

Characteristics and Issues of Fukuoka City Revealed through Population Trends

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Abstract: For rural cities in Japan, it is becoming more important than ever for urban and regional growth and development to provide special incentives to ensure social population increase. For Fukuoka City to continue to fulfill its role as the hub of the Kyushu region and contribute to the regional economy, the construction of a system to attract and keep a skilled labor force is essential, such system to be supported by providing employment opportunities for skilled personnel through industrial development (including tie-ups between industry and academia). Furthermore, improvement in education would not only attract people from Kyushu and surrounding regions, including other nations, but also help prevent them from leaving the region.

Keywords:Fukuoka City, ageing society with falling birthrate, social population change, skilled labor force

1. Introduction

The global economy is experiencing a depression unlike any in the past, in the sense that it is the first depression to take place in the globalized environment. In general, globalization is taken to mean an environment where people, goods, capital and information can flow freely across national borders, and the world economy today is a cross-border, mutually interactive environment. The financial meltdown triggered by the sub-prime loan crisis in the United States sent ripples throughout the global economy, accelerated to instantaneous speed by globalization.

The effects of globalization are felt by regional economies in Japan as well. In addition to the effects of fluctuations in national economies of distant lands, the reduced influence of national borders has created an environment where cities must now compete in the multi-national arena, instead of the traditional domestic arena.

Japan is also experiencing a rising average age accompanied by a falling birthrate, combining to produce a minus-growth population. Japanese regional cities competing with other cities in the globalized world simultaneously face these problems of an ageing population and falling birthrate, and as a result are experiencing major problems in ensuring continued development and growth.

This paper is a basic analysis of population mobility with specific reference to Fukuoka City, and is designed to serve as reference data for the development of policies to support the development and growth of Japanese regional cities in the globalized, international economy.

2. Population trends

2.1 Population trends: historical and future

It would be beneficial to first confirm the state of the population in Japan. Fig. 1 shows population trends for Japan, Kyushu, Fukuoka Prefecture, and Fukuoka and Kitakyushu cities, utilizing actual census data through 2005 and median estimates from the National Institute of Population and Social Security Research (IPSS) for 2010 and

beyond.

The Japanese population shifted from plus to minus growth in 2005. The population of Kyushu exhibited the same timing and trend, although it did have an earlier drop to minus population growth as well. The population of Fukuoka Prefecture is expected to change from plus to minus growth in 2010. In contrast, the population of Fukuoka City is forecast to continue to grow through 2025, only switching to minus growth in 2030. Kitakyushu City, another ordinance-designated city in Fukuoka Prefecture, reversed to minus growth in 1985.

Populations of Kyushu and Fukuoka Prefecture have grown until recently, and while minus growth was expected in the future, the specifics are different for each of the prefectures of Kyushu. Fig. 2 indicates the population trends for Kyushu prefectures in the same way as Fig. 1, showing that population peaked in all prefectures except Fukuoka in the 1955-60 period, and has been flat or minus since. This trend is somewhat in advance of the national trend.

2. 2 Natural and social population change

Population trends in Kyushu closely resemble national trends, but the trend in Fukuoka Prefecture is distinctly different from other Kyushu prefectures. In addition, Fukuoka Prefecture contains both Kitakyushu City where population growth shifted to minus quite early, and Fukuoka City, where minus population growth has been later.

The differences in population growth are due to different population-related factors, but can be broadly grouped into two categories: natural population change due to birth and death, and social population change due to migration. Social population change on the national level consists of people immigrating into or emigrating from Japan, but this is quite small in relative terms and so the major factor at the national level is natural population change. Population changes at the regional and city levels are due to a combination of both natural and social population changes, but characteristics are found to be different when only city development and growth factors are considered. Natural population change is defined by birth and death trends, and with the exception of a portion of the higher age group, has little effect on the labor market, for which reason it can be classified as a factor affecting long-term city and regional growth and development. Social population change is population movement directly affecting the labor market, including new employment, change in employment and retirement, making it a factor that affects city and regional growth and development over the short term. In addition, it also has a long-term effect on natural population change.

3. Natural and social population change at city and regional levels

3.1 Natural and social population change in national and wide-region levels

Population change can be natural or social, but because they function differently as factors in city and regional population change, it is essential to clarify precisely how and to what degree each functions in order to determine the characteristics of the involved cities and regions.

To accomplish this the nation was divided into ten regions, and population change and related factors investigated. The ten regions are:

Hokkaido

Tohoku (Aomori, Iwate, Miyagi, Akita, Yamagata and Fukushima prefectures)

Kanto (Ibaraki, Tochigi, Gunma, Saitama, Chiba, Tokyo and Kanagawa prefectures)

Tokai (Shizuoka, Aichi, Gifu and Mie prefectures)

Shinetsu (Yamanashi, Nagano and Niigata prefectures)

Hokuriku (Toyama, Ishikawa and Fukui prefectures)

Kansai (Shiga, Kyoto, Osaka, Hyogo, Nara and Wakayama prefectures)

Chugoku (Tottori, Shimane, Okayama, Hiroshima and Yamaguchi prefectures)

Shikoku (Tokushima, Kagawa, Ehime and Kochi prefectures)

Kyushu-Okinawa (Fukuoka, Saga, Nagasaki, Kumamoto, Oita, Miyazaki, Kagoshima and Okinawa prefectures)

Fig. 3 shows population trends for the nation and individual regions from 1920 to 2005, and Fig. 4 shows population indexed to 1920 as 100. Kanto, Kansai and Tokai regions show growth rates above the national average, and while Hokkaido had a growth rate above that of Kanto through 1950, its index dropped to about the national average by 2005. Other regions show population growth, but below the national average.

The fact that there are regions exceeding the national average by a considerable amount, and other regions below the national average, suggests that social population change due to mobility between regions is a major factor.

Figs. 5 and 6 take Kanto (as an example of a region with a growth rate above the national average) and Kyushu-Okinawa (as an example of a region with a low growth rate), showing population change in 5-year periods, broken down into natural and social change. Note that the scale, however, is to total region population.

The population growth rate of Kanto is considerably above the national average, and the breakdown shows that both natural and social population changes are plus. The natural population growth rate has slowed since 1975, while the social growth rate slowed until 1980, picked up again for a decade, dropped again in the 1990-95 period, and then picked up again, but as an overall trend it has been gradually dropping since 1980.

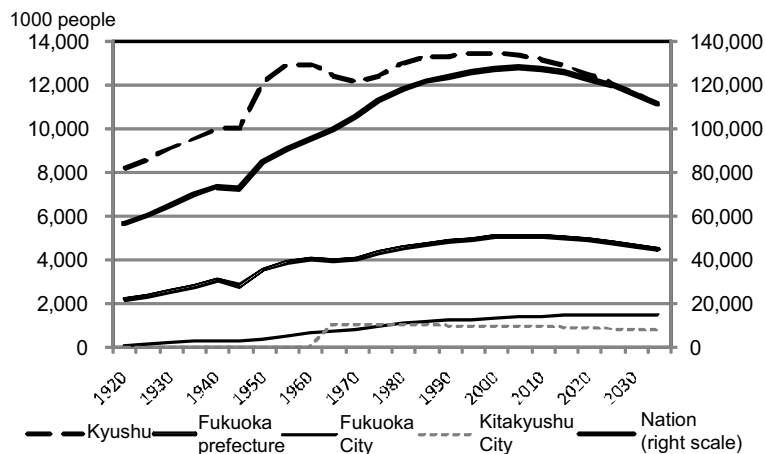


Fig. 1 Population Trends
Sources: MIC^(1) 2), IPSS^(3) 4)

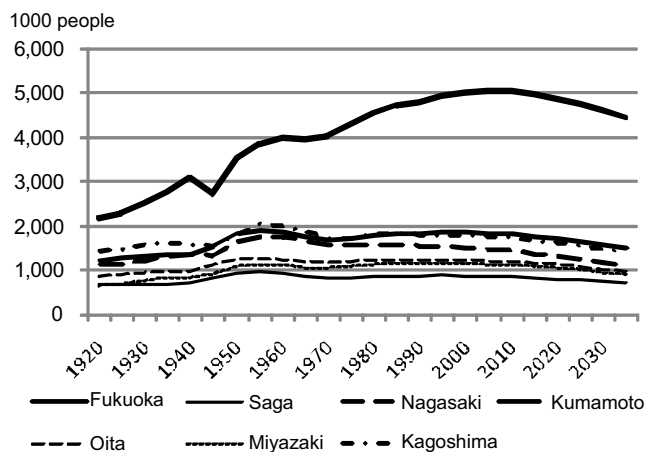


Fig. 2 Population Trends (Kyushu prefectures)
Sources: MIC^(1) 2), IPSS^(3) 4)

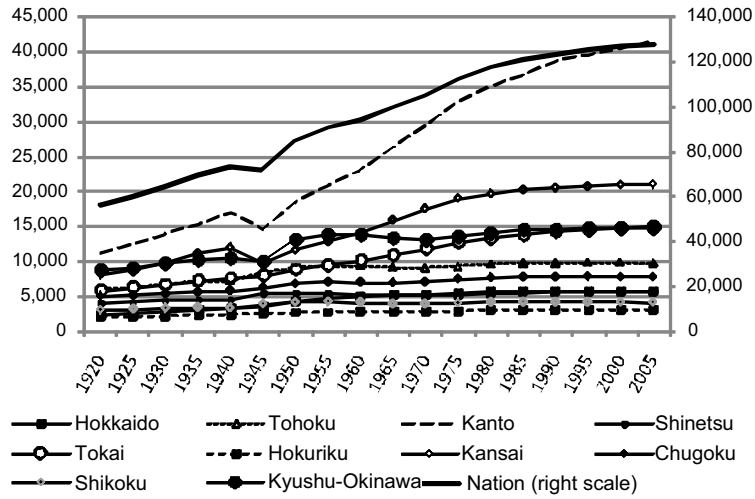


Fig. 3 National and Regional Population Trends
Sources: MIC¹⁾

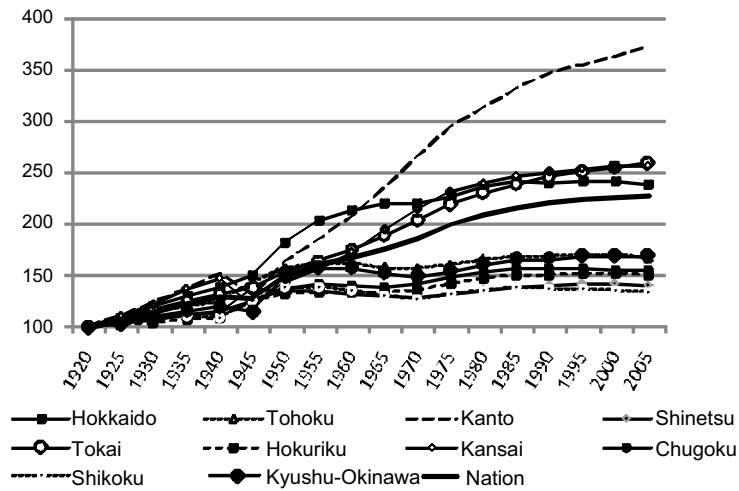


Fig. 4 National and Regional Population Trends (1920 indexed to 100)
Sources: MIC¹⁾

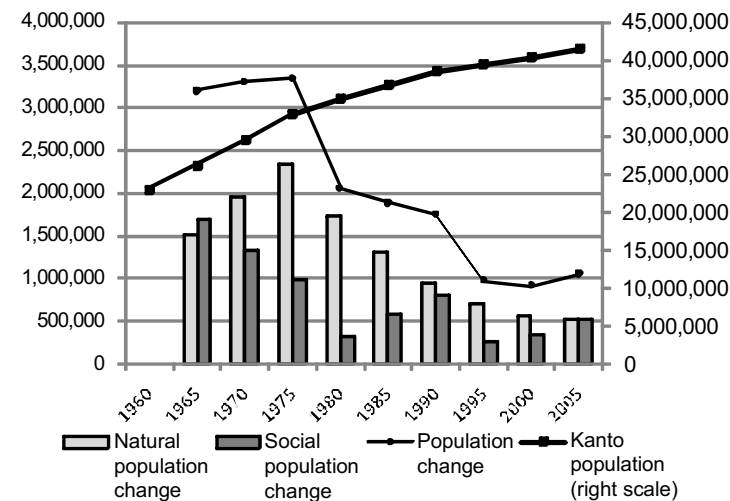


Fig. 5 Kanto Region Population Trends
Sources: MIC²⁾

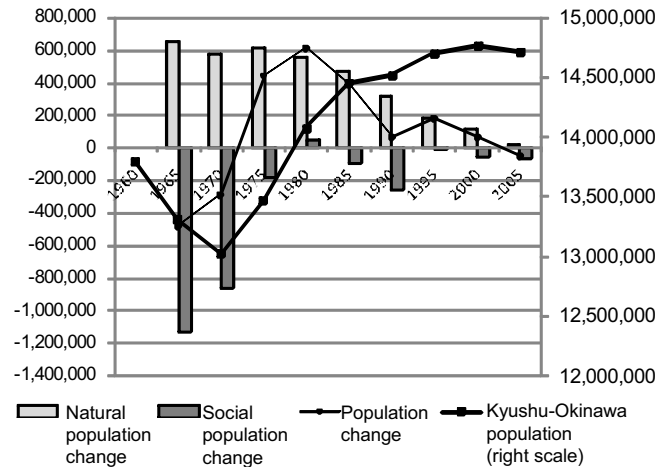


Fig. 6 Kyushu Region Population Trends
Sources: MIC²⁾

Natural population change in Kyushu-Okinawa remained plus and relatively stable through about 1980, at which point the growth rate began to flatten out. The degree of minus growth due to social population change dropped through 1980, going plus for a short period, and then increased again through 1990. The degree of minus growth dropped abruptly, and then has grown again since 1995.

Data on natural and social population change, including for regions not shown above, indicates that natural population change became relatively less significant in all regions in the 1980s, while social population change was roughly divided into high-growth and low-growth regions. These facts suggest that regional population change is primarily affected by social population change.

3. 2 Natural and social population change in Kyushu prefectures

In this section the author examines whether population change in Kyushu prefectures (where Fukuoka City is located) is due to natural or social factors, and determines what those factors are.

Figs. 7 and 8 show population trends for Fukuoka prefecture and Nagasaki prefecture for 1960-2005, in 5-year intervals, broken down into natural and social population change. Note that all the prefectures of Kyushu with the exception of Fukuoka prefecture closely resemble each other, and Nagasaki prefecture is shown as representative of the group.

There are minor differences in population change between prefectures as far as natural population change is concerned, but as with regions, all prefectures show a downward trend from the 1980s. Social population change is plus for various prefectures at various times, but with the exception of Fukuoka prefecture Kyushu overall shows low population growth rates.

Overall population change is the sum of natural and social population change, and (with the exception of Fukuoka prefecture) the prefectures of Kyushu are similar in both natural and social population change. The shift in natural population change from plus to minus and the minus trend in social population change for prefectures other than Fukuoka result in a situation so that the social population growth in Fukuoka prefecture cancels out the minus growth of the other prefectures.

3. 3 Natural and social population change in Fukuoka prefecture and Fukuoka City

Population has grown steadily in Fukuoka prefecture since 1970, but as mentioned above, the IPSS predicts it will shift to minus growth from 2010. The situations in Fukuoka City and Kitakyushu City, however, both located in Fukuoka prefecture, are different. The natural and social population changes in these two cities were compared

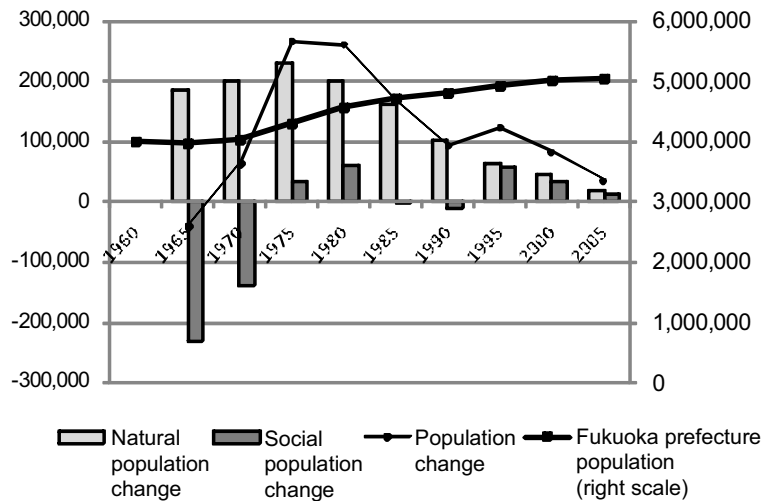


Fig. 7 Population Trends of Fukuoka Prefecture
Sources: MIC²⁾

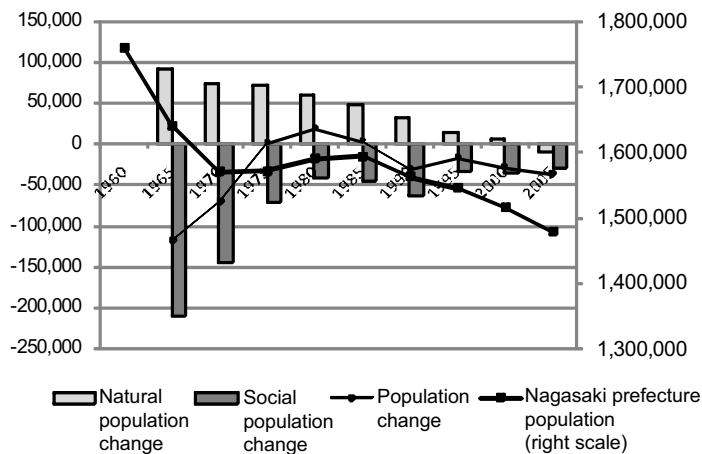


Fig. 8 Population Trends of Nagasaki Prefecture
Sources: MIC²⁾

to clarify their effect on population trends in Fukuoka prefecture.

Figs. 9 and 10 show population, natural population change and social population change for Fukuoka and Kitakyushu cities from 1988 to 2007. Natural population change in Fukuoka City remains plus, although gradually flattening out, and while social population change dropped to minus growth for a short period in the 1990s, it has remained plus since 1996, so that total population growth has remained plus. Population has continued to drop in Kitakyushu City, with natural population change gradually dropping to finally switch to minus growth in 2003. Social population change has also been minus, although the degree has lessened since 2000. Between them, the two cities account for almost half of the population of Fukuoka prefecture, and while natural population change remains plus (although dropping gradually), and social population change is plus or slightly minus, with the result that the population of Fukuoka prefecture overall continues to rise.

As discussed above, differences in wide-region population trends are primarily due to social population change, and social population change is also a critical factor in determining population at the prefectural and city levels. In addition, social population change in Fukuoka prefecture exercises a major effort on Kyushu, and social population change in Fukuoka City on the region. Based on the above, the social population change of Fukuoka City can be positioned as a key indicator of development and growth for Fukuoka City as the hub of Kyushu.

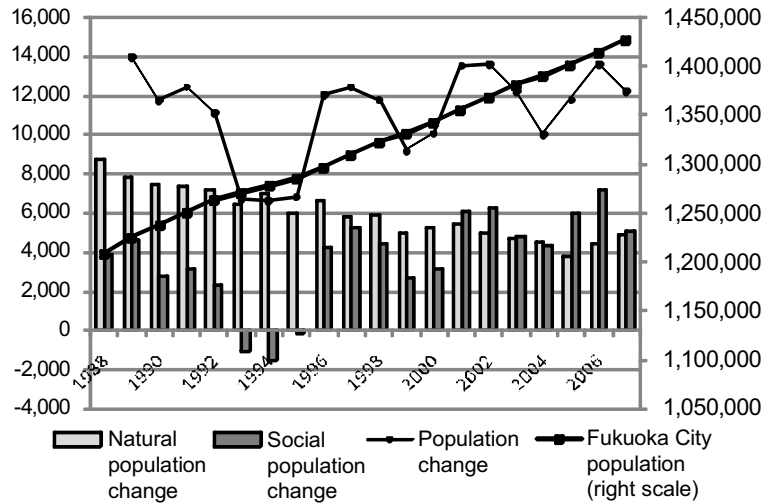


Fig. 9 Population Trends of Fukuoka City
Source: Statistics from official Fukuoka City Web sites

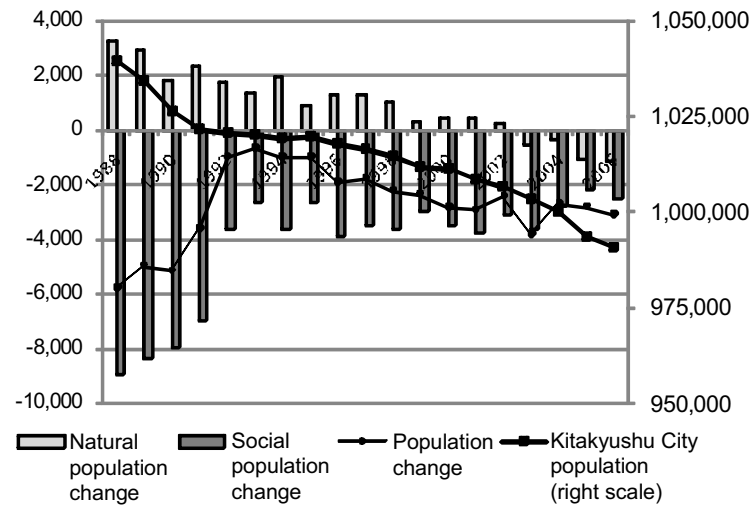


Fig. 10 Population Trends of Kitakyushu City
Source: Statistics from official Kitakyushu City Web sites

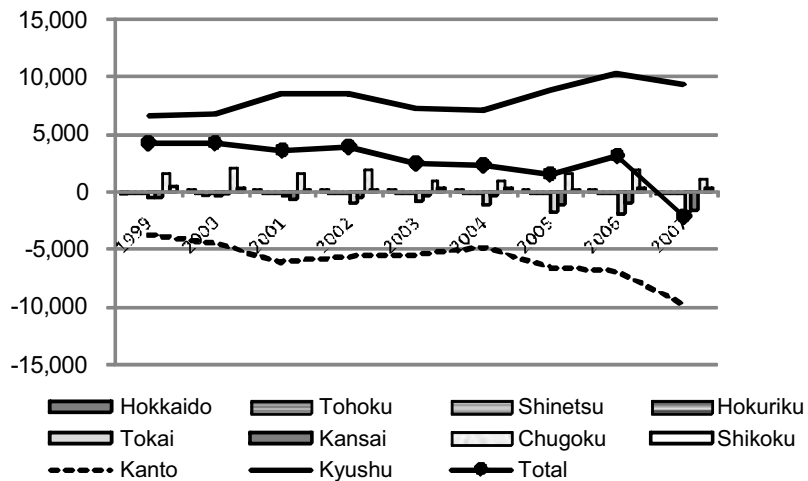


Fig. 11 Fukuoka Prefecture Regional Social Population Change (National)
Source: MIC⁵⁾

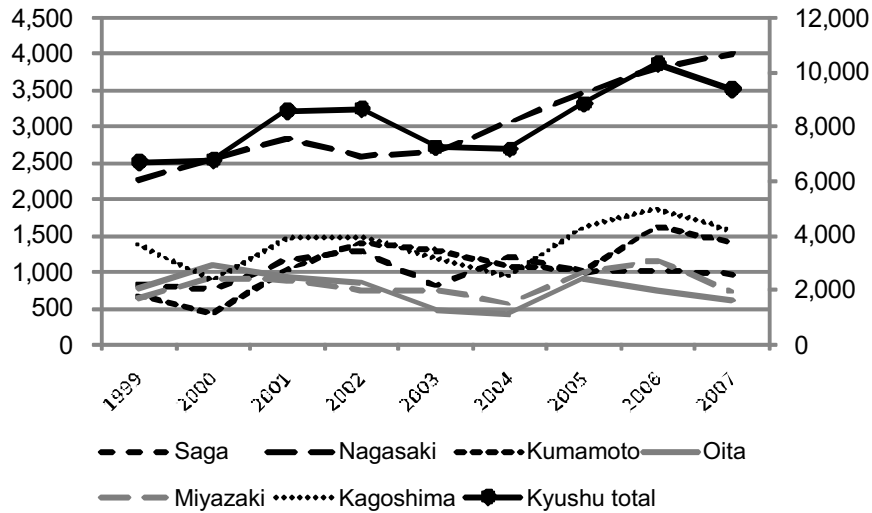


Fig. 12 Fukuoka Prefecture Regional Social Population Change (Kyushu)
Source: MIC⁵⁾

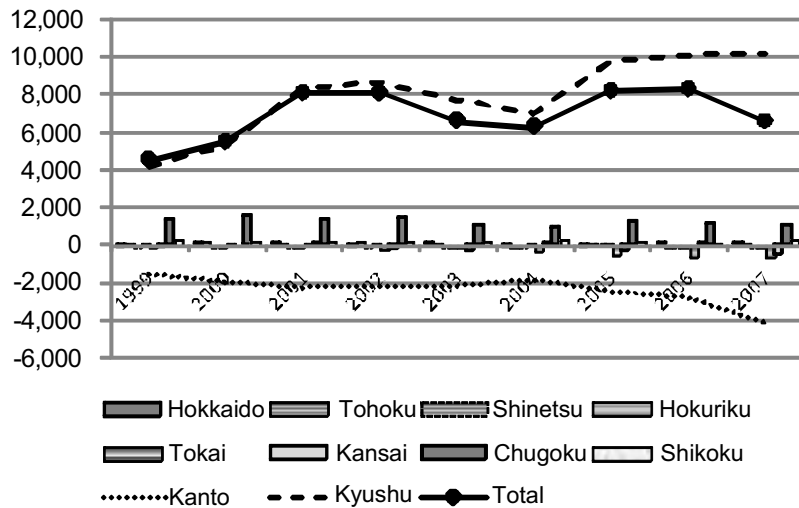


Fig. 13 Fukuoka City Regional Social Population Change (National)
Source: MIC⁵⁾

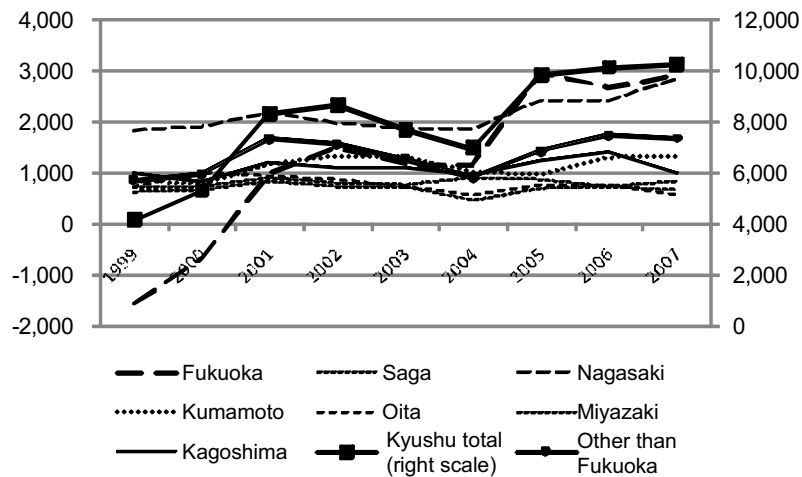


Fig. 14 Fukuoka City Regional Social Population Change (Kyushu)
Source: MIC⁵⁾

3. 4 Regional Factors in Social Population Change in Fukuoka Prefecture

Social population change in Fukuoka prefecture and Fukuoka City are critical indicators of the immediate region and Kyushu overall, and one factor in social population change is which regions immigration occurs from, and emigration to, as revealed through the structures of the individual regions.

Figs. 11-14 show the social population change for Fukuoka prefecture and Fukuoka City from 1999 through 2007, both for the entire nation and for Kyushu alone. The structures of social population change of Fukuoka prefecture and Fukuoka City resemble each other, with immigration from other prefectures in Kyushu, and emigration to the Kanto region. The structure within the prefecture, while there is dispersal from Fukuoka City throughout Fukuoka prefecture, reveals a tendency to concentrate in Fukuoka City.

Table 1 illustrates the relationship in social population growth from 1999 through 2007 for Fukuoka prefecture and Fukuoka City, showing that growth of Fukuoka City has always been greater (with the exception of change due to emigration from Fukuoka City to other locations in Fukuoka prefecture). Factors include the fact that there is immigration into both Fukuoka City and Fukuoka prefecture from elsewhere in Kyushu, with Fukuoka City experiencing the higher influx in some years, while emigration from Fukuoka City to Kanto is always less than from Fukuoka prefecture. With the exception of Fukuoka City, social population growth in Fukuoka prefecture is minus, in the same way as the rest of Kyushu is minus with the exception of Fukuoka prefecture. It is clear that social population growth in Fukuoka City is a major factor within Fukuoka prefecture.

Table 1 Outline of Social Population Growth for Fukuoka Prefecture and Fukuoka City
Source: MIC⁵⁾

| | | | | | | | | | |
|--------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| Fukuoka City | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 |
| Social population growth | 4,534 | 5,518 | 8,078 | 8,097 | 6,628 | 6,315 | 8,200 | 8,315 | 6,573 |
| Kanto | - 1,590 | - 1,991 | - 2,357 | - 2,251 | - 2,243 | - 1,944 | - 2,552 | - 2,803 | - 4,153 |
| Other | 3,548 | 2,869 | 1,149 | 202 | 65 | 121 | - 1,987 | - 1,657 | - 2,368 |
| Kyushu | 4,144 | 5,297 | 8,308 | 8,635 | 7,666 | 6,977 | 9,799 | 10,118 | 10,225 |
| Within prefecture | - 1,568 | - 657 | 978 | 1,511 | 1,140 | 1,161 | 2,940 | 2,657 | 2,869 |
| Fukuoka Prefecture | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 |
| Social population growth | 4,300 | 4,270 | 3,638 | 4,001 | 2,532 | 2,413 | 1,584 | 3,122 | - 2,125 |
| Kanto | - 3,766 | - 4,604 | - 6,108 | - 5,701 | - 5,468 | - 4,854 | - 6,552 | - 6,906 | - 9,745 |
| Other | 1,412 | 2,130 | 1,198 | 1,070 | 785 | 133 | -685 | - 290 | - 1,757 |
| Kyushu | 6,654 | 6,744 | 8,548 | 8,632 | 7,215 | 7,134 | 8,821 | 10,318 | 9,377 |
| other than Fukuoka City | - 234 | - 1,248 | - 4,440 | - 4,096 | - 4,096 | - 3,902 | - 6,616 | - 5,193 | - 8,698 |

3. 5 Attributes of Social Population Growth

Fukuoka City accounts for the majority of social population growth within Fukuoka prefecture, but it is interesting to note which groups of people account for this growth. National census data provides detailed information on migration, but the latest national census with such information was taken in 2000⁽¹⁾. However, this data is used below for an analysis.

Figs. 15-16 cover migration Fukuoka City and Fukuoka prefecture, broken down by age for both genders, while Figs. 17-18 cover the same by education, with items shown in parentheses detailing specific graduation levels. Both Fukuoka City and Fukuoka prefecture show a net loss of both male and female residents of ages 25-29, but net gains in all other age groups, and especially in the 15-19 and 20-24 age groups. By education, both Fukuoka City and Fukuoka prefecture show net increases, but a closer examination reveals that while there is a net gain for graduates of both genres in Fukuoka City, Fukuoka prefecture exhibits a net loss in male graduates, especially high in graduates from universities and graduate schools. Fukuoka City also shows a net loss in male graduates from universities and graduate schools. In contrast, both Fukuoka City and Fukuoka prefecture exhibit a high levels of female high

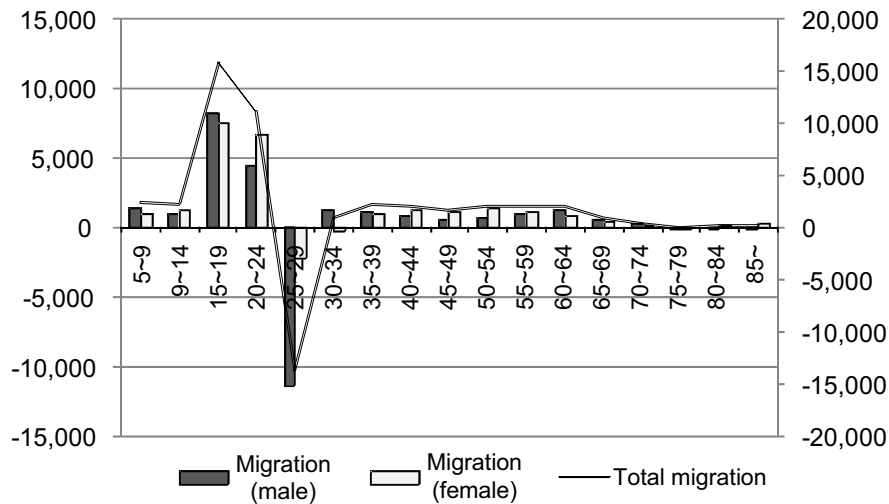


Fig. 15 Fukuoka Prefecture Migration
Source: MIC[®]

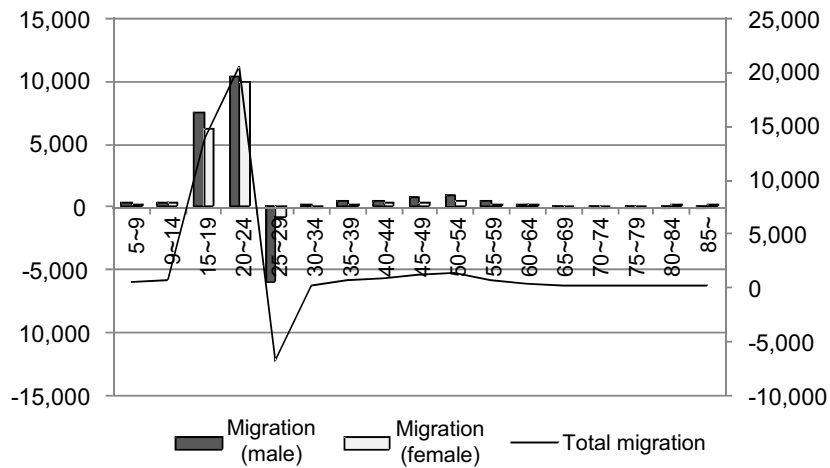


Fig. 16 Fukuoka City Migration (across prefectural border)
Source: MIC[®]

school and college (including occupational and technical schools) graduate immigration.

The data shows that male and female immigration into Fukuoka City and Fukuoka prefecture is high for high school graduates entering higher education, and for female high school and college graduates seeking employment. Emigration is especially high among male university and graduate school graduates seeking employment, and this trend is especially pronounced in the region outside Fukuoka City.

4. Population attraction of Fukuoka prefecture and Fukuoka City

4.1 Population attraction by region

The structures of population movement in Fukuoka prefecture and Fukuoka City are similar to each other, and based on data that population immigrates into these regions from the prefectures of Kyushu, and emigrated to the Kanto region, as well as on migration data by gender, age and education, there is high immigration by high school graduates of both genders for higher education, high immigration by female college graduates in search of employment, and high emigration by male university and graduate school graduates in search of employment.

Population migration is caused by a variety of factors, with one of the major factors being the scale of

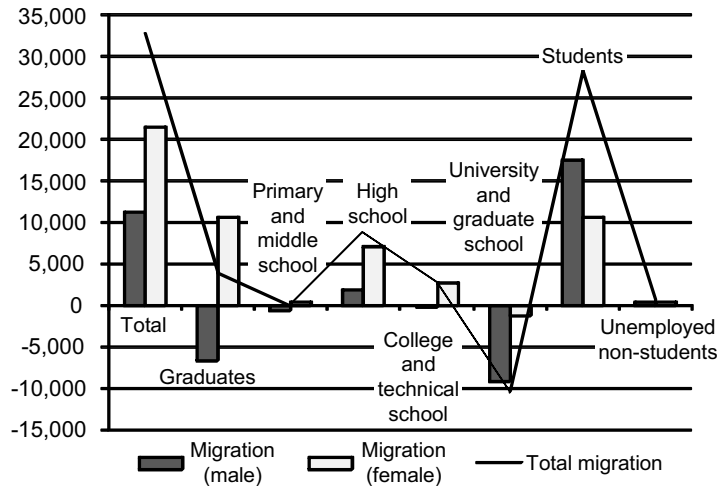


Fig. 17 Fukuoka Prefecture Migration by Education
Source: MIC⁶⁾

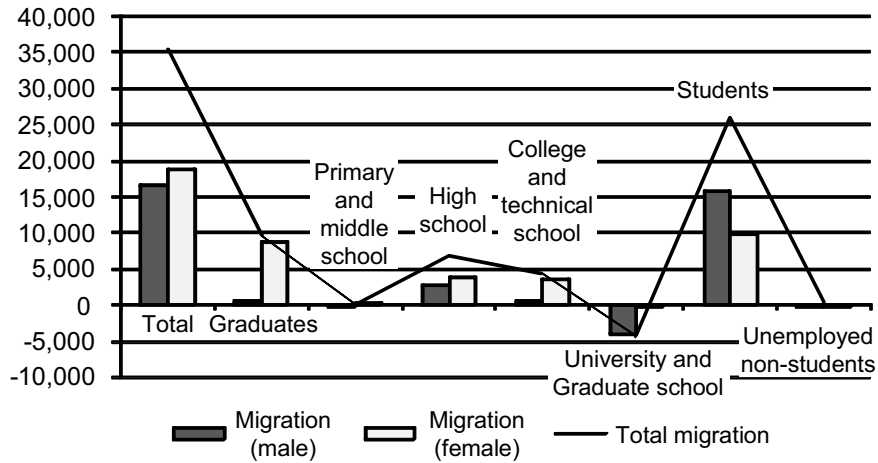


Fig. 18 Fukuoka City Migration by Education (across prefectural border)
Source: MIC⁶⁾

population in that region, but it is important to grasp other involved factors as well. Other factors involved in population migration in Fukuoka City and Fukuoka prefecture are discussed below using the “preference index,” which is an indicator specifically excluding population scale.

The preference index (PI) is a ratio of the theoretical and actual migration between two points, based on the assumption that such migration is proportional to their relative population scales, and calculated as:

$$PI_{ij} = \frac{M_{ij}}{\frac{P_i}{P_t} \cdot \frac{P_j}{P_t - P_i} \cdot \sum M_{ij}}$$

where

PI_{ij} : the PI for migration from region i to region j

M_{ij} : the population migrating from region i to region j

$\sum M_{ij}$: the total migration for both regions

P_i, P_j : the populations of regions i and j respectively

P_t : the total population for both regions

When the PI is 100, population migration is equal to that due to population scale. When PI is 100 or higher,

is indicates attractive force other than population scale, and when PI is 100 or lower it indicates that the migration expected from the population scale is not attained.

The preference indices for Fukuoka City in Table 2 for 2007 show that immigration from Kyushu prefectures is extremely high, and the only prefectures outside Kyushu exceeding 100 are Hiroshima and Yamaguchi. The indices for Fukuoka City are higher than those of Fukuoka prefecture for almost all prefectures, exceeding 100 for not only Kyushu, but also prefectures in the Chugoku region, Osaka, Hyogo, and the Tokyo region including Kanagawa and Chiba. It is clear that some factor other than that population scale is operating as an attractive force.

When compared to preference indices for migration the opposite direction, though, values are significantly high, with Tokyo 253.3, Kanagawa 158.6, Chiba 149.8 and Osaka 152.1. The only prefectures with preference indices for immigration into Fukuoka City above 100 and above the preference indices for migration in the opposite direction, then, are the prefectures of the Kyushu and Chugoku regions. Attraction factors other than the population scale of Fukuoka City are operating strongly in the Chugoku and Kyushu regions, indicating that even with a declining population a certain level of immigration can be expected.

4. 2 Population attraction by region at matriculation

Migration in Fukuoka prefecture and Fukuoka City both exhibit high immigration by high school graduates in search of employment. In this section, available data was used on immigration of university students into Fukuoka prefecture.

Table 3 indicates PIs by prefecture at matriculation, for students migrating from high school prefectures in Chugoku, Shikoku and Kyushu to university prefectures in Kyushu. The PIs for all Kyushu prefectures exceed 100, indicating that factors other than population scale play a significant part. In particular, Fukuoka prefecture shows higher PIs than an opposite with respect to other Kyushu prefectures, indicating that it has an attraction stronger than the migration index. This attraction is not as strong with regard to prefectures in Chugoku or Shikoku, however, and Fukuoka prefecture is surpassed by opposite indices for Okayama, Hiroshima, Yamaguchi and Tokushima prefectures.

Table 2 Preference Indices for Fukuoka prefecture and Fukuoka City
Source: MIC⁵⁾

| | | New address | |
|-------------------|-----------|---------------|--------------|
| | | Fukuoka pref. | Fukuoka City |
| Population (1000) | | 5,016 | 1,406 |
| PI | | 107,719 | 76,224 |
| Old address | Hokkaido | 26.0 | 42.1 |
| | Aomori | 17.8 | 17.9 |
| | Iwate | 13.7 | 13.1 |
| | Miyagi | 30.5 | 63.4 |
| | Akita | 10.2 | 19.8 |
| | Yamagata | 9.8 | 15.3 |
| | Fukushima | 12.5 | 23.1 |
| | Ibaraki | 28.5 | 33.6 |
| | Tochigi | 22.4 | 30.9 |
| | Gunma | 18.4 | 28.1 |
| | Saitama | 49.6 | 77.9 |
| | Chiba | 60.4 | 101.5 |
| | Tokyo | 77.1 | 150.5 |
| | Kanagawa | 68.7 | 118.1 |
| | Niigata | 18.0 | 29.8 |
| | Toyama | 23.0 | 23.5 |
| | Ishikawa | 33.3 | 54.2 |
| | Fukui | 17.6 | 19.5 |
| | Yamanashi | 20.5 | 23.2 |
| | Nagano | 20.0 | 30.3 |
| | Gifu | 26.3 | 29.5 |
| | Shizuoka | 37.1 | 37.5 |
| | Aichi | 58.8 | 86.0 |
| | Mie | 36.9 | 37.5 |
| | Shiga | 58.4 | 51.9 |
| | Kyoto | 60.3 | 95.8 |
| | Osaka | 76.3 | 133.1 |
| | Hyogo | 63.5 | 108.7 |
| | Nara | 49.2 | 70.9 |
| | Wakayama | 28.7 | 36.4 |
| | Tottori | 73.7 | 114.2 |
| | Shimane | 93.0 | 114.7 |
| Okayama | 82.7 | 126.7 | |
| Hiroshima | 165.1 | 280.7 | |
| Yamaguchi | 472.4 | 583.5 | |
| Tokushima | 44.3 | 75.0 | |
| Kagawa | 91.9 | 175.9 | |
| Ehime | 85.0 | 145.4 | |
| Kochi | 51.3 | 64.3 | |
| Fukuoka | - | 2,164.2 | |
| Saga | 1,174.8 | 1,735.8 | |
| Nagasaki | 961.2 | 1,898.5 | |
| Kumamoto | 656.6 | 1,099.0 | |
| Oita | 772.2 | 1,122.8 | |
| Miyazaki | 480.7 | 932.0 | |
| Kagoshima | 474.9 | 934.0 | |
| Okinawa | 204.1 | 346.9 | |

Table 3 Preference Indices (PI) by Prefecture at Matriculation
Source: MEXT⁶⁾

| | | Student quantity | University pref. | | | | | | | |
|-------------------|-----------|------------------|------------------|----------|----------|----------|----------|----------|-----------|---------|
| | | | Fukuoka | Saga | Nagasaki | Kumamoto | Oita | Miyazaki | Kagoshima | Okinawa |
| High school pref. | Tottori | 2,404 | 55.96 | 28.69 | 64.17 | 4.10 | 77.71 | 41.79 | 40.76 | 11.42 |
| | Shimane | 2,937 | 107.37 | 58.69 | 173.31 | 46.96 | 108.11 | 111.15 | 16.68 | 9.34 |
| | Okayama | 9,005 | 41.49 | 30.28 | 38.95 | 18.39 | 71.77 | 22.06 | 19.72 | 22.60 |
| | Hiroshima | 15,275 | 79.84 | 39.86 | 40.63 | 18.99 | 55.19 | 72.60 | 32.51 | 35.26 |
| | Yamaguchi | 5,369 | 439.12 | 95.91 | 157.35 | 78.58 | 148.97 | 135.08 | 102.96 | 22.91 |
| | Tokushima | 3,764 | 16.60 | 27.42 | 20.45 | 5.22 | 24.76 | 39.95 | 25.98 | 29.11 |
| | Kagawa | 4,697 | 35.51 | 7.33 | 26.24 | 12.57 | 51.64 | 32.05 | 34.72 | 14.59 |
| | Ehime | 6,756 | 83.78 | 35.59 | 68.24 | 21.79 | 209.33 | 129.62 | 33.71 | 16.19 |
| | Kochi | 2,935 | 41.85 | 35.22 | 15.76 | 16.78 | 89.04 | 51.31 | 22.24 | 14.02 |
| | Fukuoka | 22,862 | 1,419.90 | 898.28 | 306.12 | 303.84 | 329.93 | 222.33 | 165.09 | 32.24 |
| | Saga | 3,752 | 924.69 | 4,619.31 | 908.06 | 527.53 | 343.31 | 354.55 | 221.81 | 40.21 |
| | Nagasaki | 6,134 | 498.83 | 1,164.21 | 5,053.60 | 500.67 | 494.29 | 411.80 | 387.01 | 80.21 |
| | Kumamoto | 7,444 | 373.06 | 473.31 | 394.74 | 4,689.56 | 393.36 | 559.00 | 474.42 | 56.70 |
| | Oita | 4,511 | 587.33 | 342.88 | 576.14 | 594.47 | 4,499.70 | 727.11 | 220.12 | 75.82 |
| Miyazaki | 4,415 | 435.23 | 374.21 | 397.64 | 637.20 | 620.89 | 6,218.42 | 919.32 | 86.89 | |
| Kagoshima | 6,543 | 395.44 | 351.70 | 373.42 | 526.55 | 335.58 | 864.16 | 5,680.36 | 133.72 | |
| Okinawa | 6,121 | 103.29 | 117.70 | 110.33 | 91.30 | 130.57 | 183.72 | 167.22 | 8,020.06 | |

4. 3 Population attraction at matriculation

The PIs indicate that Fukuoka prefecture exercises a strong attraction on immigration from other prefectures in Kyushu at matriculation, due to some factor other than population scale. This section discusses what factors other than population scale could be involved.

The PIs show a strong attraction by Fukuoka prefecture on immigration from other prefectures in Kyushu. One factor is thought to be geographical proximity. Yamaguchi and Matsuyama¹²⁾ point out that migration at matriculation in the past has been affected by regional differences in the university capacity ratio, defined as university admissions for that region divided by the number of students matriculating in the same region. A result above one indicates that the university can accept all matriculating students from the region, and a result below one indicates that it lacks the capacity to accept them all. As a result, the higher the capacity ratio of the prefecture where the university is located, the more excess capacity it has to accept matriculating students from other prefectures, while a low capacity ratio indicates that students are more likely to leave the prefecture for university.

Based on the above, it is possible to theorize that the number of students accepted from other prefectures at matriculation is proportional to the capacity ratio of the receiving prefecture, and inversely proportional to the capacity ratio of the producing prefecture and the distance between the two prefectures. The following model can then be developed to estimate the number of students matriculating from other prefectures, based on the capacity ratios of the producing and receiving prefectures, the distance between them, and the total number of matriculating students in the producing prefecture, as shown below:

$$P_{ij} = \frac{R_j^{a_1}}{R_i^{a_2}} \cdot \frac{1}{D_{ij}^{a_3}} \cdot P_i^{a_4}$$

where

P_{ij} : the number of students matriculating from region i to region j

R_i, R_j : the capacity indices of the two regions

D_{ij} : the distance between regions i and j

P_i : the total number of matriculating students in region i

The model is assumed to be log-linear, and the two logs make it possible to express it as below:

$$\ln(P_{ij}) = a_1 \ln(R_j) - a_2 \ln(R_i) - a_3 \ln(D_{ij}) + a_4 \ln(P_i) + C + e$$

where

C : constant

e : error

This estimation expression was used to perform a regression analysis on the survey results of the *2008 Basic School Survey* (university admissions broken down by high school prefecture). The capacity indices were determined for each prefecture from the *2008 Basic School Survey*, and the distance between the regions calculated as a straight-line distance between prefectural capital cities. The total number of data items is the number of prefectures squared, but data items for matching prefectures were deleted, as were data sets for zero matriculating students, leaving 2081 valid data items.

As indicated in Table 4, the value of t is high, with 1% significance. While the signs are as expected for distance between the regions, total number of matriculating students in the producing prefecture and capacity ratio of the receiving prefecture, the capacity ratio of the producing prefecture is unexpectedly negative.

Verification of the source data shows that Fukuoka prefecture accepted a high 1462 matriculating students from Tokyo (capacity ratio 196.18) and 565 from Kanagawa prefecture (capacity ratio 136.27), ranking Tokyo in first place for producing prefecture, and Kanagawa in fifth. The population scale for matriculating students had an effect on other prefectures, as a condition for student capacity of producing prefecture, pushing the sign for student capacity of producing prefecture positive because the high capacity ratio was combined with a high number of matriculating students.

5. Characteristics and problems of Fukuoka city

It is essential for cities to maintain a certain minimal population in order to continue to grow and develop, but as the population continues to shrink in Japan natural population decrease is unavoidable. Social population change has always had an effect on regional population change, but the importance of positive social population change in maintaining essential urban growth and development is increasing.

In the Kyushu region, Fukuoka City is a major city⁽²⁾ that is expected to experience positive social population change for some time to come, and its outlook for the future is not at all bleak. The social population change of Fukuoka City primarily consists of immigration from other Kyushu prefectures, and emigration to the Kanto region. Because factors other than population scale are in effect on immigration from other Kyushu prefectures, it is expected that Fukuoka City will maintain a certain level of immigration even if the national population drops.

According to 2000 national census data, population migration choices occur most frequently in the younger age groups, and it is theorized that the majority of population migration is at high school graduation (for employment or higher education) and university graduation (for employment). The high levels of immigration into Fukuoka prefecture and Fukuoka City at university admission are due to population scale (which attracts immigration from across the nation), and to geographic proximity and high university capacity ratios (which attract immigration primarily from Kyushu). It is theorized that migration at high school graduation for admission into specialty schools

Table 4 Estimation Results

| Variable | Partial regression coefficient | t | P | Judgment |
|--|--------------------------------|-----------------------------|------|----------|
| Distance | - 1.31 | - 48.21 | 0.00 | ** |
| Total matriculating students in producing prefecture | 0.87 | 25.07 | 0.00 | ** |
| Producing prefecture capacity ratio | 1.15 | 18.32 | 0.00 | ** |
| Receiving prefecture capacity ratio | 0.27 | 5.42 | 0.00 | ** |
| Constant | -2.87 | -7.37 | 0.00 | ** |
| Coefficient of determination: | 0.70 | Judgment** : 1% significant | | |

(non-university institutions) is also due to similar factors, so that a certain level of immigration can be expected to continue in the form of high school graduates searching for employment, even as the overall population continues to decline.

Natural population decline has already begun in the Kyushu prefectures providing the population for this migration, and it is questionable if immigration can continue at its present level.

If it is assumed there are no major differences between the time the data was collected and now, then Fukuoka City is successful in providing opportunities for higher education and employment for women, but is experiences difficulty in providing employment for men, especially for university undergraduates and postgraduates.

The concentration of young women has the potential to produce a long-term positive natural popular change, contributing to urban growth and development. The fact that quality university undergraduates and postgraduates, who can be expected to find employment in high value-added businesses, are emigrating, however, represents a loss of valuable human resources, and a concomitant loss of opportunities for growth and development for Fukuoka City, as a core city of Kyushu and a city facing international urban competition. This problem requires urgent resolution.

In response to these issues, local industrial policy including attracting corporate investment and promoting collaborative efforts between industry and academia is being actively implemented, but these initiatives have not been as effective as hoped. For Fukuoka City to continue to function as the core city in the Kyushu area and contribute to the regional economy, it would seem essential that new employment opportunities be provided for skilled labor through enhancement to the educational and industrial sectors, creating a positive feedback loop that will help attract immigration not only from areas of Japan outside Kyushu, but also from overseas, while simultaneously preventing such invaluable human resources from emigrating from the area.

6. Conclusion

In rural Japanese cities where the population is declining, the dependence of development and growth of the city and area on a positive social population change is through to be increasing. The results of the data analysis above suggests that the accumulation of population through the enhancement of educational and industrial sectors in Fukuoka City is essential, as is the nurturing of industries capable of utilizing the skilled human resources now emigrating from the area.

The above analysis concentrated on human migration statistics, and a large number of issues remain to be clarified, such as a detailed analysis of human factors (including employment of immigrating and emigrating population), application of methodologies such as the development and application of indexes, and demonstrational analysis of the economic effects of social population change and migration. In addition, some of the data was relatively old (2000), and the latest data should be utilized in verification, and in the analysis of larger-scale cases

covering the extended Fukuoka City region.

The problem of human resource erosion through emigration is not unique to Kyushu, but probably exists for all Japanese cities, and is one of the causes of significant differences in various social, economic and other indices between cities and rural areas. Cities and region throughout Japan exist in hierarchical structures, causing migration from small- and medium-population rural cities to local core cities (for example, prefectural capitals), from these local core cities to area core cities (such as Fukuoka City), and eventually to the major metropolises. One of the factors cited as a cause is the fact that the larger cities have proportionally more educational institutions and more private enterprise capable of employing skilled labor. It must therefore be mentioned that the points of potential improvement discussed above could also be beneficial in resolving the differences existing between the cities and the rural areas.

Notes

- (1) National census data covers residents age five or older who have migrated within a five-year period prior to the census date, so the 2000 census covers residents who have migrated between 1995 and 2000.
- (2) The population is also rising in other cities in Kyushu, including Oita City, Kumamoto City and Kagoshima City.

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