Analyze and Prospect of Employment Structure in Fukuoka City with Relation to Other Major Cities in Japan

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■ **Summary**: While urban areas in Japan confront a problem with increasing aging population and fewer babies, they also encounter worsening global environmental and energy issues. Under the circumstances, cities in our country not only need closer international and regional cooperation but also are exposed to cutthroat competitions among them. Needless to say, those situations have an enormous influence on industrial economic activities in cities. Furthermore, citizens' activities greatly affected, too. The development of the city depends on the understanding of the activities and whether or not promotion measures will succeed. When considering how a city should be and grow, it is necessary to have a grasp and view of its activities in detail. Therefore, this study compares and analyzes the structure and fluctuation of employment in Fukuoka City and other major cities in Japan. It also argues that Fukuoka City is more than just a central city in the region. Moreover, based on the results, it suggests a practical way to predict future employment structure. Then employment in the near future is also forecasted by using it.

■ **Keywords**: employment structure, problem for large cities, Fukuoka City, urban activities, urban structure

1. Introduction

Fukuoka was selected as one of "the world's 10 hottest cities" in the Newsweek magazine issued in July 2006[1]. The headline of the article said "The last half-century was the age of the megacity. The next will belong to their smaller, humbler urban relations." Furthermore, this rise of Second Cities is dramatically illustrated by the Newsweek top-10 list, which encompasses the fastest-growing cities in each of the world's 10 most important economies. Among them, only London and Moscow were capital cities. The other cities were Las Vegas, Munich, Nanchang, Toulouse, Ghaziabad, Goyang, and Florianopolis. Along with them, the only Japanese city was Fukuoka. The reasons were that Fukuoka became a center of global economy, conducted busy trade and continued to be a destination for various enterprises as well. Furthermore, Hakata Port and Fukuoka Airport played an active role in dealing with both passengers and distributions to and from them and expanded as a Gateway to Asia.

However, our country has confronted a problem with increasing aging population and fewer babies even in big cities for recent years. There are concerns about the discouragement of urban industrial economic activities by lower rate of increasing population.

Moreover, in terms of urban activities in industrial economic aspects, while closer regional cooperation is needed, competition among cities is more severe than before. As a result, there is and assumes to be widening a gap between growing cities and declining ones.

In addition, under the high technological innovation and IT, information has had more added values than any time before, which has transformed the substance of industrial economic activities. Or companies have been forced

to deal with serious global environmental and energy issues for their survival. In these situations, there have been radical changes in industrial economic activities. How cities' infrastructure should build and expand is an urgent task related to those circumstances.

As mentioned above, the environment surrounding industrial economic activities in urban areas has fundamentally changed. It is important even or all the more for Fukuoka, chosen as one of the 10 hottest cities in the world, to comprehend the whole picture of industrial economic activities, to forecast future properly, and to consider how the city's infrastructure should be sustainable and active in industrial economic activities.

There are two points of view about the understanding of industrial economic activities in urban areas. One is related to economy and industry such as the yield and volume of business. The other is citizen activities including employment.

In this study, the word 'employment' includes two types of workers in the city. One of them means a city's inhabitants who have jobs and the other workers, whether or not they live in a city, who work there. The former is called *syugyosha* in Japanese, and the latter, *jyugyosha*.

The former is output of industrial economic activities directly from the point of view of business. However, we have difficulty in analyzing urban structure based on only this viewpoint because it is collective and representative understanding of the places, mainly urban districts where results are obtained. Or comparison of the amount of money earned such as yield between one city and another is difficult due to various reasons ranging from price fluctuation and changes of the times to different life styles. Furthermore, each data is dubious of universality and accuracy.

The latter is grasped by relation between industrial economic activities, and citizens and cities. Urban economy and industry are embedded in employment with both types of working, and depend on activities and lives both within and outside a city. In addition, employment activities transform along with changes of industrial economic activities. Under those circumstances, it is crucial to have a grasp of industrial economic activities through employment structure when considering cities or citizens involvement in those activities. Historical data on the actual state of workers has been accumulated by Population Census and Establishment and Enterprise Census, which indicates that the meaning and accuracy of the figures remain unchanged, providing us favorable condition. However, those numbers have just indirect influence on the relation to industrial economic activities such as the number of employees or that of engaged persons by industry. In fact, reflection of the reality is difficult because while some industrial fields depend more heavily on engaged persons than other areas, others do less greatly on them due to the replacement by the IT and robot in factory, the introduction of vending machines and internet retailing in retail trade and services.

On the other hand, when considering policies and strategies on how city infrastructure should be built or improved, population in urban areas, population dynamics, and the distribution of age and space have been discussed in detail. However, there has not been full examination on details of economy and industry, and relations between employment structure and cities.

During the course of increasing population and developing cities based on economy and industry, new contents are added along with expanding conventional economy and industry.

Despite some problems, there is development with quantitative expansion, which can lead to the discussion of outline or prediction of future prospect with relatively easy. However, quantitative expansion is not a problem for a society without the hope of population increase and with increasing aging population and severe competitiveness among cities. It is a problem that trade-off of society and industrial economic activities change. Among them there is a quantitative change in industrial economic structure, therefore in employment structure. When considering both how a city is and grow and how its infrastructure is improved, in addition to population characteristics such as age distribution, it is crucial to understand employment structure and forecast its future.

In consideration of above-mentioned points, this study discusses the trend of employed persons and engaged persons as key actors for economy and industry in Fukuoka City. Firstly, compared to other large cities in Japan,

characteristics of employment in Fukuoka City is to be revealed from urban perspective. Based on that, contents and historical changes are to be fully studied. Moreover, on the basis of the results, this study suggests a practical way to predict future employment structure. Then employment structure in the near future, in approximately ten years, is also forecasted by using it.

2. Employment characteristics in Fukuoka City in comparison with other large cities in Japan

Major large cities, members of the Major cities Statistics Council, total 16[2)]. First of all, compared to the other large cities, this chapter examines employment structure in Fukuoka City, revealing its features.

(1) Characteristics of employment structure in urban areas

Regarding relations between workers and cities, there are two points; where to live and where to work. In this paper, the following two terms are clearly defined. A resident with job is referred to as an employed person and person who engage in job at work place as an engaged person. Figure1 shows rough outline of relations between space, e.g. inside and outside of a city, and employment form of employed person and engaged person. Employed persons in one city are classified into three types: ones at home in the city, ones outside the home in the city, and ones outside the city. On the other hand, engaged persons in one city are made up by employed persons at or outside the home in the city and ones who live outside the city and flow into it.

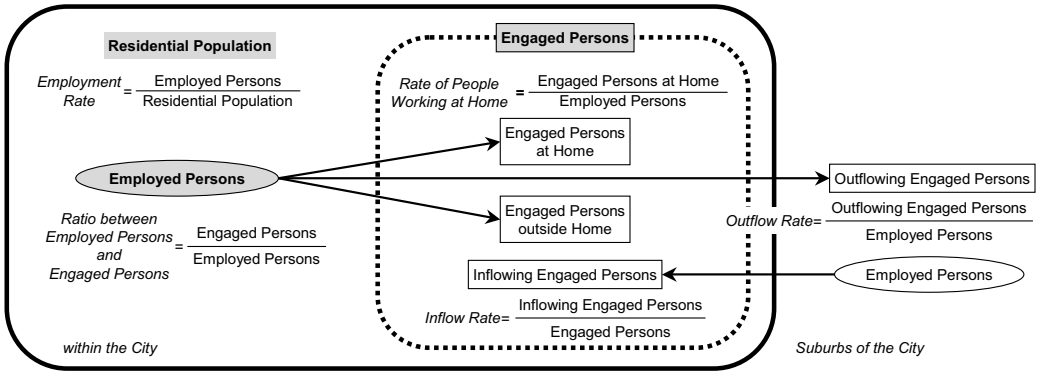


Figure 1 Outline of employed workers and persons engaged in the cities

Based on those analyses, the outline of employed persons and engaged persons is measured and defined by indexes, which represent employment rate, ratio between employed persons and engaged persons, rate of engaged persons at home, inflow rate and outflow rate in Figure 1.

Table 1 shows five indexes in 16 cities based on the 2005 national population census. There are no strong mutual relations between the indexes. Actually correlation coefficient of employment rate and outflow rate is at most minus 0.560. The fact indicates that each index illustrates characteristics of employment from the point of individual index's view.

Average employment rate is 47.4%, with a maximum of 47.4% (Kawasaki) and a minimum of 43.9% (Kobe). Fukuoka is close to average at 46.9%. While the ratio between employed persons and engaged persons fluctuates between a maximum of 1.808 and a minimum of 0.794, the ratio of Fukuoka is large at 1.231, following the three largest cities' figures.

The highest rate of employed persons who take on a job at home is 0.140 in Kyoto where a number of people are engaged in household industry such as traditional craft. On the contrary, the lowest figure of 0.064 is in Chiba where there are few house industries. Fukuoka's number is lower than average, at 0.076.

Furthermore, in terms of Fukuoka, although outflow rate remains at approximately 50% of the average, inflow

Table 1 Characteristics of employment in the cities

City	Employment rate	Ratio between employed persons and engaged persons	Rate of people working at home	Outflow rate	Inflow rate	Characteristics cluster
Fukuoka	**0.469**	**1.231**	**0.076**	**0.103**	**0.271**	**1**
Kitakyushu	0.454	1.049	0.077	0.101	0.143	2
Hiroshima	0.493	1.037	0.081	0.103	0.135	2
Kobe	0.439	1.020	0.071	0.235	0.250	3
Sakai	0.448	0.874	0.077	0.418	0.334	4
Osaka	0.447	1.808	0.110	0.178	0.545	5
Kyoto	0.471	1.114	0.140	0.149	0.236	3
Nagoya	**0.497**	**1.249**	**0.100**	**0.156**	**0.324**	**1**
Shizuoka	0.515	1.053	0.137	0.070	0.117	2
Yokohama	0.490	0.823	0.067	0.376	0.242	4
Kawasaki	0.526	0.794	0.070	0.506	0.378	4
23 special wards	0.480	1.669	0.118	0.083	0.451	6
Chiba	0.470	0.933	0.064	0.412	0.371	4
Saitama	0.492	0.844	0.080	0.471	0.373	4
Sendai	0.454	1.127	0.075	0.102	0.203	3
Sapporo	0.448	1.019	0.065	0.067	0.084	2
Ave.	**0.474**	**1.103**	**0.088**	**0.221**	**0.279**	
S.D.	0.026	0.283	0.025	0.158	0.128	
Min.	0.439	0.794	0.064	0.067	0.084	
Max.	0.526	1.808	0.140	0.506	0.545	
Range	0.087	1.014	0.076	0.439	0.461	

rate is nearly average. In addition to the situations, the ratio between employed persons and engaged persons is high, which means that Fukuoka plays greatly a central role in urban areas.

Judged from the indexes comprehensively, the rightmost column in Table 1 shows the result of cluster analysis[6] by five indexes for the comparison of the cities. The 23 special wards in Tokyo and Osaka, which have the high ratio between employed persons and engaged persons and inflow rate, are different from the rest of the cities. The other cities except the two areas are categorized into four clusters. Fukuoka and Nagoya generate one cluster. They have similarity in comparatively low outflow rate and high inflow rate and the ratio between employed persons and engaged persons. Therefore, it means that following the 23 special wards in Tokyo and Osaka, Fukuoka and Nagoya have characteristics of core metropolis, which differentiates them from the other cities such as Sapporo, Sendai, and Hiroshima referred to as a core local city respectively.

(2) Urban structure transformation by changes in employed persons and engaged person

Figure 2 illustrates how employed persons and engaged persons have expanded or reduced quantitatively inside or outside of each city and how the cities have been changing their characteristics. The number of employed persons and engaged persons could increases or decreases in each period of the Population Census. Let the decrease or increase in the number of employed persons be at the horizontal axis, and that of engaged persons at the vertical axis and then plot the recent 10-year- change by dividing the period into two parts.

For your information, Saitama, Kyoto, and Hiroshima are excluded from the sixteen cities mentioned above because the areas changed due to municipal mergers. Moreover, Sakai and Shizuoka are not included as they did not join the Major cities Statistics Council for the whole ten years.

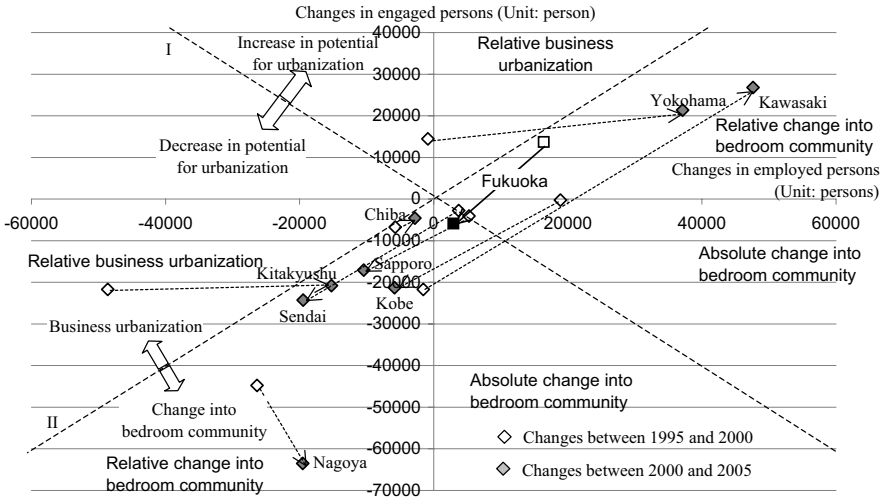


Figure 2　Interpretation on the changes in employees and engaged persons in nine cities

An increase in the number of employed persons means night city with people who have a job stay at night. On the other hand, a rise in the number of engaged persons indicates day city with an increasing number of workers in the city. Mutual relationship can lead to a wide variety of interpretation on urban development.

According to Figure 2, being plotted at the upper right from the dotted line I means the expansion of urbanization potential. The sum of the increase and decrease in employed persons and engaged persons is plus, which represents urban development and potential expansion from the comprehensive view of employment. Moreover, being plotted at the lower left can be interpreted that employment potential is reduced.

In addition, being plotted at the upper left from the dotted line II means that the number of engaged person goes up relatively or absolutely more than that of employed persons, boosting daytime activities in the cities. On the contrary, being plotted at the lower right indicates that the number of engaged persons rise more than that of employed persons relatively and absolutely.

Therefore, bedroom suburbs characteristic is intensified.

The 23 special wards in Tokyo and Osaka city are removed from the Figure 2. The reason is that the scale is quantitatively large. Therefore, including the two cities make it difficult for us to understand the trend of the other cities. However, fluctuations in both employed persons and engaged persons show minus, being plotted at the lower right of the third quadrant like Nagoya. For your reference, the fluctuation in employed persons in the 23 special wards in Tokyo is minus, 128,869 and that of engaged persons was minus 274,797 for five years from 1995 to 2000. During a five-year- period between 2000 and 2005 was minus 231,499 and minus 299,468 respectively. Consequently, as the Newsweek magazine pointed out, the 23 wards, Osaka, and Nagoya downsized urban potential and became relatively bedroom suburbs as time passed from 1995 to 2000 to 2005.

In terms of Sapporo, Sendai, and Kobe, they moved from the origin to the third quadrant. Recently, they decreased the number of engaged persons rather than that of employed persons, which is comparable to the movement of the 23 special wards.

Opposite trend was shown by Yokohama and Kawasaki. Especially, from 2000 to 2005 the two cities became relatively bedroom suburbs and increased the number of employed people and person engaged as well, developing urban potential. The reason for this is that they play a role as suburbs to take on the flow of people from the 23 special wards.

Regarding Fukuoka city, it followed a similar trend of Sapporo, Sendai, and Kobe. As clearly shown by the Figure, Fukuoka shifted from the first quadrant to close to the origin. Different from Sapporo, it managed to maintain urban potential as Chiba did.

In short, considering recent urban potential from the point of view of employment, Kawasaki, Yokohama

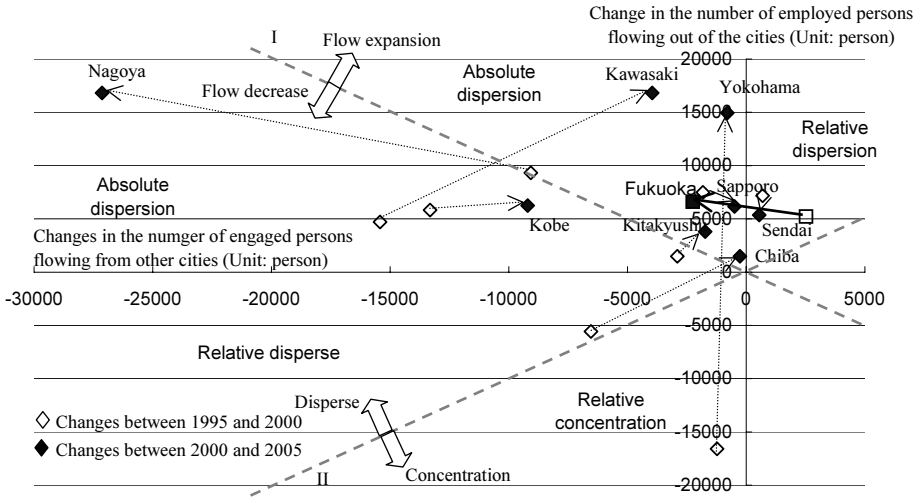


Figure 3　Interpretation on the movements of employed persons flowing in and out of the nine cities

expanded, and Fukuoka and Chiba preserved the status quo, the other cities reduced the number of employed persons and engaged persons.

Figure 3 illustrates the change of employment structure through time series variation: the outflow of employed persons to the outside of a city and inflow of them from other cities. Being plotted at the upper right of the dotted line I means that the total amount of the inflow and outflow of employed persons multiply and the number of commuters from and to neighboring cities rises. On the contrary, the lower left means the shrinkage of the inflow and outflow of employed persons. Furthermore, the area which is located at lower right than the dotted line II indicates that employed persons in metropolitan areas concentrate in their urban areas, whereas the outflow outreaches the inflow and working places disperse at the upper left from the dotted line II.

For the same reason applied to Figure 2, the 23 special wards in Tokyo and Osaka are not included in Figure 3. Those districts slowed both inflow and outflow for the past 10 years. For instance, the 23 special wards decreased the inflow by 157,396 and the outflow by 11,468 from 1995 to 2000, and by 73,441 and 5,472 from 2000 to 200 respectively. The figures are placed at the third quadrant of the Figure and at the upper left of the dotted line II. As the flow decreased, working places tend to disperse relatively.

Compared to the two areas, different trend was taken by local major urban areas such as Sapporo, Sendai, and Fukuoka, which showed little change in both outflow and inflow. However, flow expanded as a whole and working places dispersed relatively or absolutely.

To be more specific, Fukuoka city showed relative decentralization with an increasing amount of inflow and outflow from 1995 to 2000, whereas there was absolute decentralization: the amount of inflow decreased and that of outflow increased from 2000 to 2005. In conclusion, during a course of 10 years flow expanded, however, there was no change in inflow and outflow increased. This means that more people commuted to neighboring cities and working population dispersed. Development of large-scale facilities for attracting customers and distribution in the suburbs may have had influence on the situation.

(3) Distribution of employed persons and engaged persons by industry

The distribution of employed persons who live in urban areas and engaged persons at work there depends on industrial economic activities. Therefore, characteristics of Fukuoka will be explored by revealing which cities are similar to Fukuoka by cluster analysis.

Table 2 is the result of cluster analysis based on the distribution of employed persons and engaged persons in the 11th revision of the Japan Standard Industrial Classification (JSIC). Taking a closer look at it results in six or four clusters in a rough way. Moreover, Figure 4 illustrates the distribution of industrial classification in 6 clusters.

Table 2 Classification of employed persons and engaged persons by industrial classifications

(1) Cluster analysis of employed persons by industrial classifications

City	Details	Divisions			
Fukuoka	**1**	1	**1**	1	1
Sendai	**1**	1	**1**	1	1
Sapporo	**1**	1	**1**	1	1
Kitakyushu	**2**	2	**2**	2	2
Sakai	**2**	2	**2**	2	2
Shizuoka	**2**	2	**2**	2	2
Hiroshima	**3**	2	**2**	2	2
Kobe	**3**	2	**2**	2	2
Osaka	**4**	3	**3**	2	2
Kyoto	**4**	3	**3**	2	2
Nagoya	**4**	3	**3**	2	2
Yokohama	**5**	4	**4**	3	1
23 special wards	**5**	4	**4**	3	1
Chiba	**5**	4	**4**	3	1
Saitama	**5**	4	**4**	3	1
Kawasaki	**6**	5	**4**	3	1

(2) Cluster analysis of employed persons by industrial classifications

City	Details	Divisions				Correlation between employed persons and engaged persons
Fukuoka	**1**	1	**1**	1	1	0.9970
Sendai	**1**	1	**1**	1	1	0.9982
Sapporo	**1**	1	**1**	1	1	0.9994
Kitakyushu	**2**	2	**2**	2	2	0.9996
Kobe	**2**	2	**2**	2	2	0.9993
Sakai	**2**	2	**2**	2	2	0.9911
Kyoto	**2**	2	**2**	2	2	0.9993
Shizuoka	**2**	2	**2**	2	2	0.9987
Kawasaki	**5**	5	**4**	2	2	0.9718
Hiroshima	**3**	3	**3**	3	1	0.9976
Yokohama	**3**	3	**3**	3	1	0.9895
Chiba	**3**	3	**3**	3	1	0.9927
Saitama	**3**	3	**3**	3	1	0.9879
Osaka	**4**	4	**3**	3	1	0.9803
Nagoya	**4**	4	**3**	3	1	0.9902
23 special wards	**6**	4	**3**	3	1	0.9877

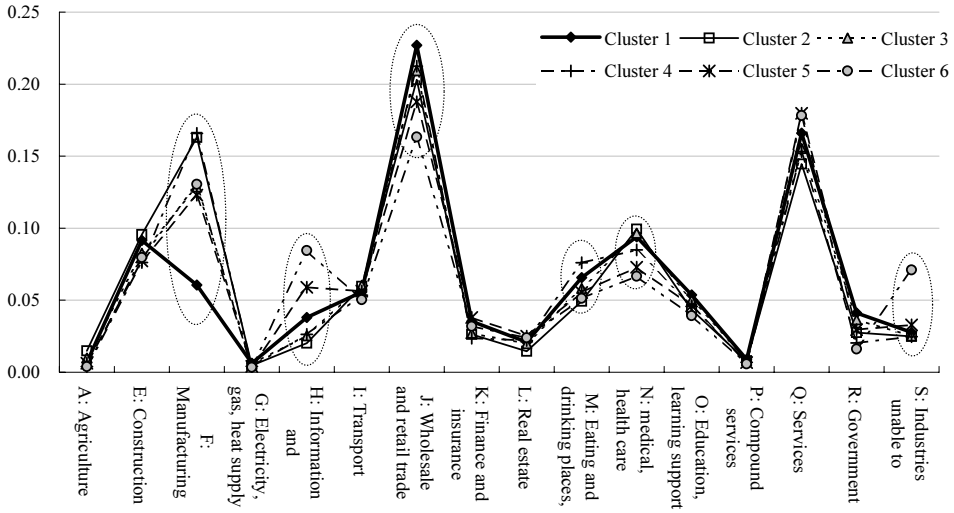


Figure 4 Distribution of engaged persons by cluster (by division of the JSIC)

Although Kawasaki has different characteristics from the other cities, cities in Tokyo metropolitan area form a cluster, accounting for larger percentage of intellectual information and communication industry and lower percentage of retail industry compared to other cities. Furthermore, Osaka, Kyoto, and Nagoya shape a cluster, and have many hotel and restaurant business and manufacturers, which is a characteristic of the three cities.

Another cluster is formed by Fukuoka with Sapporo and Sendai. Their characteristics are comprising of less manufacturers and more distributors than the other clusters do. In addition, information and communications account for relatively higher rate in this cluster, not so much as in Tokyo metropolitan area, among local cities.

The distribution of engaged persons by industry is closer to that of employed persons. However, cities such as

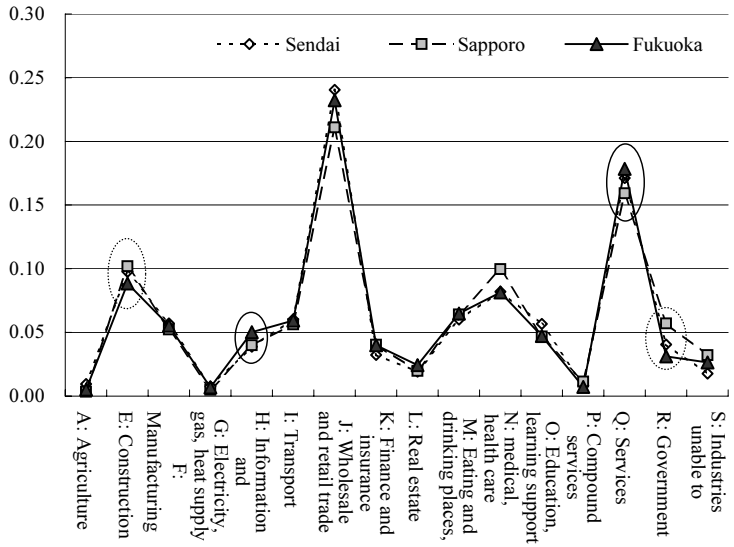


Figure 5　Distribution of engaged persons by industry in Sapporo, Sendai and Fukuoka

Kawasaki and Osaka, where the turnover of employed persons and engaged persons is high due to outflow and inflow, employed persons bear little relevance to engaged persons. Local cities show opposite trend: low turnover and high correlation between them. (See the rightmost columns of Table 2 (2)). According to the table, Fukuoka, Sendai, and Sapporo form a cluster, having a similar pattern by cluster analysis concerning the distribution of engaged persons by industry.

Figure 5 compares the distribution of engaged persons by industry in the three cities in order to explore minute differences between them even in the same cluster. Each city has similar distribution form in the following two points. While wholesale and retail trade is the highest, followed by services, construction, and medical, health care and welfare; agriculture, electricity, gas, heat supply and water, and compound services account for little in Fukuoka different from the other two cities, which are circled with ovals. Although in Fukuoka the proportion of public services and construction is small, that of information and communications and services is high. Additionally, Fukuoka, like Sendai, has a higher proportion of wholesale and retail trade, and a smaller rate of medical, health care and welfare than Sapporo. Judged by the data, it can be said that Fukuoka shifted to higher-level services.

3. Changes in employment in Fukuoka City and its industrial structure

3. 1　Historical changes in the characteristics of employed persons and engaged persons

The characteristics of employment in Fukuoka City are revealed in the former chapter. This new one is to examine the trend through historical changes.

Although Fukuoka City's population has been constantly going up, there is a slight increase in the number of employed persons and slight reduction in that of engaged persons (See Figure 6). This means that while the number of residents in Fukuoka City increased, however, that of 'not in labor force' also climbed due to the development of aging society and decreasing inflow of engaged persons from neighboring cities or towns. Therefore, even in Fukuoka a shadow falls on the employment environment. In terms of its future urban industrial policy, how to deal with the situation is a crucial challenge for Fukuoka.

Five characteristics of employment shown in the table above Figure 6, there are some changes: a decrease in the rate between employed and engaged persons, and the rate of people working at home, and an increase in the rate of outflow and inflow. As time passes, working places spread, which employment flow is becoming active. In terms of employment rate, there is not necessarily obvious trend of change; however, it can be interpreted that there is a tendency to decrease as aging society grows.

Index	1990	1995	2000	2005
Employment rate	0.4709	0.4899	0.4815	0.4685
Rate between employed persons and engaged persons	1.2517	1.2565	1.2443	1.2311
Rate of people working at home	0.1061	0.0775	0.0804	0.0763
Outflow rate	0.0745	0.0870	0.0929	0.1027
Inflow rate	0.2606	0.2734	0.2710	0.2711

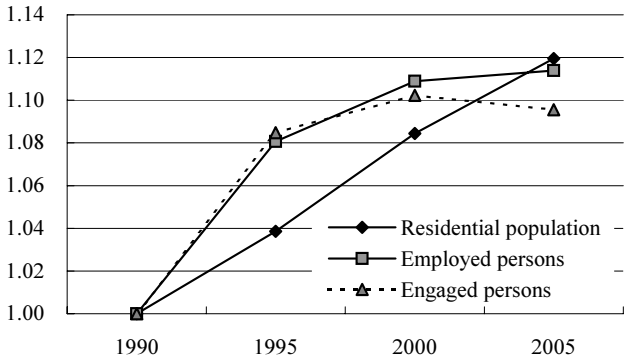


Figure 6　Characteristics of employment (*syugyo*) and historical changes in population in Fukuoka

For your reference, projections for four indexes except employment rate in 2015 are made by time-series analysis (logarithmic curve or line).

	2005		2015
rate between employed persons and engaged persons	1.2311	→	1.2220
rate of people working at home	0.0763	→	0.0643
outflow rate	0.1027	→	0.1087
inflow rate	0.2711	→	0.2764

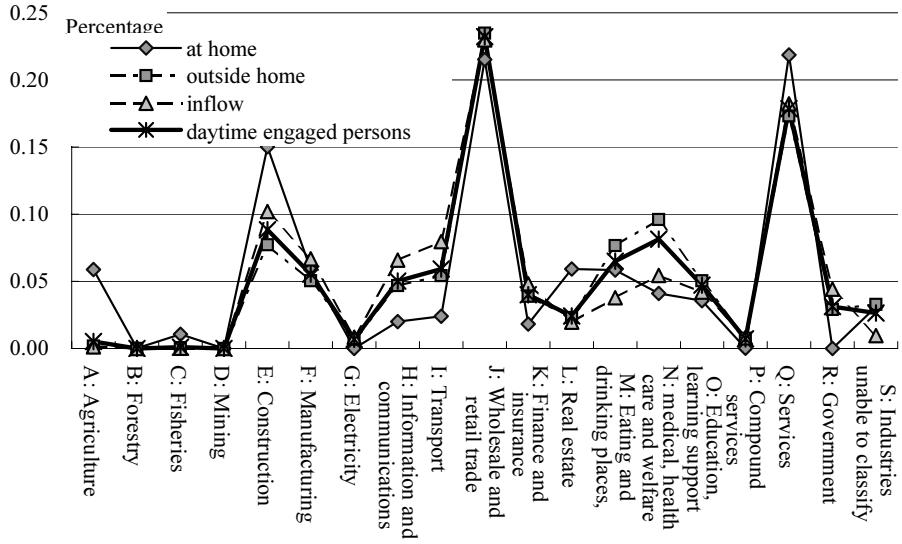
3. 2　Correlation between the type of engaged workers and distribution by industry

Figure 7 (1) shows both the rate of engaged persons structure in four categories by industry in Fukuoka City. By further analysis, that of engaged persons in three types by industry is also illustrated in (2) of the Figure.

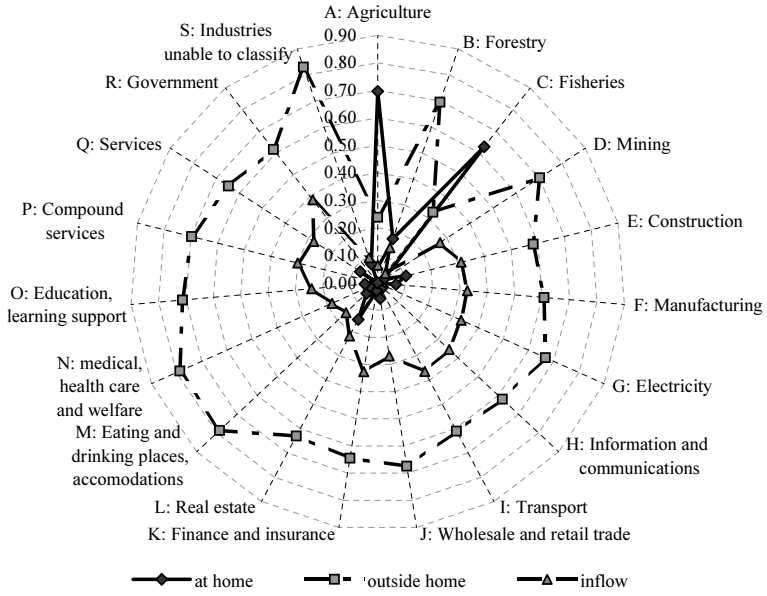
Engaged persons at home just account for 6.2% among all engaged persons, in which major industries are wholesale and retail trade, services, and construction, followed by manufacturing, agriculture, real estate, eating and drinking places, accommodations on a medium scale. Engaged persons outside the home comprise of the majority of 66.7%. Same things can be said for persons engaged in major industries at home; however, different industries follow such as medical, health care and welfare and eating and drinking places, accommodations. The rest of 27.1% are made up by engaged persons from outside of the city. Wholesales and retail trade is major industry, followed by construction, transport, information and communications, medical, health care and welfare.

To sum up, engaged persons at home take on conventional industries. The industrial distribution of engaged persons at home and that of engaged persons from outside of the city show a similar trend. However, there are different trends between the two categories; while engaged persons from the outside of the city comprise a higher percentage of information and communications, and transport, engaged persons at home do a higher rate of eating and drinking places, accommodations, , and medical welfare.

Figure7 (2) illustrates the rate of engaged persons in three types by industry. Naturally, engaged persons outside the home constitute a majority of all industries, followed by inflowing engaged persons, and engaged persons at home. However, there were some exceptions with a high rate of engaged persons at home such as agriculture and fisheries, accounting for 70% and 63% respectively. Forestry (17%) and real estate (15%) remain low compared to the other industries.



(1) Distribution of engaged persons at home, outside home and inflowing from other cities by industry



(2) Percentage of engaged persons at and outside home and inflowing from other cities

Figure 7 Structure of engaged persons by industry in Fukuoka City (2005)

Engaged persons outside the home constitute of more than 60% in each industry other than agriculture and fisheries. Especially, industries unable to classify, medical, health care and welfare, and eating and drinking places, accommodations are over 80%. Regarding these industries, engaged persons outside the home and inflow totaled nearly 100%.

The rate of inflowing engaged persons is 27.1% in average; however, over 30% is demonstrated by some industries such as government, transport, information and communications, electricity, gas, heat supply and water, manufacturing, finance and insurance, construction, and compound services. Specifically, in terms of government inflow comprises of 38.4%.

In conclusion, regarding engaged persons of the all types in Fukuoka City main industries are wholesale and retail trade, and services. Engaged persons outside the home of the two industries accounted for two thirds and approximately 27% are made up by engaged persons inflowing from the outside of the city. They are followed by construction, medical, health care and welfare, eating and drinking places, accommodations. The rate of engaged persons outside the home the latter two reached about 80%, different from 60% of construction.

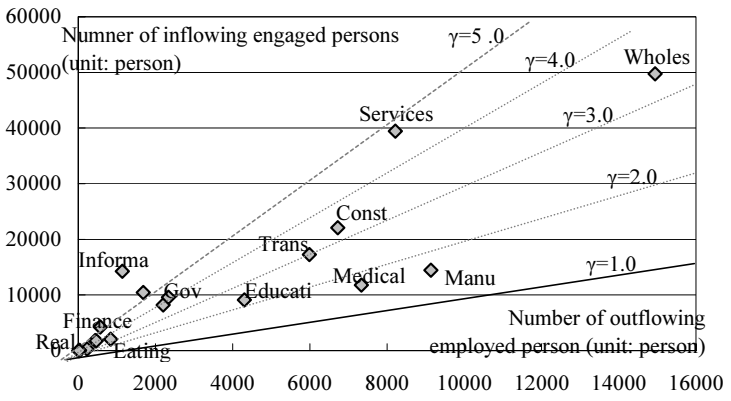


Figure 8 Correlation between outflowing employed persons and inflowing engaged persons (2006)

3. 3 Situation of inflow and outflow by industry

With regard to flow to and from Fukuoka City, naturally, while employed persons flow to the outside of the city, engaged persons do into the city. Correlation between the two parties is plotted in Figure 8.

The ratio (γ) of people who flew in and out of the city was 3.25, which means that of inflow exceeded outflow. Examined it by industry, all industries except forestry and mining were ranked above 1.0 of inflow and outflow rate, which means Fukuoka City is a core of Greater Fukuoka in many industries.

Information and communications had the largest γ with 12.48, followed by real estate (7.42) and finance and insurance (6.20). Industries which have large scale of inflow and outflow were wholesales and retail trade, and services, showing 3.33 and 4.80 as γ respectively.

On the contrary, some industries which Fukuoka City is not a center and have γ from 1.0 to 2.0 were fishery, agriculture, manufacturing, medical, health care and welfare, especially forestry and mining were below 1.0.

To conclude, Fukuoka City as a whole has a wide difference between the rate of inflow and outflow, despite some exceptions. The gap of the rate of inflow and outflow mainly in primary and secondary industries is small; however, that in each area of tertiary industry is large, particularly, in information and communications, real estate, finance and insurance, which are urban-oriented industries.

3. 4 Study based on major groups in the 11th revision of the Japan Standard Industrial Classification (JSIC)

The following four fields in major groups of the JSIC will be examined by comparing with the other local cities or reading historical changes. Some of the four fields are wholesale and retail trade, services which represent Fukuoka City's industry. Information and communications will be also examined, comparing to other local cities, and finance and insurance whose gap between the rate of inflow and outflow will be also studied.

(1) Wholesale and retail trade, finance and insurance

Figure 9 illustrates the ratio of the tertiary industry including the following three areas, wholesale and retail trade, finance and insurance, to the total population. Each field has the largest rate next to the three largest cities. Especially, the proportion of retail trade, finance and insurance respectively is slightly higher than that of Nagoya, which means that Fukuoka possess a more dominant characteristic as a commercial city.

Left column of Table 3 shows the result of 16 cities' cluster analysis in order to perform a comprehensive assessment of the distribution of persons engaged in wholesale and retail trade, finance and insurance in 11 categories of business in the 11th revision of the JSIC.

Fukuoka, Hiroshima, and Sendai form one cluster. In those cities, persons engaged in wholesale trade account for a large percentage next to the three largest cities and small proportion is made up by persons engaged in retail trade.

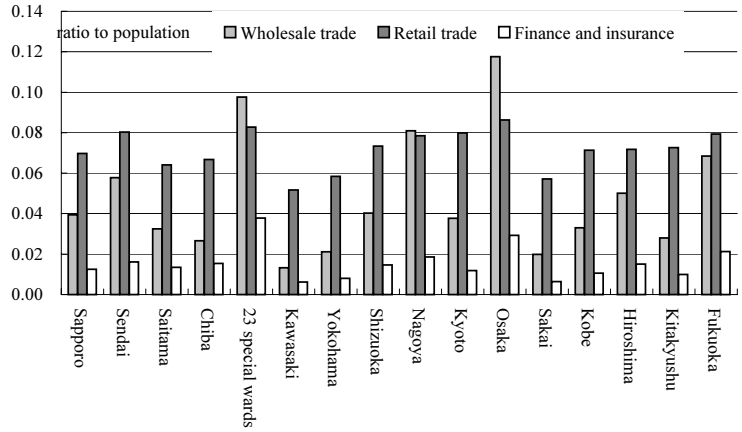


Figure 9　Ratio of persons engaged in wholesale and retail trade, finance and insurance to population（2006）

Table 3　Cluster Analysis by the distribution of persons engaged in major industries in major groups of the JSTC

Wholesale and retail trade, finance					Services					Information and communications					
City	Cluster				City	Cluster				City	Cluster				
Sapporo	1	1	1	1	Sapporo	1	1	1	1	Sapporo	1	1	1	1	1
Sendai	2	**2**	2	2	Sendai	2	2	1	1	Sendai	1	1	1	1	1
Saitama	1	1	1	1	Saitama	3	3	2	2	Saitama	2	2	1	1	1
Chiba	1	1	1	1	Chiba	4	4	3	2	Chiba	3	3	2	2	2
23 special wards	3	3	3	2	23 special wards	5	5	4	3	23 special wards	4	4	3	3	2
Kawasaki	4	4	4	3	Kawasaki	6	6	5	4	Kawasaki	5	5	4	4	3
Yokohama	5	4	4	3	Yokohama	7	2	1	1	Yokohama	5	5	4	4	3
Shizuoka	1	1	1	1	Shizuoka	3	3	2	2	Shizuoka	6	6	5	5	4
Nagoya	3	3	3	2	Nagoya	8	**7**	6	5	Nagoya	7	7	**6**	2	2
Kyoto	6	5	1	1	Kyoto	9	8	7	6	Kyoto	8	6	5	5	4
Osaka	3	3	3	2	Osaka	8	**7**	6	5	Osaka	7	7	**6**	2	2
Sakai	5	4	4	3	Sakai	10	9	8	7	Sakai	7	7	**6**	2	2
Kobe	6	5	1	1	Kobe	3	3	2	2	Kobe	1	1	1	1	1
Hiroshima	2	**2**	2	2	Hiroshima	11	10	9	8	Hiroshima	1	1	1	1	1
Kitakyushu	5	4	4	3	Kitakyushu	3	3	2	2	Kitakyushu	1	1	1	1	1
Fukuoka	2	**2**	2	2	**Fukuoka**	8	**7**	6	5	**Fukuoka**	7	7	**6**	2	2

（2）Service industry

Services（not elsewhere classified）account for the largest proportion in 14 categories of services in major groups of the JSIC in all the cities, followed by professional services, laundry, beauty and bath services, and amusement services. Central column of Table 3 illustrates cluster analysis based on the percentage of service industry in major groups of the JSIC. Fukuoka, Osaka, Nagoya form a group, whose characteristics are different from Sapporo, Sendai, Hiroshima similarly referred to as local core cities. Features of the former group are that despite having similarities to the 23 special wards in Tokyo, services（not elsewhere classified）constitute a higher percentage compared to the other cities. On the other hand, industrial disposal business or amusement services comprise a small proportion and laundry, beauty, and bath services relatively slight portion as well.

（3）Information and communications

Information and communications has a similar trend in the ratio to population as wholesale and retail trade do（bar chart in Figure 10）. In other words, the percentage of people engaged in information and communications to

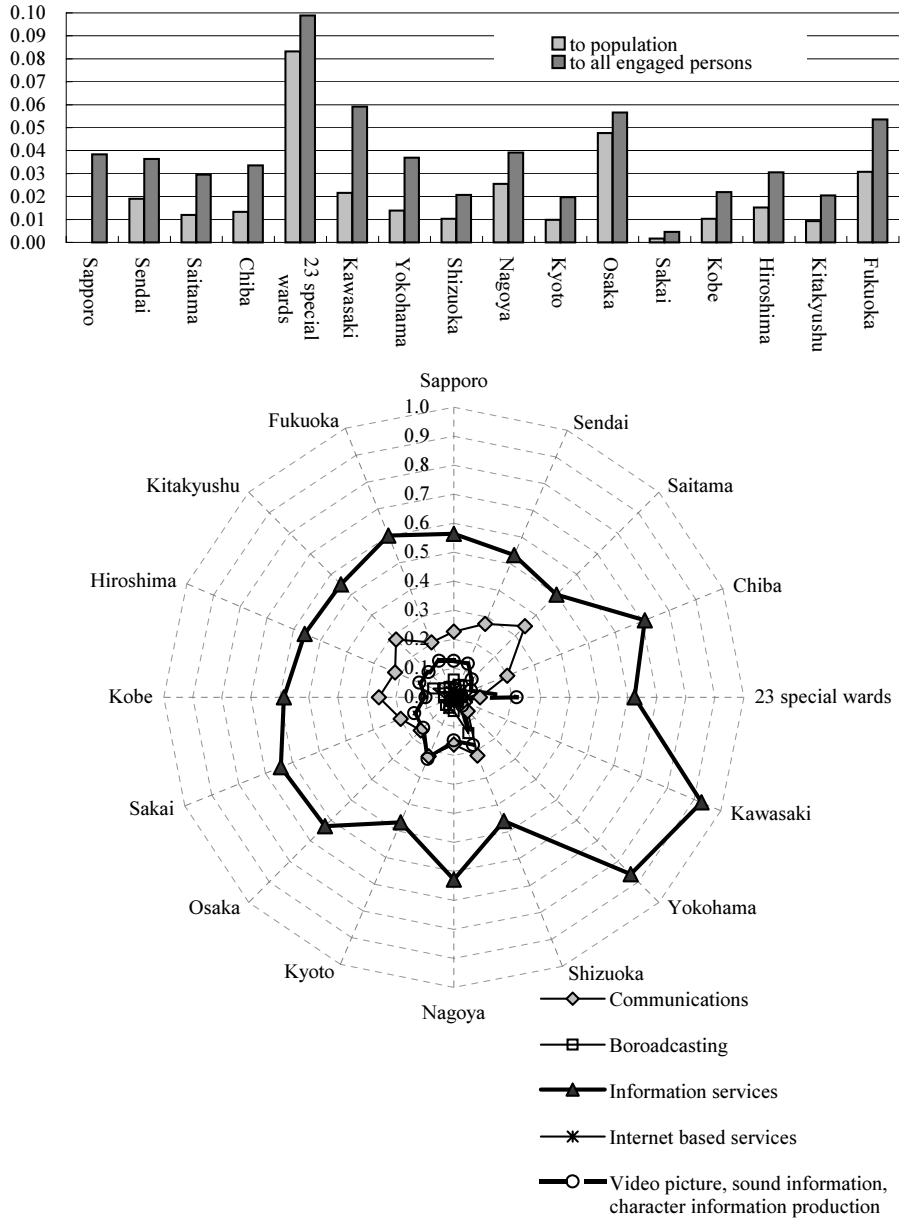


Figure 10　Comparison of the numbers of persons employed in ingormation and communications between the cities（2006）

the total population in Fukuoka follows the 23 special wards in Tokyo and Osaka, and the percentage to the laboring population is almost equal in Osaka and Fukuoka.

Radar chart in Figure10 shows the ratio of five types of industries in information and communications. Information services, communications, and video picture, sound information, character information production and distribution represent a major proportion in Fukuoka. The ratio of information and communications in Fukuoka city are slightly higher than local cities; however, not necessarily the highest. In a sense, there are decent developments in each area of information and communications. The rightmost column of Table 2 illustrates the result of cluster analysis. Fukuoka forms a same cluster as Nagoya, Osaka, and Sakai do.

In terms of the recent trend, the number of persons engaged in information and communications in Fukuoka has increased. That of 2006 grew by 21% from 2004. Especially, among information and communications there was a significant rise by 80% in the number of both people engaged in communications and internet based services respectively. That of information services also jumped by 15%. On the contrary, broadcasting, with poor performance, showed a negative growth of 15%.

4. Construction of forecast system for employment structure

Employment structure described in the previous chapters is not necessarily appropriate to just analyze the current and past situations.

When considering urban policy based on relationship between industrial economic activities and a city, prospecting future is important and how to implement it is tested.

Basically, each city has different structure of employment and industry. While Fukuoka City has characteristics of employment equal to the three major cities in Japan in some areas such as information and communications, employment structure in Fukuoka City is similar to local core cities like Sendai and Sapporo. Furthermore, because of continuous flow to and from other municipalities the structure of employed workers is not only different from that of engaged workers but also by industry. Moreover, as discussed in Chapter 2, employment structure can change during a period of five years, which is even relatively short term.

Based on those characteristics, it is necessary to construct a forecast system to examine Fukuoka both separately and in accordance with the changes over time and in a flexible manner. This chapter suggests a following forecast system as a simple way.

(Step 1)

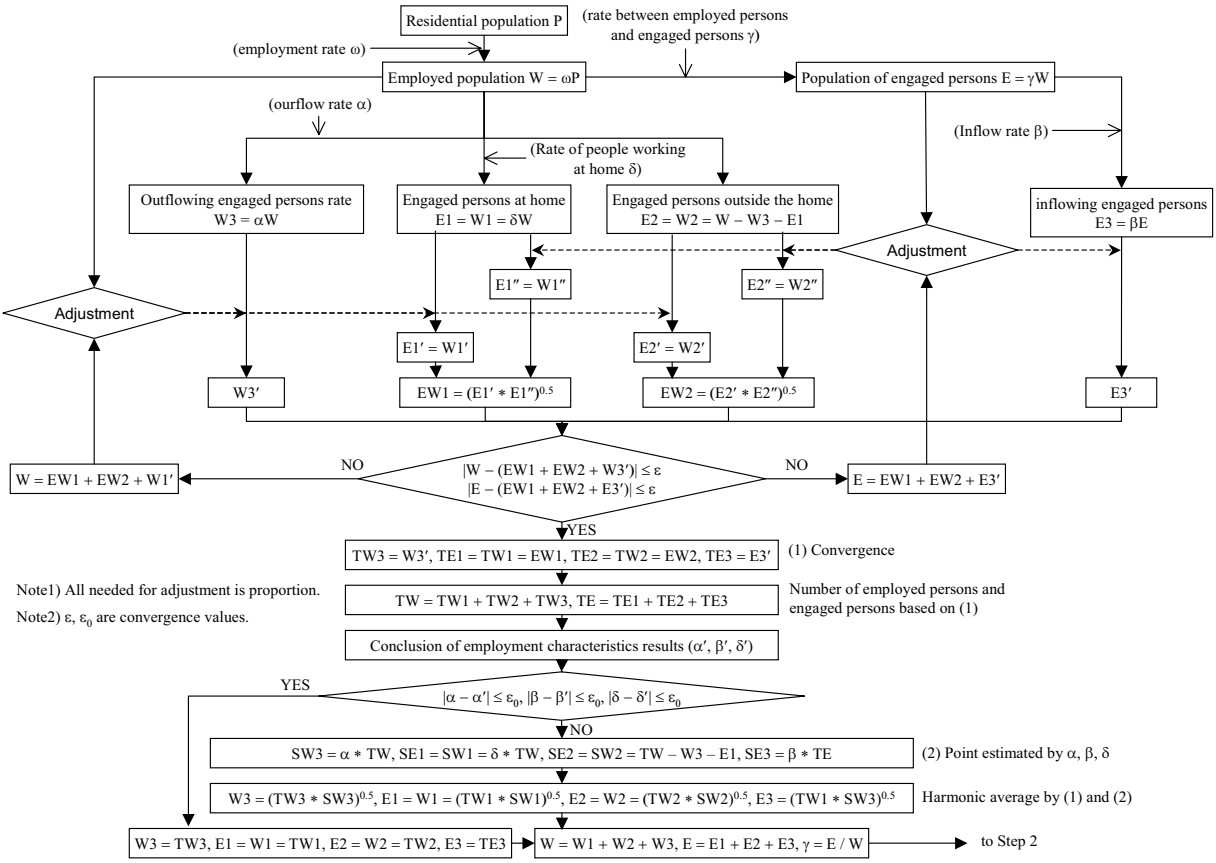


Figure 11 Forecast of employees and engaged persons by type of employment (*syugyo*)

Figure11 is a system which estimates not only the number of all employed persons and all engaged persons but that of engaged persons at home and outside the home, engaged persons outflowing to the city, and engaged persons inflowing from the outside of the city based on forecast figures of resident population as exogenous variables. This process is Step 1. In case of prediction, predicted figures for employment rate, rate between employed persons and engaged persons, outflow rate, inflow rate, and rate of people working at home are needed. Followings are basic

concept of the figures.

Employment rate and rate between employed persons and engaged persons are greatly affected by economic trend and political judgment is needed for them as well. The following three are important administrative policies: How to promote employment measures in a city, how to attract businesses, and how to build an industrial economic system and cooperation. Some of the main purposes are employment rate and rate between employed persons and engaged persons. It is realistic for us to set policy goals based on time-series projection.

On the other hand, it is necessary to forecast outflow rate and inflow rate, and rate of people working at home because they do not depend on policy but do heavily on citizens' choice of occupation and working place, situation of area, and industrial structure. The rates of short-medium term—five to ten years—can be sufficiently forecasted by time-series projection result based on the recent ten to twenty year data.

Employed population is resolved into the four types based on the number of employed persons and engaged persons as a control figure, and by using outflow rate, inflow rate, and rate of people working at home. In this setting, people working at home and outside the home is overlapped with employed persons and engaged persons. As Figure11 shows, for satisfying the two control figures a process of trial and error is taken, resulting in convergence, which is projection.

However, during the process this convergence may cause errors in characteristics of employment set at the start during the process, which is sometimes difficult to ignore. Then again the number of employed persons and that of engaged persons by the type of employment are calculated by applying characteristics of employment against all the employed persons and engaged persons, which are initially set, based on convergence. Moreover, on the condition that figures averaged harmonically by above-mentioned convergence are the number of employed persons by the type of employment and the number of persons engaged, you obtain approximations adjusted comprehensively by the number of all the employed persons, that of engaged persons, or characteristics of employment. Although all conditions cannot be completely satisfied by the results, there is no problem to consider them final prediction due to the ambiguity of the system and measures or the accuracy of indicators introduced exogenously.

(**Step 2**)

Step 2 predicts both employed persons and engaged persons by working place through resolving them by division of the Japan Standard Industrial Classification. Firstly, the number of employed persons and engaged persons by industry needs to be estimated. Their control figures are the number of all the employed persons and that of all the engaged persons in Step 2. In addition to them, when the current situations are highly considered, those figures can be divided proportionally and found in recent industrial distribution (Current Pattern Method).

Or, time-series analysis of only figures expected to change in the future is replaced by the current numbers. Moreover, industrial distribution is found again by modification, on which depends on policy development, if necessary. The result can be proportionally distributed (Modificating method of time-series estimation)

The blanks of Table 4, where the three types of employed persons are compare with those of employed persons by industry, is filled by the sum which is found by the former steps and the above-mentioned methods. Under the condition that those figures are equal to the sum, columns of the cross tabulation are filled by the estimation through this step. They are calculated by setting present distribution, part of time-series estimate, or modification by policy figures to an initial value cause, and by joint probability maximization method[7].

It means that in Table 4 the number of all the employed persons divided by distribution values (current values or modified values) gives p_{ij}. This figure is used for a priory probability. Based on this, let initial value be ω_i, λ_j (e.g. $\omega_i = 1+\ln U_i$, $\lambda_j = 1+\ln V_j$) and be modified repeatedly by using formula (2), (3) in Table 4, convergence (ω_i, λ_j) is obtained. Substitute the result into the expression (1), by which you can estimate the number of employed persons (y_{ij}) in working place (i) and of industry (j) is given.

What is mentioned-above is similarly adopted to the types of engaged persons and engaged persons by industry in Tale 4. In that case, classification of engaged persons is as follows: engaged persons at home, engaged persons outside the home, and inflowing engaged persons.

Table 4 Forecast of employed persons and engaged persons by employment type and by industry

Step 2

Division j Employment type of engaged persons i	A Agriculture	B Forestry	.....	S Industries unable to classify	Total (periphery value) U_i
1. Working at home		$[p_{ij}]$ (Initial value distribution)			Number of engaged persons at home
2. Working outside the home					Number of engaged persons outside the home
3. Outflow to the outside of the city					Number of employed persons outflowing to other cities
Total (pheriphery value) V_j	.....	number of employed persons by division j		.....	Total of the above three categories

Number of persons engaged in j, employment type i $y_{ij} = P_{ij} \exp(\omega_i + \lambda_j - 1)$ (1)

Where $\omega_i = 1 + \ln U_i - \ln\left(\sum_j p_{ij} \exp \lambda_j\right)$ (2)

$\lambda_j = 1 + \ln V_j - \ln\left(\sum_i p_{ij} \exp \omega_i\right)$ (3)

$i = 1, 2, 3 \quad j = \mathrm{A}, \mathrm{B}, \ldots, \mathrm{S}$

Step 3 (In case of wholesale and retail trade)

Major groups j Employment type of employed persons i	49 Retail trade, general merchandise	50 Retail trade (dry goods, apparel and apparel accessories)	.....	60 Miscellaneous retail trade	Total of wholesale and retail trade (periphery value) U_i
1. Working at home					Number of persons engaged in wholesale and retail trade at home
2. Working outside the home		$[p_{ij}]$ (Initial value distribution)			Number of persons engaged in wholesale and retail trade outside the home
3. Outflow to the outside of the city					Number of employed persons who take on wholesale and retail, outflowing to other cities
Total (pheriphery value) V_j		Number of employed persons by major group j			Number of employed persons who take on wholesale and retail trade

$i = 1, 2, 3 \quad j = 49, 50, \ldots, 60$

Engaged persons at home and outside the home by industry are forecasted by Table 4 of employed persons and engaged persons. The sum totals of them are equal, however, that by each industry is not completely equal. Therefore, averaged numbers of the two categories are final prediction.

(**Step 3**)

In Step 3, distribution of employed persons and engaged persons by major group of the JSIC is projected, if necessary, regarding appropriate contents in divisions. The measure to predict it is totally same as Step 2; by using periphery values in cross tabulation based on the result of Step 2 as control value, contents in the cross tabulation are estimated by joint probability maximization method.

5. Future prospect of employment structure in Fukuoka City

In this chapter, how to forecast employment structure in 2015 is confirmed and predicted by applying the method of the previous chapter.

It is estimated that population in 2015 at 1,509,413 based on time-series population projection (straight line) by using data from 1990 to 2006 (Table 5). For information, the table includes figures forecasted by other measures

Table 5 Estimate of future population in Fukuoka City

FY	Population	Time-series forecast of population	Population estimated by the KERC[3]	Population estimated by the IPSS[4]	Population estimated by the IPSS[5]
2006	1,414,417				
2007	1,426,724	1,421,709			
2008	1,437,718	1,432,672			
2010		1,454,598	1,446,079	1,443,789	1,443,049
2015		**1,509,413**	1,490,577	1,481,285	1,467,838
2020		1,564,228	1,521,754	1,508,828	1,481,314

Table 6 Projection result of the number of employed persons and engaged persons by employment type

employed persons and engaged persons	Convergence	By characteristics of employment	Harmonic average (final)	Total	Default	Residual error
Outflow W3	77,918	77,070	**77,493**	employed		[−0.1%]
At home W1=E1	45,528	45,590	**45,559**	**709,012**	709,424	−412
Outside the home W2=E2	585,566	586,354	**585,960**	engaged		[0.3%]
Inflow E3	236,232	239,729	**237,974**	**869,493**	866,916	2,577

Characteristics of employment	Setting	Convergence	Convergence /Setting	Final	Final /Setting	Employment rate
Rate between employed persons and engaged persons γ	1.2220	1.2233	1.0011	**1.2263**	1.0036	0.470
Outflow rate α	0.1087	0.1099	1.0110	**0.1093**	1.0055	
Rate of people working at home δ	0.0643	0.0642	0.9987	**0.0643**	0.9993	
Inflow rate β	0.2764	0.2724	0.9854	**0.2737**	0.9902	

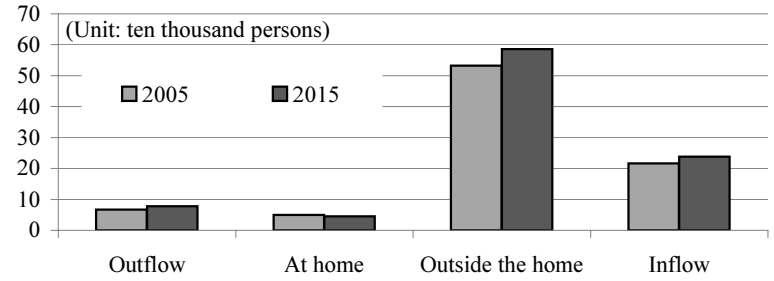
of other institutions. In fact, numbers by time-series projection are larger than them. However, real numbers (population estimates) exceed time-series projection by considering the trend in recent two years. If this trend continued, the 2009 population of Fukuoka would surpass forecasts by other institutions and actually did. According to the information, above-mentioned time-series projected population is adopted because of its feasibility.

Employment rate is set at 0.47, equal to national average in status quo. Time-series projected numbers other than employment rate which were calculated in § 3.1 are used.

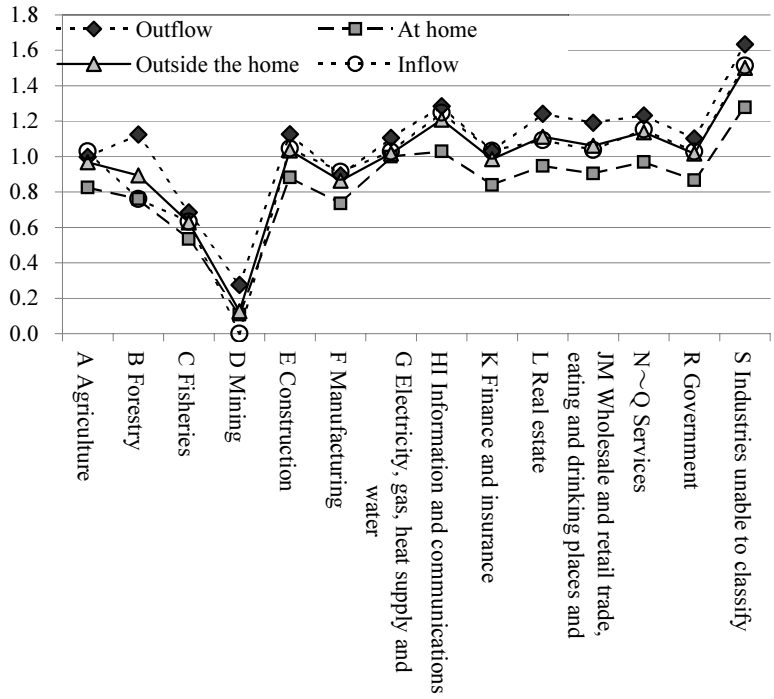
Table 6 illustrates forecasted figures regarding Step 1. The second column from the left of the top table shows convergence numbers by setting ε =500 persons. The third column of the lowest table illustrates characteristics of employment calculated by the number of employed persons and engaged persons in the table above. Characteristics of employment are nearly equal to those which were originally set.

Considering the accuracy of projection owning characteristics of employment, convergence figures by type can be fully used as forecast figure.

Or the number of employed persons calculated by type, based on the convergence figures, and characteristics of employment set in the first part of this chapter, are shown in the third from the left of the upper table in Table 6. By setting harmonic average between those figures and convergence figures as forecast figure, final forecast figures are found in the fourth column from the left of the upper table, obtaining predicted figures adjusted by both the number of employed persons and engaged persons, and characteristics of employment to residential population. In addition, characteristics of employment based on this result are illustrated in the fifth column of the lower table. It can be said that characteristics of employment is almost equal to set values with satisfactory accuracy (with



(1) Comparison between the predicted figures of employed persons and engaged persons



(2) Comparison between the numbers of employed persons and engaged persons by industry in 2015 and 2005

Figure 12　Comparison between the numbers of employed persons and engaged persons

uncertainly of less than 1%).

As a result, compared with 2005, the number of employed persons and engaged persons in Fukuoka city will increase by 60,000 and by 70,000 in 2015 respectively. That of the two categories will total 709,000 and 869,000 (Table 8) with an increase in outflowing employed persons of 11,000, inflowing employed persons of 53,000 and inflowing engaged persons of 21,000, and decrease in engaged persons at home of 4,000 (Figure 12 (1)).

Then, above-mentioned result is used as the number of engaged persons by industry and employment type in Table 4 of Step 2.

Furthermore, the result of the total number of employed persons and engaged persons used as control figure assume the number of employed persons and engaged persons by industry. Although industrial classification was different between the past and the present one, past one is adopted because of the necessity of long term view.

To begin with, judged from historical data, time-series changes are observed by examining how the number of employed persons and engaged persons fluctuated. The column of "Trend" in Table 7 shows them. Word "leveling out" means that there is little change in the recent trend. In this case, the 2005 figures are adopted as forecast number. Basically changes can be read by decline, slight decrease, and increase. The 2015 figures are forecasted by one of the most adoptable figures by time-series data analysis which uses straight line, exponential or logarithmic curve.

Table 7 Forecast of the number of employed persons and engaged persons by industry

Classification	Employed persons			Engaged persons		
	2005	Trend	**2015**	2005	Trend	**2015**
A：Agriculture	4,133	Decrease	3,409	4,173	Decrease	3,826
B：Forestry	62	No change	63	59	Decrease	43
C：Fisheries	829	Decrease	474	829	Decrease	472
D：Mining	48	Decrease	13	37	Decrease	0
E：Construction	55,243	No change	56,531	70,599	No change	72,299
F：Manufacturing	38,876	Decrease	32,191	44,218	Decrease	39,858
G：Electricity	4,076	No change	4,171	5,449	No change	5,580
H,I：Information and communications / Transport	63,122	Increase	74,693	87,509	Increase	108,344
K：Finance and insurance	23,216	Slight decrease	21,972	31,975	No change	32,745
L：Real estate	15,723	Increase	17,477	19,381	Increase	20,605
J,M：Whole sale and retail trade / eating and drinking places and accomodations	209,335	No change	214,217	237,344	No change	243,060
N～Q：Services	209,335	Increase	236,068	251,082	Increase	285,657
R：Government (not elesewhere classified)	17,736	No change	18,150	24,979	No change	25,581
S：Industries unable to classify	19,896	Increase	29,582	21,118	Increase	31,423
Total	648,832		**709,012**	798,752		**869,493**

By dividing those figures proportionally for meeting total forecast figures of employed persons and engaged persons, the 2015 columns in Table 7 illustrates the forecast figures of employed persons and engaged persons by industry.

By using the numbers in the above mentioned process as periphery value, distribution figures by employment type are estimated by joint probability maximization method. Table 8 shows the average of predicted figures of people working both at home and outside the home. The first table shows figures for 2005, the second projected figures for 2015, and the third gap between the two.

Judged by the result of the forecast, the 2015 structure of employed persons and engaged persons is as follows:

1） Both the number of employed persons and engaged persons are expected to increase by 10% and to expand more urban potential because of the relative dispersion of flow in Greater Fukuoka.

2） While the rate of people working at home in employed persons will decrease, that of outflow, that of people working outside the home, and that of inflow will increase. As a result, employed persons by type will be comprised of 10.9% (outflow), 6.4% (at home), and 82.6% (outside the home), with a decrease of 'at home' by 1.2 point from 2005, which will add to the other two categories. Furthermore, the percentage of the number of engaged persons inflowing from the outside of the city will go up from 27.1% to 27.4%.

3） Although an increase in outflowing and inflowing engaged persons will change from the situation of dispersion to that of concentration, the ratio between inflow and outflow will improve from 3.25 to 3.07 because of the high growth rate. It is also estimated that commuting flow will be formed between Fukuoka City and its neighboring cities.

4） Figure12 (2) shows a growing number of engaged persons by industry and type. Change in the number of engaged persons by industry on the basis of figures as of 2005 as a standard is illustrated. The most significant rise is shown in industries unable to classify: 1.63 of outflowing engaged persons, 1.28 of inflowing engaged persons, 1.50 of engaged persons outside the home, and 1.51 of inflowing engaged persons, compared to 2005. People engaged in arts and culture, or part-time workers seem to be classified into this genre. As NPOs and self-employed persons are actively working, an increasing number of people will be engaged in those activities in the future.

Table 8 Prediction result of the number of employed persons and engaged persons by industry

2005	A	B	C	D	E	F	G	H, I	K	L	J, M	N∼Q	R	S	Total	
Outflow	230	11	37	21	6,725	9,131	439	7,128	1,684	570	17,140	20,321	2,338	839	66,614	Employed
At home	2,907	10	521	1	7,437	2,909	0	2,177	897	2,926	13,541	14,635	2	1,536	49,499	648,832
Outside the home	996	41	271	26	41,081	26,836	3,637	53,817	20,635	12,227	165,856	174,379	15,396	17,521	532,719	Engaged
Inflow	270	8	37	10	22,081	14,473	1,812	31,515	10,443	4,228	57,947	62,068	9,581	2,061	216,534	798,752
Total	4,403	70	866	58	77,324	53,349	5,888	94,637	33,659	19,951	254,484	271,403	27,317	21,957	865,366	

2015	A	B	C	D	E	F	G	H, I	K	L	J, M	N∼Q	R	S	Total	
Outflow	230	12	25	6	7,572	8,162	485	9,152	1,737	708	20,422	25,031	2,579	1,371	77,493	Emplopyed
At home	2,399	8	279	0	6,560	2,141	0	2,242	753	2,774	12,251	14,186	2	1,964	45,559	709,012
Outside the home	965	37	170	3	42,528	23,184	3,701	65,033	20,342	13,602	176,095	198,360	15,647	26,293	585,960	Engaged
Inflow	278	6	23	0	23,081	13,236	1,864	39,336	10,789	4,623	60,162	71,602	9,854	3,120	237,974	869,493
Total	3,871	63	498	9	79,742	46,723	6,050	115,763	33,621	21,707	268,930	309,180	28,081	32,748	946,986	

Amount of change	A	B	C	D	E	F	G	H, I	K	L	J, M	N∼Q	R	S	Total	
Outflow	0	1	−12	−15	847	−969	46	2,024	53	138	3,282	4,710	241	532	10,879	Employed
At home	−508	−2	−242	−1	−877	−768	0	65	−144	−152	−1,290	−449	0	428	−3,940	60,180
Outside the home	−31	−4	−101	−23	1,447	−3,652	64	11,216	−293	1,375	10,239	23,981	251	8,772	53,241	Engaged
Inflow	8	−2	−14	−10	1,000	−1,237	52	7,821	346	395	2,215	9,534	273	1,059	21,440	70,741
Total	−532	−7	−368	−49	2,418	−6,626	162	21,126	−38	1,756	14,446	37,777	764	10,791	81,620	

5） Industries unable to classify are followed by information and communications, transport and real estate. Figures for engaged persons at home in the four categories almost remain stable and those for other types will increase by 110% to 130%. On the contrary, the growth rate of less than 0.9% will be shown by forestry, agriculture, manufacturing, fisheries, and mining. Especially, there will be a decline in fisheries and mining to 60% and 20% of the present rates respectively.

6） Regarding a significant qualitative change, while there is an increase in the number of persons engaged at home in services, information and communications, transport, wholesale and retail trade, eating and drinking places, accommodations, industries unable to classify and the inflowing engaged persons of services, the number of persons engaged outside the home in manufacturing will decline（Table 8）.

6. Conclusion

In order to understand industrial economic structure in Fukuoka City, employment structure by type in relation to the city is analyzed in this paper. Consequently, Fukuoka City has characteristics of a core regional city, ranked with Sapporo and Sendai. However, concerning general characteristics of employment of urban industries such as information and communications, professional services, finance and insurance, Fukuoka has obviously characteristics more similar to Nagoya and Osaka.

Furthermore, in terms of maintaining urban potential, Fukuoka is in a more desirable condition than the three major cities in Japan and core regional cities. In the sense, there will be enough room to enrich urban potential if industrial economic policy develops favorably.

On the other hand, employment structure by industry and type in the next ten years was projected by the way devised to effectively forecast them. This kind of projection can be adopted in five to ten years at most, given the fast speed of technological innovation and economic situations at home and abroad. A simple way to project the figures, which satisfies this point and is for practical use, is suggested in this paper.

As a result of the projection by the way, it is estimated that some industries mainly in information industry, industries unable to classify, or services will be increasingly specialized. With a high rate of flow caused by inflow and outflow, potential for urbanization will be higher. On the contrary, it is presumed that the number of employed persons and persons engaged in primary and secondary industry will decrease.

Taking the current situation and future prospect into account, followings are considerations of how to promote development in Fukuoka City.

1） If this situation continues, the number of employed persons and engaged persons in primary industry will decline with no doubt, which then leads to a threat to food security, maintenance of farmlands, conservation of mountains. Drastic measures are needed for avoiding the risk, including not only keeping the industries active and using urban lands effectively. To be specific, followings are included: development of primary industry by corporation, policy to promote elderly power, construction of a management system for farmlands, and mountains and forests, and review of policy on land utilization.

2） Although inflowing and outflowing engaged persons accounts for 33% of all the engaged persons at present and will do in the future as well, the number is expected to increase from 280,000 to 310,000. With a decrease in the number of engaged persons at home, that of engaged persons outside of home will rise by 50,000. Taking into consideration those figures, environmental problems, and energy issues, discussion on measures to use more actively urban transport system mainly public transport[8), 9)], and furthermore to develop effective use of urban land, and to create a policy in order to invigorate urban area[10)] are needed.

3） It is estimated that the rate of employed persons and persons engaged in information or services will increase. Those industries are more specialized and work for more urban-oriented. Taking the situation into account, a way for urban industrial policies in Fukuoka, which has strong competitiveness internationally and in wide areas, is found. Various policies should be developed: human development and support for people who are

eager to promote leading-edgy business, active promotion and introduction of high technology development, more constructive development of information industry, expansion of an international and wide-area network for exchange[11]. In short, it is necessary for us to create an intelligent-type network city.

This study discusses mainly a method to understand and forecast employment structure in Fukuoka City. The problem is how the city will improve based on urban industrial economic policy by actively using the way and reviewing employment structure from all points. However, this issue is just examined by time-series analysis of 2015 as an example, confirming it in above-mentioned consideration and §5. For outlining a more specific strategy on how the city should be improved on the basis of more detailed industrial economic policy and its prospect, possible policies, and their forecasts and effects of each case need to be examined and fully discussed. This is a challenge for the future.

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