease are converged to between the 273rd and the 445th. There are 33 cities of which shares decrease in between the 15th

to 150th. The cities of which share of the finance/insurance workers decrease is almost confined to the lower middle part of the range.

Figure 2C Decrease in the middle cities' shares of finance/insurance workers

Percentage variation

1-1-4 Reduction of middle cities' shares of population

Finally, the variation of each ranked city's population share is inquired. Figure 2D shows the percentage of the increase and decrease of the share of the cities. There are 191 cities of which share decreases in between the 15th to the 250th. There is no city of which share decreases in the range lower than the 388th. It is thus obvious that the middle-sized cities tend to decrease in the share of population.

Figure 2D   Decrease in the middle cities' shares of population

Percentage of variation
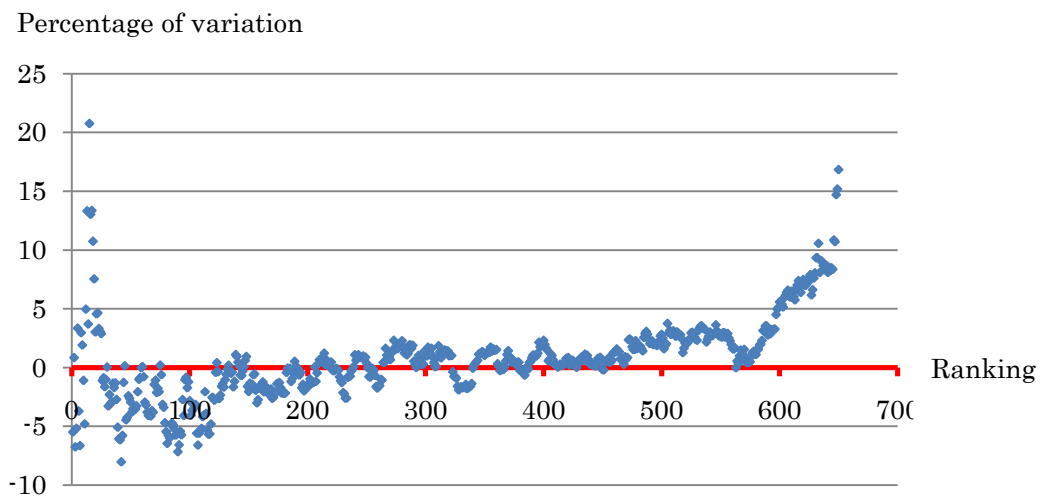
1-2 Distributions of economic activity and population in urban systems

Now, let us inquire if the change of the cities' shares of the number of employments and population in 1990s makes their distributions converge to a large city or level among cities in urban system. There are 47 prefectures in Japan. It is safe to say that an urban system is laid in a prefecture. It is possible to classify 24 prefectures into the existing industrial area and 22 ones to the rural area (since Okinawa prefecture is an isolated island, it is excluded in the examination). The industrial prefectures are shown by the black painted area in Figure 3.

The distribution change of the labors and population in the urban systems is examined for the existing industrial area and the rural one. The change is indicated by quotient of convergence, QC. Lower quotient implies that the distribution is more converged to a large city, higher quotient means the distribution becomes level between cities in an urban system.

First, the values of QC of the three industries' labor distributions are obtained for 46 prefectures as of 1990 and 2002. And then, the average values of QC in the two areas are derived. Comparison of the two average values at the two different times shows the direction of the change of the distributions in the two areas, converging to a large city or leveling between cities. Table 3 illustrates the average values of QC in the two areas as well as the directions of the changes of the distributions in the two areas in 1990s.

Figure 3　Existing industrial regions and rural regions in Japan
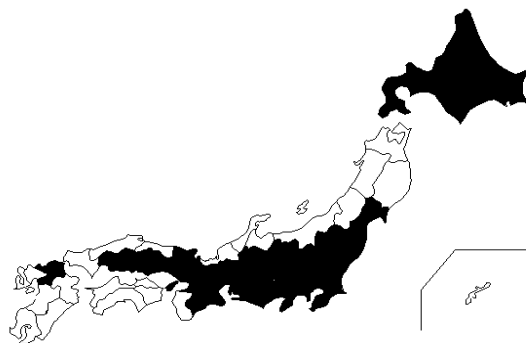
From the figures shown in Table 2, the followings are founded for each of the three industry sectors and population in Japan.

Table 2　Change of distributions of economic activities and population in Japan

Manufacturing	Existing industrial area	Rural area
Average QC in 1992	0.6096	0.6327
Average QC in 2002	0.6355	0.6305
Variation of Av. QC	＋0.0258	-0.0022
Number of prefecture, leveling	20	9
Number of prefecture, converging	4	13
Retailing		
Average QC in 1991	0.5363	0.5298
Average QC in 2002	0.5426	0.5374
Variation of Av. QC	＋0.0063	＋0.0077
Number of prefecture, leveling	16	10
Number of prefecture, converging	8	12
Finance/insurance		
Average QC in 1990	0.3761	0.3565
Average QC in 2000	0.3788	0.3569
Variation of Av. QC	＋0.0028	＋0.0005
Number of prefecture, leveling	13	10
Number of prefecture, converging	11	12
Population		
Average QC in 1991	0.5531	0.5569
Average QC in 2002	0.5605	0.5543
Variation of Av. QC	＋0.007	-0.003
Number of prefecture, leveling	18	9
Number of prefecture, converging	6	13

(1) The manufacturing factories diffuse from large cities in the existing industrial area to the neighboring small cities in this area and disperse to relatively large cities in the rural area. As a result, the manufacturing labors distribution is leveled in many urban systems in the existing industrial area. While in many urban systems in the rural area the distribution converges to a large city. Furthermore, it is interesting that the value of QC in rural area becomes higher than that of the existing industrial area in 1990s.

(2) The retail industry in small cities in the existing industrial area raises the activity standard, while that of the large cities relatively falls. Thus, the distribution of retailing workers in many urban systems in the existing industrial area has a tendency to become level. While the distribution change of the retailing workers in the rural area is evenly

divided into the two ways, to converging and to leveling.

(3) The distribution of the finance/insurance activity primarily has a tendency to centralize at the large cities in the nation and the central cities in regions. There is not a remarkable difference in the change of the distribution between the existing industrial area and the rural one.

(4) Population distribution of many urban systems in the rural area converges to a large city, while in the industrial area the distribution has a tendency to be leveled. The trends in the distribution are almost same with those of the manufacturing industry.

## 2 A test of the hypothesis by using Swedish dada
2-1 Reduction of economic activity and population in medium scale cities
2-1-1 Reduction of medium scale cities' shares of labors in production sector

Let us examine the reduction of the middle-sized municipalities' shares of the labors in producing sector in 1990s in Sweden.

Figure 4A illustrates the variation of the share of each ranked city from the 50th to 289th. Figure 4A does not cover the range from the 1st to 49th since the variations of the large cities are too high to show them in this figure. Many of the cities which decrease in the share are in between the 70th and the 228th. Especially, the cities from the 100th to the 150th greatly decrease in their shares. While there are 24 municipalities which increase in their shares in the range higher than the 29th and small municipalities lower than the 230th also raise their shares. It is said that the medium scale municipalities greatly decrease in the share of the production workers.

Figure 4A   Decrease in medium cities' shares of labors in the secondary sector
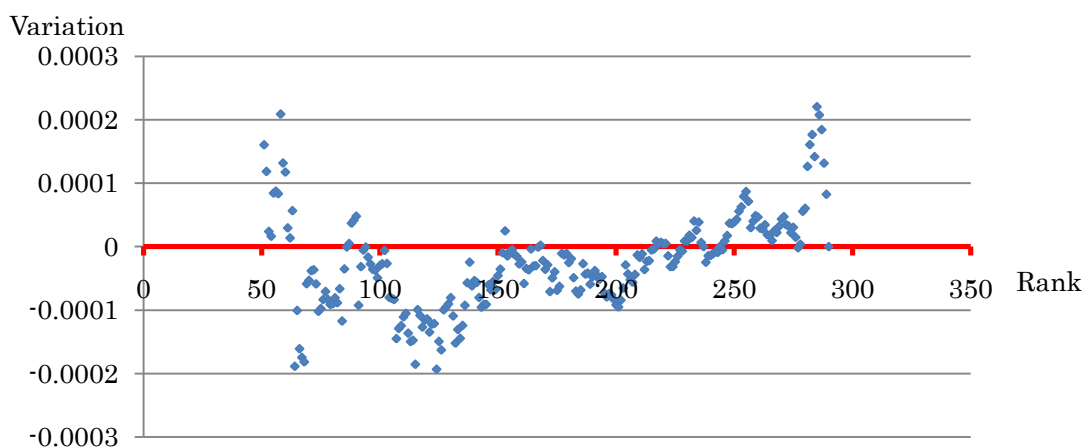
2-1-2 Reduction of middle-sized cities' shares of workers in the tertiary sector

Figure 4B, which covers the rank range from the 20th to 289th, illustrates the variation of each municipality's share of the workers in the tertiary sector. The cities of which shares decrease are belong to the range between the 60th and the 240th. The decrease of the shares of the municipality ranked from the 57th to 110th are relatively large compared with others. Many large municipalities increase their shares, and some of the municipalities between the 115th and the 132nd also increase in their shares. It can be said that the medium scale cities lose the activity volume in the tertiary. But, the variation trend of the tertiary sector in the range from the 100th to the 150th is the opposite to that of the producing.

Figure 4B   Decrease in the medium cities' shares of workers in the tertiary sector
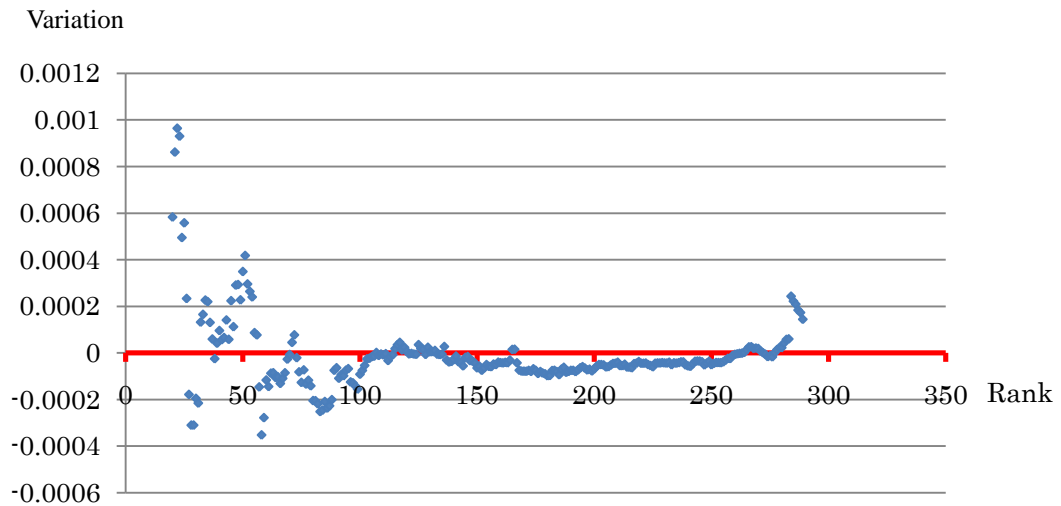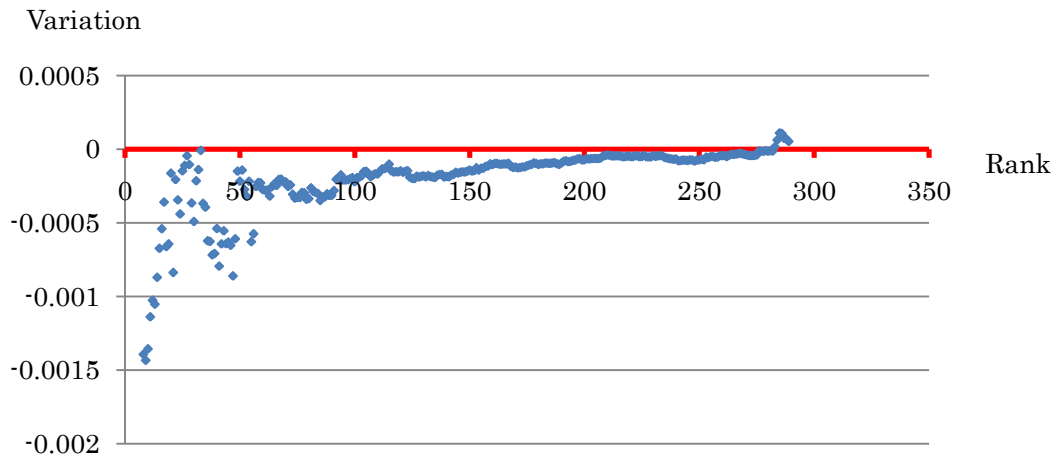

2-1-3 Reduction of the middle cities' shares of finance/business workers

Figure 4C shows the increase and decrease of the share of cities ranked from the 8th to 289th. There is no city of which share increases between the 8th and the 282th.   On the contrary, there is no city of which share decreases in between the 1st and the 7th. As shown in this figure, as the rank becomes lower, the variation of the city's share becomes smaller in the range from the 8th to the 282nd. It is said that the reduction of finance/business activity of the medium scale cities are large compared with the large scale municipalities and small ones[7].

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[7] Herfindahl index of the finance/ businesses is 0.078 and 0.102 for 1990 and 2000, respectively. The value of 0.102 is the highest of all indexes. It means that workers of this sector concentrate at a small number of municipalities.

Figure 4C Decrease in the middle cities' shares of the finance/business workers

2-1-4 Reduction of the middle cities' shares of population

Finally, the variation of each ranked city's population share is inquired. Figure 4D shows the variation of the share of the cities which are in between the 50th and 289th. All municipalities from the 71st to the 270th reduce in their shares. Especially, the municipalities in the range between the 71st and the 117th largely decrease in their shares of the population compared with other municipalities. There are 28 municipalities which increase in the share in the rank larger than the 50th.   All municipalities lower than the 271st. increase in the share.   It is clarified from the examination of the variation of municipalities'' shares of population that the middle-sized municipalities reduce the share of population.

Figure 4D   Decrease in the middle cities' shares of population
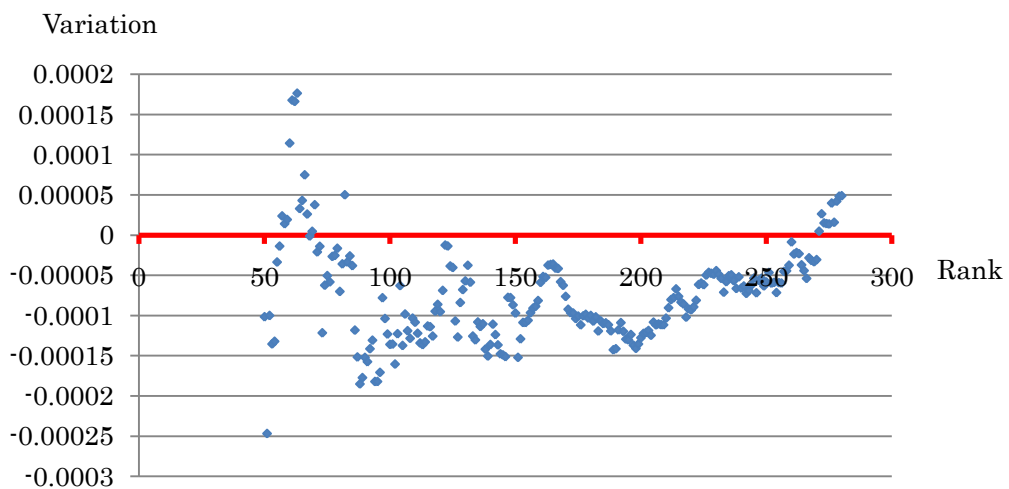
2-2 Distributions of economic activity and population in urban systems

Let us inquire whether the change of municipalities' shares of the number of employments and population in 1990s in Sweden makes their distributions converge to a large city or level among cities in urban systems. There are 21 counties in Sweden. An urban system is laid in each county. Of all counties 13 are classified into the existing industrial area and 7 counties to the rural area (since Gotland is an isolated island, it is excluded in this examination). The industrial counties are continuously located in the southern part of Sweden as shown by Figure 5.

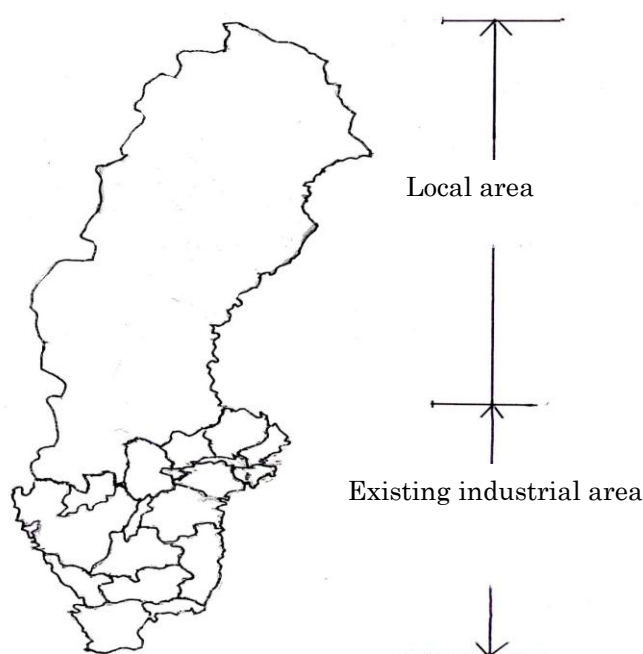**Figure 5   Industrial area and rural area in Sweden**

Table 3 shows the average values of QC in the industrial area and rural one as well as the directions of the changes of the distributions in the two areas in Sweden.

The following facts are founded for each of the three industries and population.

(1) The production activities diffuse from large municipalities in the industrial area to the neighboring small municipalities in this area or disperse to relatively large cities in the rural area. This trend is the same as that of Japan. In addition, production activities in Sweden are more concentrated at large municipalities than Japanese ones

(2) The tertiary industry in the urban systems in the rural area becomes more

concentrated at large municipalities, while that of the industrial area does not change, it maintains the status quo.

(3) The distribution of the finance/business activity in the industrial area becomes remarkably converged to the large municipalities. Although the average QC in the rural area rises, as shown by the number of the counties in the rural area, the finance/businesses sector has a trend to concentrate at large municipalities. These trends are different from that of Japan.

(4) Population distributions converge to a large city in many urban systems in both the industrial area and the rural area.　The trend that the distribution of population in the existing industrial area converges to large municipalities is different from Japanese one.

Table 3　Change of distributions of economic activities and population in Sweden

Secondary	Existing industrial area		Rural area	
Average　QC　in　1990	0.6012		0.5847	
Average　QC　in　2000	0.6078		0.5815	
Variation of Av. QC	＋0.0066		－0.0032	
Number of county, leveling		9		2
Number of county, converging		4		5
Tertiary				
Average QC in　1990	0.4596		0.4932	
Average QC　in 2000	0.4596		0.4828	
Variation of Av. QC	0		-0.0104	
Number of county, leveling		7		1
Number of county, converging		6		6
Finance/Business				
Average QC in　1990	0.3763		0.3983	
Average QC in　2000	0.3605		0.4017	
Variation of Av. QC	-0.0158		＋0.0034	
Number of county, leveling		4		2
Number of county, converging		9		5
Population				
Average QC in　1990	0.5722		0.6800	
Average QC in　2000	0.5640		0.6017	
Variation of Av. QC	-0.0082		－0.078	
Number of county, leveling		3		2
Number of county converging		10		5

3 Results of the inspection of the hypothesis

An empirical analysis of the distributions of the labors and population in Japan and Sweden shows that (1) the economic activities of the middle-sized cities are largely depressed, while many large cities and some of small cities relatively raise their activity level. It is, therefore, said that due to the economic decay of the medium scale cities, the distribution of the economic activity and population in a region becomes divided into two parts, a large city and many small cities. (2) The distributions of the production activities and population become relatively converged to a large city in the rural areas in both Japan and Sweden.   On the other hand, the distribution change of population in the existing industrial area is different between Japan and Sweden. The distribution of population in the existing industrial area in Japan becomes leveled among cities, while that of Sweden becomes converged to large cities. In addition, the distribution of the finance activity is different between the two countries. The finance activity in the industrial area in Sweden trends to concentrate at large cities, while the activity is leveled among cities in both areas in Japan.

Although there are some different changes in the distribution patterns between the two countries, the results from the empirical analysis second the proposed hypothesis that as the globalization makes progress, the distributions of economic activity and population become polarized into a few of large cities and many small cities.

IV   Concluding remarks

One of the important economic changes that the globalization raises in regions is to divide the location distributions of the economic activity and population into a few large cities and many small cities. This division causes two different social economic phenomena; on the one hand, it contributes to alleviate the economic disparity between cities since the production processes scattered across regions, on the other hands, it widens the disparity between cities as well as workers because the economic activities distributed between the cities are divided into the sophisticated activity and the simple one, and these activities are distributed according to the city's economic characteristics. As a result, the globalization makes the spatial economic organization in regions complex and often creates a cause of social problems.

In order to solve and alleviate the social problems which concern with cities and workers, it is one of the important steps to clarify and understand the mechanism in which the globalization alters the spatial distributions of the economic activities in a region. This paper proposes a hypothesis from the perspective of the industry's location that explains how the globalization makes the location distributions of production and

retail facilities bipolar to a large city and many small cities; it is shown that according to these location changes, many urban systems become composed by a large and diversified city and many small and simplified cities.

The first inspection of the hypothesis by analyzing the data of Japan and Sweden shows that many medium scale cities decrease in the number of workers of production, retail, and finance sector compared with large and small cities. While there are some differences between two countries in the distribution change of economic activities and population in the existing area and rural area, the results obtained in this inspection are not inconsistent with the essential contents of the theoretical hypothesis.

Appendix   Derivation of quotient of convergence (QC)

Coefficient of the divergence (CD) which indicates the divergence of the population distribution to the primary city in a region is derived according to Sheppard (1982).

Assuming there are N cities in a region. Let p_i denote the population share of a city, i for all urban population in the region. Then, equation (A_1) is established,

$$1 = \sum_{i=1}^{N} p_i \tag{A_1}$$

If there is no *apriori* information on the cities, it is rational to infer that the every city has the same share, $p_i = 1/N$. This inference is derived by maximizing equation (A_2) in the subject to the equation (A_1)

$$H = -\sum_{i=1}^{N} p_i L_N(i) . \tag{A_2}$$

In the real world there is *apriori* information on the cities. Thus, let *i* indicates the rank of a city according to its population size, and multiplying *i* by its share as a weigh and then summing up these values. Dividing it by N gives equation (A_3). The value of K_1 obtained by equation (A_3) is considered as the coefficient of divergence of the population distribution to the primary city in the region.

$$K_1 = (1/N) \sum_{i=1}^{N} p_i L_N(i) \tag{A_3}$$

If population of the region is distributed equally between cities, the coefficient of divergence is given by the equation (A_4), and the value of this case is notified by K_2,

$$K_2 = N^{-2} \sum_{r=1}^{N} L_N(r) \tag{A_4}$$

In this paper the value which is given by equation (A_5) is named as the quotient of convergence, QC.

$$QC = K_1/k_2 \tag{A_5}$$

The QC is used as an index which shows the characteristic of the distribution of economic activities between the cities in an urban system.

References

Capello, R. (2007) *Regional Economics,* Routledge.

Capozza, D., and Van Order, R. (1978) A Generalized Model of Spatial Competition*, American Economic Review*,68,pp.896-908.

Dluhosch, B. (2000) Industrial location and economic integration, Edward Elgar.

Ishikawa, T., and Toda, M. (1990) Spatial configurations, competition and welfare, *Annals of Regional Science*, 24, pp.1-12.

Ishikawa, T., and Toda, M. (1998) An application of the frontier price concept in spatial equilibrium analysis, *Urban Studies*, pp.1345-1358.

Schöler, K. (1993) Consistent conjectural variations in a two-dimensional spatial market, *Regional Science and Urban Economics*,23,pp.765-778.

Sheppard、E.(1982) City size distributions and spatial economic change, *International Regional Science Review*, 7, 2, pp.127-151.

Statistics Sweden, http://www.scb.se.

Statistics Bureau (1990, 2000) Census of Japan.

Toyo Keizai (2002) *Chiikikeizai Soran* (Data Book, in Japanese).Tokyo.