The Changing Japanese Urban Settlement System, 1970-1990

by

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Abstract

The main purpose of this thesis is to examine the population growth pattern of the Japanese urban settlements and the factors behind the changes between 1970 and 1990.

From previous studies of the Japanese settlements, it was observed that Japan achieved a high degree of urbanisation, and that a pattern of internal migration saw the population shift into the three Japanese metropolitan areas from outside. However, these observations were based on administrative boundaries, which was not suitable for examining actual changes to the Japanese settlement system. Therefore, a new definition of functional urban regions called 'Japanese Functional Urban Area' (JFUA) was established.

Various analyses based on the new JFUA definition, such as population change, city size distribution and urban development stages, showed that the Japanese settlement system witnessed the concentration of population into larger settlements in the 1970s and the 1980s. The largest settlements such as Tokyo and Osaka recorded growth in the 1970s and 1980s. In addition, the Tokyo area showed a 'unipolar concentration' pattern of population growth. This pattern was different from the US and UK settlements, with both their settlement systems showing a decline of the largest settlements in the 1970s and the recovery in the 1980s.

Although the Japanese settlement system represented a different growth pattern from the US and UK, the factors contributing to urban change in Japan turned out to be similar those. The role of the service sector was highly important to growth,

whilst the declining industries such as steel and shipbuilding were no longer important in promoting regional development and influenced urban decline.

This thesis also examined the government's policies for regional development, but an examination of population change in the policy targeted areas found that it is difficult to find any evidence of policy effectiveness.

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This thesis is dedicated to my parents.

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Susumu Osada

Chapter 1: Introduction

1.1. Main Objective and Background

The main purpose of this thesis is to demonstrate the characteristics of the Japanese urban settlements in terms of demographic change between 1970 and 1990 and to test against the evidence that is collected significant concepts and hypotheses that have emerged from studies of the urban settlement system elsewhere. How and to what extent, if any, does the Japanese urban settlement system differ from those elsewhere?

What happened to Japan after World War II (WWII)? General demographic trends will be briefly outlined. During the 1950s and 1960s, Japan experienced rapid economic growth (Allen, 1981; Takahashi, 1982). This resulted in a hyper-concentration of the population in the three metropolitan areas: Tokyo, Kansai and Nagoya (Glickman, 1979; Takahashi, 1982; National Land Agency, 1987; Tsuya and Kuroda, 1989; Yamada and Tokunaga, 1991; Kawashima et al., 1993).

Following the first oil crisis in 1973, economic growth slowed down dramatically (Glickman, 1979; Allen, 1981; Takahashi and Sugiura, 1992). During the 1970s, Japan showed a new demographic shift from the three metropolitan areas to non-metropolitan areas (National Land Agency, 1987; Tsuya and Kuroda, 1989). The national settlement patterns were thus characterised by de-concentration from metropolitan to non-metropolitan areas.

In the 1980s, the three metropolitan areas recorded a population increase resulting from migration. Tokyo - the largest metropolitan area - was overwhelmed

by a massive concentration of people and rapid economic growth (Takahashi and Sugiura, 1992; Miyao, 1994). This unipolar concentration into the Tokyo area is known as *'Tokyo-Ikkyoku-Shuchu'*. This phenomenon is widely acknowledged amongst Japanese researchers, and the government has tried to tackle this tendency in order to correct regional inequality.

When patterns of settlement are examined, we must take into consideration different interpretations of a spatial unit. The general trends of Japanese urban settlements, as sketched above, are based on ambiguous spatial units and these are questionable. For example, in Japan, 'metropolitan area' is an ambiguous concept. 'Tokyo' may be seen as the (1) central area of the Tokyo prefecture, (2) whole of the Tokyo prefecture, or (3) the wider Tokyo metropolitan area that extends beyond the prefectural boundary. In this sense, Japanese settlements may show variations from the general trends outlined above, and should therefore, be examined more closely.

This thesis will examine urban areas throughout Japan. It recognises that urban settlements are not independent from each other, and therefore that at a national level they should be treated as a 'system' of settlements. The focus will be on urban areas and will thus make reference to the 'Japanese urban settlement system'.

In Section 1.2 of this chapter, the subject of the thesis and its theoretical background will be outlined; in section 1.3, the target period will be clarified; section 1.4 will examine the wider contribution of the thesis, and seek to clarify its characteristics. In the final section, the structure will be explained and outlined. Since each chapter is independent, the implications of a particular chapter for the thesis as a whole may sometimes be unclear. To avoid this problem, this section will act as a guide to specific topics and the connection between them.

1.2. Topics and Theories[1]

This thesis examines the national settlement system. The following section briefly reviews the various topics that will be examined in this study.

1.2.1. The Concept of the 'Urban' Area

Each country will have its own definition of an 'urban' area, dependent on its particular characteristics, e.g. population size and population density. Hall and Hay (1980) gave three definitions of 'urban': *physical, functional* and *political* or *administrative*. The *physical* definition is given where the 'urban' area looks like a town, e.g. large numbers of buildings close together; the *functional* definition is given where the 'urban' area functions like a town, e.g. economic functions based on manufacturing and services, and the *political* or *administrative* definition is given where the 'urban' area is governed or administered as a town.

In the past, there was perhaps no clear distinction between these three definitions of 'urban' areas. However, in the 20th century, the distinctions have become more apparent (Smart, 1974; Hall and Hay, 1980). The fundamental reason for this can be attributed to a growing geographical separation between the place of work and place of residence, caused by the development of transport. As a result, the concept of the functional urban region has acquired greater importance in the examination of real settlement change.

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[1] Each topic and theory will be further examined in later chapters. (See also section 1.5 for an explanation of the structure of this thesis.)

The first characteristic of functional urban regions is that they focus on the relationship between the urban core and its commuting hinterland. Analysis of the US settlement system is based on the functional definition of urban regions. The US government's official definition of functional urban regions, Metropolitan Statistical Areas (MSA), has frequently been used for settlement studies. This definition was developed from that of the Standard Metropolitan Area (SMA) in 1949, and the Standard Metropolitan Statistical Area (SMSA) in 1958. This US government approach has been adapted by researchers in both the US and elsewhere (Hall et al., 1973; Smart, 1974; Hall and Hay, 1980; van den Berg et al., 1982; Coombes et al., 1982; Spence et al. 1982; Champion, Coombes and Openshaw, 1983; Cheshire and Hay, 1989; Cheshire, 1995).

There have been further modifications emphasising the functional connection between areas. Berry (1973) developed it in his Daily Urban Systems (DUS) which focused on unifying functions such as commuting and the telephone network. In the UK, the Labour Market Area (LMA) and Travel-To-Work Area (TTWA) are defined more specifically in terms of the self-containment of each settlement (Smart, 1974; Green and Owen, 1990).

Is the concept of functional urban regions relevant for Japan? Japan has experienced the rapid growth of the three metropolitan areas since the 1950s, and the consequent gap between functional and administrative urban areas has caused serious problems for national government policy. Japanese functional urban regions were established for urban analysis by the national government and academic researchers (Kawashima, 1977; Glickman, 1979; Yamada, 1982; Yamaguchi, 1984; Kawashima et al., 1993; Ministry of Construction 1994; Ministry of Home Affairs, 1995; the 1990 Population Census of Japan). For this thesis, these definitions will be examined to clarify the Japanese urban settlements.

1.2.2. Urbanisation

In general, urban settlements are examined, in relation to population change in the urban areas – thus, the word 'urbanisation' is used to describe demographic change in urban areas in relation to the total population. The process of urbanisation indicates the degree of urban development. In the UK, various studies have examined the coverage of the population in functional urban regions (Hall and Hay 1980; van den Berg et al., 1982; Spence et al., 1982; Champion et al., 1987).

Many studies on urbanisation in Japan are based on the population of administrative urban areas (Kohnhouser, 1976; Yorimitsu, 1987; Tsuya and Kuroda, 1989; Kuroda, 1990; Yazawa, 1990). Studies based on the functional urban regions of Japan have also examined its population change (Kawashima, 1977; Glickman, 1979; Yamada, 1982, 1986; Kawashima et al., 1993; Yamada and Tokuoka, 1991; Tokuoka, 1995).

1.2.3. Population Change, 'Counterurbanisation' and Migration

Beale (1975) observed the urban-to-rural shift of populations in the US from the early 1970s, in contrast to the pattern observed in urbanisation, the process of the concentration from rural to urban settlements. Berry (1976) called this new pattern of rural development, 'counterurbanisation'. This process was also observed in the UK (Spence, 1976), and developed by Fielding (1982). When Berry (1976) initially described 'counterurbanisation', he used the word to explain the population deconcentration from metropolitan to small, or rural areas. Fielding redefined this concept as 'the negative relationship between settlement size and migration'. Fielding (1982, 1986) and Champion (1989) found that British settlements conformed to the pattern described in this revised definition.

It is also important to examine the effect of migration on population and settlement change. This is most significant in highly urbanised nations such as the UK, where changes in the patterns of migration have a significant effect on the national settlement pattern. When Vining and Pallone (1982) examined migration between core and peripheral regions in 22 countries in the 1970s, they observed the population dispersal from core regions to peripheral regions in developed countries. However, this tendency was not a long-term trend. In the 1980s, Cochrane and Vining (1988) remarked that this core-periphery dispersal ended in the 1980s.

1.2.4. The City Size Distribution and the 'Urban Rank-Size Rule'

The city size distribution focuses on the relationship between urban settlement size and its rank within the hierarchy of the settlement system. When the special relationship of the city size and its rank was satisfied, this can be called the 'urban rank-size rule'. Since the first study by Auerbach (1913), there have been many that have discussed this city size distribution. Some of them have focused on methodological development whilst others have used distribution as an analytical tool for international comparative studies (Rosen and Resnick, 1980), and changing national distribution patterns (Parr, 1985). Japan has been examined as one of the examples (Rosen and Resnick, 1980; Parr, 1985).

1.2.5. Urban Development Stages

The growth pattern of urban areas can be better understood by applying stages of urban growth. There are two main approaches that focus on functional urban regions and their development stages. The first is based on Hall and Hay (1980), who identified six key stages of urban change in their study of the

European Urban settlement system between 1950 and 1975. Cheshire and Hay (1986) redefined this approach, using eight stages in order to investigate the development of the European urban settlement in the 1970s. The Cheshire/Hall/Hay Model was also used in Cheshire (1995) to examine the changes experienced by European urban settlements in the 1980s. The concept served a useful tool for the classification of urban areas.

Another important approach is based on the urban life cycle hypothesis (van den Berg et al., 1982). This divides urban growth into four key stages: urbanisation, suburbanisation, disurbanisation and reurbanisation. Moreover, each stage is divided into two substages so that the status of each urban area can be classified into eight substages. This approach is used in van den Berg et al. (1982) to examine European settlement between 1950 and 1975. Some studies of the Japanese urban settlements used this classification to investigate the characteristics of their growth (Yamada, 1986; Yamada and Tokuoka, 1991; Kawashima et al., 1993; Tokuoka, 1995).

1.3. The Target – Why 1970-1990?

This study will focus on the Japanese settlement system for the period between 1970 and 1990. There are four reasons for the choice of this period.

The first is in relation to previous studies of the Japanese settlement system. Glickman (1979), who examined the Japanese settlement changes between 1950 and 1975, represents the most famous of these. Studies also exist for the Japanese urban settlement system in the 1970s and the 1980s (Yamada, 1982, 1986; Yamada and Tokuoka, 1991; Kawashima et al., 1993; Tokuoka, 1995), however, those were minor studies from which further research would be expected.

The second reason is from the perspective of international comparative study. When researchers discussed national settlement changes in the 1970s and 1980s, new findings included 'counterurbanisation' (Berry, 1976; Fielding, 1982, 1986; Champion et al., 1987; Champion ed., 1989). Others used urban development and decline or centralisation and decentralisation (Hall and Hay, 1980; van den Berg et al., 1982; Cheshire and Hay, 1989; Cheshire, 1995). In the 1980s, some researchers looked at the re-centralisation or re-generation of large urban settlements (Cheshire, 1995). Thus, more recent change in the Japanese settlement system should be examined first and then compared to those of the US, UK and Europe.

Thirdly, the specific circumstances of the Japanese economy during the 1970s should be noted. Although the Japanese economy suffered following the oil crisis of 1973, Japan recorded a better growth in terms of its national economy than most western countries. These economic structural changes might have been expected to affect the settlement pattern, with changing economic circumstances affecting jobs in the areas with job creation/loss affecting population movement. In this period, the economic structure of Japan changed rapidly from a manufacturing base to service sector-oriented pattern. Under these circumstances, the settlement system should show new patterns of the growth over the last two decades.

Technical reasons are also important. In Japan, the borders of local authorities are changeable. However, settlement studies fixed the spatial unit of urban settlements (Hall and Hay, 1980; Champion et al., 1987; Champion, 1992; Cheshire and Hay, 1989; Cheshire, 1995). Fixed spatial unit basis analysis is only one approach, but it is simple and popular. It is reasonable to adopt this approach and to use the 1990 census data for Japan, in order to examine the period between 1970 and 1990. This is because the 1990 Population Census of Japan provides 1970 data that was modified to reflect the 1990 local authority borders.

1.4. Contribution

The contribution of this thesis falls into two main areas; (1) its findings with respect to the analysis of the Japanese settlement system based on functional urban regions, and (2) the context this provides for settlement studies in the context of international comparative studies.

1.4.1. Contribution in the Context of Japanese Settlement Studies

The importance of this study of the Japanese settlement system should be highlighted. The first important point is that it will examine the spatial unit of Japanese urban settlements. When previous studies of the Japanese settlement system were examined, it was found that they used administrative units as their basic statistical unit (Yamaguchi 1984; Yorimitsu, 1987; Tsuya and Kuroda, 1989; Kuroda, 1990). These studies relied on the availability of statistical data. As mentioned in section 1.2.1, administratively defined urban areas may be problematic in the settlement analysis of Japan.

Prefectural divisions are unsuitable for an examination of the settlement. Japan is divided into 47 prefectures, which are administrative divisions, with each prefecture containing functional urban and rural areas. As a result, it is difficult to understand what happened to the Japanese settlement system because the analysis will show only general trends in these aggregated but heterogeneous areas. On the other hand, it is also questionable to use the minimum statistical units, i.e. municipalities. They are potentially too small to analyse the real change of settlements.

As in the US and Europe, researchers in Japan therefore attempted to examine the Japanese settlement system based on functional urban regions. The government introduced functional definitions, and some researchers established their own definition of the Japanese functional urban regions (Kawashima, 1977; Glickman, 1979; Tanabe, 1982; Yamada, 1982; Kawashima et al., 1993; The 1975 Population Census of Japan). This study will investigate these definitions in order to examine the Japanese settlement system, and will highlight previous studies, clarifying their conceptual background and analysis.

The second point is the comparison of results based on different spatial units - administratively and functionally defined urban areas. This comparative approach has two important aims. Firstly, it will provide results based on functional urban regions, which may show new aspects of the changing Japanese settlement system. Secondly, the comparative results will aim to clarify the meaning of previous studies of the Japanese settlement system. For example, examining the city size distribution of Japan will provide interesting results, as previous studies of the Japanese city-size distribution did not attach enough importance to sample taking or to the definition of 'settlements'. As there is no previous study comparing administrative areas and functional urban regions, this will be the first one to carry out such a comparison.

1.4.2. Contribution in the Context of International Comparative Studies

As mentioned in section 1.4.1, this study examines the Japanese settlement system based on functional urban regions. This analysis makes possible direct comparison with the findings for international studies of the settlement system. Most importantly, studies that examine the national settlement system in the US and UK use the concept of functional urban regions as the basic spatial unit (Berry,

1973; Smart, 1974; Hall and Hay, 1980; van den Berg et al., 1982; Spence et al., 1982; Cheshire and Hay, 1986, 1989; Cheshire, 1995).

When we look at studies of the Japanese settlement system, it will be found that some of them are based on functional urban regions. Glickman (1979) applied the functional definition known as Regional Economic Clusters (RECs)[2]. He observed that between 1950 and 1975, the Japanese settlement system was prone to population concentration to larger settlements such as Tokyo and Osaka. Kawashima et al. (1993) examined the recent change of Japanese metropolitan areas with their original definition of functional urban regions and found that this tendency was continued. Yamada and Tokuoka (1991) and Tokuoka (1995) examined the Japanese settlement system using another original definition called the Standard Metropolitan Economic Area (SMEA)[3], between 1965 and 1985.[4]

This thesis will examine the Japanese settlement system based on functional urban regions for the 1970s and the 1980s. Therefore, it will achieve two important contributions. The first one is to provide various analyses of the Japanese settlement system from the 1990 census data. This thesis is based on the newest data set available.[5] The second is that it will allow a comparison of the evolution of the Japanese settlement system with the changes in the US, UK and Europe, using results based on functional urban regions.

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[2] This definition will be examined in Chapter 3.

[3] This definition will be examined in Chapter 3.

[4] Yamada (1982, 1986) examined the settlement change between 1965 and 1975.

[5] Kawashima et al. (1993) carried out their study using the 1990 census data, however, the urban definition was based on the 1985 Population Census of Japan. This thesis is completely based on the 1990 Population Census of Japan.

1.5. Structure

Now to come to the structure of this thesis: as mentioned in the previous sections, the main object is to examine and illustrate the changes in the Japanese settlement system. To achieve this objective, the thesis is made up of 8 chapters. The background and objectives of each chapter, and the relationship between the chapters are outlined below.

As a starting point for the urban analysis of the Japanese settlement system, three basic questions regarding Japan will be addressed. What is the Japanese settlement system? What happened to Japan in previous periods? What are the basic characteristics of the Japanese settlement system? Chapter 2 will provide information on various topics about Japan in order to answer these questions. To illustrate the background of the thesis, the analysis in this chapter will cover a longer period than that chosen for other chapters. By showing the circumstances of the Japanese settlements pre-1970, it will be easier to understand what happened in the 1970s and 1980s. Therefore, the analysis in this chapter will go back to the 1950s and occasionally as far back as 1920 when the first Population Census of Japan was carried out.

In the first part of this chapter, the administrative system of Japan will be explained. Japan has a three-tier system of administration: national, prefectural and municipal. The country can be divided into 47 prefectures, made up of over 3,000 local authorities. The municipalities are the basic spatial unit for statistical data collection. This section will explain the two official definitions of Japanese urban area, the '*shi*' areas and the 'Densely Inhabited Districts (DIDs)'.

The second part of Chapter 2 will examine urbanisation and internal migration in Japan. The characteristics of Japanese urbanisation will be examined, on the basis of the two definitions above. This chapter will also examine the changing pattern of population movement between 1950 and 1990. There are two

reasons why it is important to examine this topic within Chapter 2. The first reason is the importance of internal migration for the settlement system. The second is because of data availability. Data for internal migration in Japan is only published on a prefectural basis. Therefore, it is difficult to handle this topic in the later chapter. Internal migration in Japan will be examined from 1950-1990, based on results of the 1990 Population Census of Japan.

Historically, Japan has three dominant metropolitan areas, i.e. Tokyo, Kansai and Nagoya, and one of the most important characteristics of the Japanese settlement change is the hyper-concentration into these areas (National Land Agency, 1987; Takahashi and Sugiura, 1992). In the third part of Chapter 2, the characteristics of these metropolitan areas will be examined in terms of their population change and internal migration.

Although Chapter 2 looks at a wide variety studies on Japan, these findings are limited because of the basic statistical unit of urban areas. Administratively defined urban areas as applied to Japan are different from the studies of urban settlements used in the US, UK or Europe. In international comparative studies such as those conducted by Berry (1973) and Hall and Hay (1980), the concept of the functional urban region is used as the basic spatial unit for studies of the national settlement system. The functional urban region is defined by economic activity in an attempt to handle the real urban structure.

Chapter 3 discusses and defines the basic spatial unit for urban analysis used in this thesis. It examines the functional urban regions of the Japanese settlement system. In order to discuss the correct definition of Japanese urban areas, previous studies of functional urban regions will be examined. Thus in the first part of the chapter, the basic definition of the US and UK settlements is discussed. The Japanese government recognised the problem of the gap between administrative and functional urban areas. The government tried to define the functional urban regions, and so did some independent researchers. After an

investigation of previous definitions, this thesis will establish a new and original definition of Japanese functional urban regions, i.e. the Japanese Functional Urban Area (JFUA). In the latter part of this chapter, the process of defining JFUAs will be explained. The definition is based on the 1990 Population Census of Japan. Japan is divided into 154 JFUAs and rural areas. Use of the JFUA definition means that the analysis will be comparable to studies of the US and UK settlement systems.

In Chapter 4, we examine the basic patterns of population change for the Japanese urban settlements in the 1970s and the 1980s. The characteristics of the urban settlement system will be reconsidered based on the JFUA definition as the basic urban unit. The result is to provide comparison not only with the US and European settlement systems, but also with the results discussed in Chapter 2. Firstly, this chapter shows the geographical distribution pattern of the Japanese urban settlements by showing the spatial distribution of the 154 JFUAs. Secondly, it reveals the changing population in the 154 JFUAs. Thirdly, the pattern of population change will be examined on the basis of the JFUA definition. To demonstrate the Japanese characteristics, in this part, we examine specific categories of JFUAs such as those that recorded the fastest population growth and those that recorded the slowest growth (or decline).

In Chapter 5, we further analyse the Japanese urban settlement system. The main purpose of this chapter is to tackle the question: 'from 1970 did Japan experience a concentration or de-concentration of its urban population?' To discuss the pattern of population distribution, the city size distribution has frequently been used over the last 50 years. In addition, the 'urban rank-size rule' is discussed when the city size distribution shows this special relationship.[6] Several researchers have tried to develop the city size distribution theory, while others have examined whether the rule is an appropriate description of what is observed. The

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[6] For details of this special relationship, see Chapter 5.

city size distribution is used to examine the long-term change of settlements and also for international comparison of population distribution. However, the city size distribution should be treated with care. Rosen and Resnick (1980) showed the sensitivity of results to various aspects of sample taking. Looking at past analysis of the Japanese urban settlement system, researchers do not use this method carefully. Some researchers have tried to examine the city size distribution of Japan, but no evidence for the examination of sample taking for Japanese settlements has been found. Here we analyse the sensitivity of the urban rank-size rule' to sample taking procedures in the context of the Japanese urban settlements.

Theoretical development is not the purpose of this chapter, which will focus instead on the gap between the pattern of actual Japanese urban settlements and the result of international studies. In the first part, studies about the city size distribution and the 'urban rank-size rule' will be reviewed. In the second part of the chapter, various tests of the city size distribution will be examined by comparing results based on the JFUAs and the administrative definitions. In addition, the effect of the number of settlements sampled will be examined. From these tests, this chapter will demonstrate the advantage of the analysis based on functional urban regions by showing the stability of the results for different samples. In the final part of the chapter, the changing pattern of the Japanese settlement system since 1970 will be examined. From this analysis, the Japanese settlement system under the JFUA definition will show concentration of larger settlements for the last twenty years of the period examined.

Chapter 6 will examine the relationship between Japanese urban development patterns and the Japanese economic background. Chapter 5 looked at the Japanese urban settlement system as a whole. However, it is also useful to examine the development pattern of individual urban settlements in terms of the urban development stages. Chapter 6 also compares the results with studies of the European urban development. Firstly, the concept of the urban development stages

will be introduced and the characteristics of the US, UK and European settlement system based on these stages will be reviewed. Secondly, previous studies of the Japanese urban settlements will be reviewed. Thirdly, the changing pattern of the Japanese urban settlement from the perspective of total population growth and the balance of the ring and core areas will be analysed. Additionally, some further examination will be carried out for some groups of JFUAs that were identified in the previous section. This will focus on the characteristics of the rapidly growing areas and their political functions, but short comments will also be given on the declining areas, such as the old style industrial centres, e.g. steel manufacturing.

Chapters 4, 5 and 6 form the analytical section of the thesis. From these chapters, it will be clear that the Japanese population has become concentrated into larger urban settlements between 1970 and 1990. Although most urban settlements recorded a population growth, some urban settlements that depend on the old style industries have suffered a population decline. From these findings, it is natural to consider the role of the national government not only in its direct policies on settlement, but also with respect to industrial policies which may affect the settlement system as a result of the effect of those policies on jobs creation.

The importance of the Japanese government's role in Japan's economic development is examined in Chapter 7. This chapter explains the basic attitude of the national government towards the settlement system. Until 1990, there were four Comprehensive National Development Plans in Japan[7], which were the basis for regional development plans. In order to clarify the background of the government's approach to regional development, these four plans will be described. Concrete policies to support the plans were introduced in the 1960s and the 1980s. In the latter section of the chapter, three types of target areas will be evaluated in terms of their implications for settlement change between 1970 and 1990. To trace the government's approach towards the settlement system, some pre-1970 policies will

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[7] In 1998, the Fifth Comprehensive National Development Plan was formulated.

also be outlined. Previous studies based on the government's defined areas for evaluation are discussed, too. There is also an evaluation based on the combination of the JFUA definition.

As a concluding chapter, Chapter 8 has two main aims. The first is to sum up new findings on the Japanese urban settlement system and to explain the changes that took place between 1970 and 1990. This includes a comparison of the characteristics of development of the Japanese urban settlement system, with that of the UK and other countries. The second is to discuss possible limitations of the research and suggest projects for further investigation.

Appendix 1.1. Data Set for This Thesis – Japanese Statistics that Related to Population Change

To examine the changes in the Japanese settlement system, statistics collected for population change will be used for this thesis. This section outlines the Japanese statistics that are related to population.

The Population Census of Japan has been taken repeatedly approximately every five years since 1920. The seventeenth census was conducted in 2000. An exception to the quinquennial census-taking was the sixth census originally scheduled for 1945 but suspended owing to the influence of war. An Extraordinary Population Census was carried out in 1947. After the 1950 Population Census, a large-scale census was conducted every ten years and a simplified version was taken every five years, and every census has been carried out on 1st of October. Since then, in 1960, 1970, 1980, 1990 and 2000, the large-scale censuses were conducted and in 1955, 1965, 1975, 1985 and 1995 a simplified census was conducted. The difference of these two types of the census is only in the number of questions asked. The large-scale censuses cover questions on dwellings, internal migration and education in addition to the demographic and economic characteristics of the population. On the other hand, the simplified censuses cover questions only on the demographic and economic characteristics of the population and on dwellings.

To estimate the annual change of the Japanese population, the Japanese Statistics Bureau, Management and Coordination Agency provides 'Population Estimates' for inter censal years. With respect to the population of the whole country, the estimates of the total population for each month are based on the population enumerated in the Census, by adding to or subtracting from it the live births, deaths and entries into and departures from Japan, that occurred thereafter. And for the population by prefectures, the estimates are obtained by further adding or subtracting the migrants between prefectures. These following three sources are

used to derive the necessary statistics: (1) data on births and deaths are provided by 'Vital Statistics', (2) those on entries into and departures from Japan, by 'Statistical Survey on Legal Migrants', and (3) those on migrants between prefectures, by 'Internal Migration in Japan Derived from the Basic Registers'.

To handle the circumstances of the birth and death, 'Vital Statistics' has been annually conducted since 1872. Since 1947, this survey has been conducted by the Ministry of Health and Welfare. This survey is obtained from the questionnaires submitted by municipalities for every declaration of live birth, death, marriage, divorce or foetal death to the head of city, town or village pursuant to provisions of the Civil Registration Law and the Regulations Regarding Declaration of Foetal Deaths.

'The Annual Report of Internal Migration in Japan Derived from the Basic Resident Registers' displays the internal population movement with in Japan. This is compiled by the Statistics Bureau, Management and Coordination Agency. The immigrants who declared migration in conformity with the law of the Basic Resident Registers and the immigrants who were entered as such in the register in conformity with the law are reported to the Statistics Bureau by municipalities through prefectures. Those who are not of Japanese nationality are therefore not included. Furthermore, those who changed their places of residence within the same cities, towns or villages, those whose former addresses are unknown or foreign and those who departed from Japan are also excluded.

'Statistical Survey on Legal Migrants' shows international migration. The results of this survey are compiled monthly and annually by the ministry of Justice based on reports submitted by Regional Immigration Bureaus, their branches and sub-branches. Persons who legally entered or departed from Japan are those who performed due formalities under the Immigration-Control and Refugee-Recognition Act.

This thesis uses the data from 'The Population Census of Japan' as its basic data set. This data set has advantages as follows. 'The Population Census of Japan' is treated as the basic data by the national government. In addition, the census provides comprehensive and consistent coverage for the national population. This thesis examines the economic structure or commuting pattern, and only the census covers these wide topics. Moreover, the spatial units for which the data are available are also important. Although municipalities have conducted various surveys, only the Population Census data has been published based on the municipalities. This thesis examined not prefectural changes but urban settlement changes. For this purpose, the prefectural basis data is not suitable.

Although where possible 'The Population Census of Japan' is preferred, 'the Annual Report of Internal migration in Japan Derived from the Basic Resident Registers' is used in Chapter 2. This is to examine the population movement into the Japanese metropolitan areas. Although 'the Population Census of Japan' also examines internal migration, the indexes about this topic are limited and have been changed. For this reason, it can be said that 'the Annual Report of Internal migration in Japan Derived from the Basic Resident Registers' is the best source to understand the longer run patterns of migration.

Chapter 2: General Demographic Trends in Japan

2.1. Introduction

Japan has experienced rapid economic growth since WWII. Not only the scale of the economy has expanded, but we have also witnessed a change in its economic structure. This structural change in the Japanese economy had large effects on the national settlement pattern. The main result of the change was the concentration of the economy into the three dominant metropolitan areas during the period of rapid economic growth, i.e. 1955-70. To understand settlement change in Japan, it is important and useful to investigate two indicators of population change, urbanisation and migration patterns. Of course, some general level of information about Japan is also required for the examination, especially for those readers who are not familiar with Japan.

Thus, as the first stage of this thesis, this chapter sets out the basic facts of the changing patterns of the Japanese settlement system. Various topics will be examined to help understand the changes. In this chapter, the following five topics will be focused on. The first section outlines the Japanese administrative boundaries and urban areas. This is to understand the Japanese settlement system that is generally accepted. Any settlement system is defined by each country's circumstance. Therefore, before we start examining Japan, the system should be outlined clearly. As the second topic, Japanese urbanisation will be examined in section 2.3. This section will show the geographical and historical characteristics of the Japanese urbanisation pattern. The third topic is to examine the internal

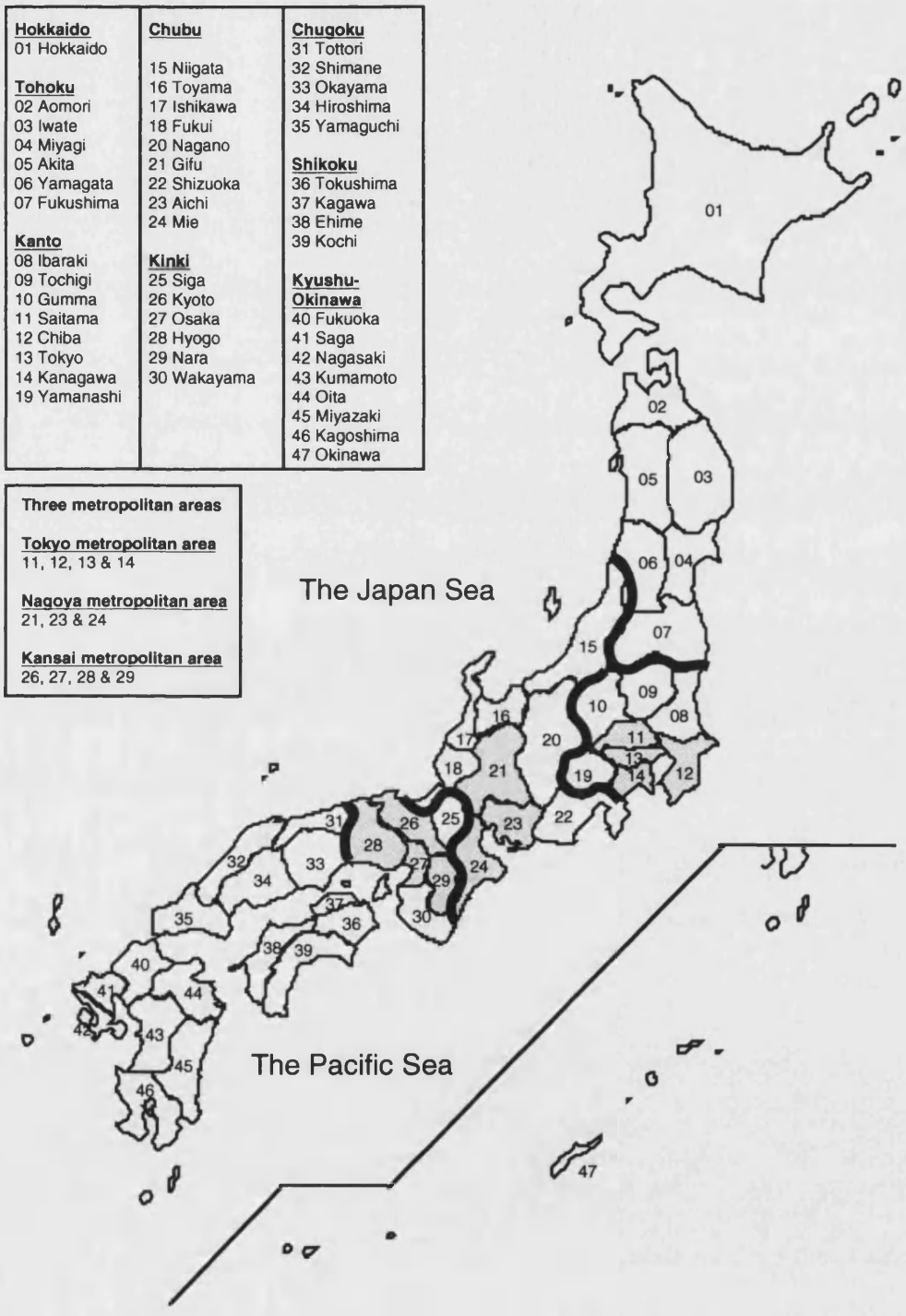
migration, i.e. population movement within Japan. This is one of the fundamental sources of change in all settlement systems. Section 2.5 will organise the findings of the previous two sections. As the last topic in this chapter, population growth and internal migration in Japan's three metropolitan areas will be examined.

2.2. Administrative Division and Urban Areas of Japan

2.2.1. Administrative Systems of Japan

In Japan, there are several levels of administrative division. The Prefecture is the basic geographical division for local administrative purposes and there are 47 prefectures in Japan. Prefectures are classified into four types; *to*, *do*, *fu* and *ken*. '*To*' means metropolis in Japanese, and Tokyo-to is a unique metropolitan prefecture and different from the other 46 prefectures because it has a special system of wards called '*ku*'. There are 23 wards in the central area of Tokyo-to and these areas are treated as nearly equal to urban areas in other prefectures. Three different types of prefectures result primarily from the historical background and there is in effect no systematic difference. '*Do*' is used only for Hokkaido, and '*fu*' is used for only Osaka and Kyoto. '*Ken*' is the most common type of prefecture and 43 prefectures belong to this type (Council for Local Authorities for International Relations, 1994).

Figure 2-1: Japan's 47 Prefectures



Regional Boundaries as defined by the National Land Agency (1987)

The *shi-cho-son* division is a lower administrative level below the prefecture; it is used as the smallest unit for data collection. According to the 1990 Population Census of Japan, there were 3,246 such municipalities in Japan. This division contains three types of local authorities; *shi*, *cho* (or *machi*), and *son* (or *mura*). *Shi* is usually translated as city and is usually treated as an urban area. There were 656 *shi* areas in 1990. On the other hand, *cho* (or *machi*) is translated as town and *son* (or *mura*) is translated as village, both are smaller than *shi*, and they are treated as rural areas. Towns are more urbanised, with more inhabitants engaged in commerce and industry. There is, however, no difference in terms of administrative functions and authority between towns and villages.

As an upper administrative level above the prefecture, prefectures are grouped together to make regions by location, which are called *chihou*. Although '*chihou*' is a popular word, there is no single definition. Various definitions of Japanese region are based on the regional office of Japanese Ministries. As the result, the 'regions' of Japan are complicated. Figure 2-1 shows eight regions as defined by the National Land Agency, which are the divisions that will be used in this thesis.[8]

Generally speaking, there are three dominant metropolitan areas in Japan; i.e. Tokyo, Kansai and Nagoya. The concept that they have larger areas than a prefecture is widely accepted, but the area of these three metropolitan areas is not clearly defined. The area is sometimes defined on the basis of municipalities and at other times defined on a prefectural basis. According to the 'Annual Report of the Internal Migration in Japan Derived from the Basic Resident Registers', the area of each metropolitan area is defined as follows: The Tokyo metropolitan area is the largest metropolitan area of Japan and it covers four prefectures; i.e. Saitama, Chiba,

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[8] Usually, the Okinawa Region (a.k.a. Okinawa Prefecture) is not part of the Kyushu Region. However, the population size of Okinawa is too small to be treated as independent in statistical data. Therefore, in this thesis, Okinawa was unified with the Kyushu Region and re-named as the Kyushu-Okinawa Region.

Tokyo and Kanagawa. The Kansai metropolitan area is the second largest metropolitan area. Osaka, Kyoto, Hyogo and Nara are components of this metropolitan area. The Nagoya metropolitan area is the third largest metropolitan area and this one consists of Aichi, Gifu and Mie prefectures. All of these three metropolitan areas are in central Japan. This area is often called the Tokaido Megalopolis; it is named after the historic road between Tokyo and Kyoto.

2.2.2. Two Definitions of Urban Areas

There are no universal measures to distinguish 'urban' from 'rural' because these definitions depend on specific conditions which vary from country to country. However, it is possible to identify a core idea for the determination of urban and rural areas. Urban describes a high population density area with most of its resident workers employed in the manufacturing and service sectors. On the other hand, rural areas show lower population density and a larger proportion of the workforce is engaged in the primary sector, e.g. agriculture. In Japan, there are two definitions of 'urban' area that are in official use by the Japanese government.

The first definition is a simple administrative distinction between urban and rural areas; this applies to the *shi-cho-son* classification. As outlined in section 2.2.1, *shi* is treated as an urban area. According to the United Nations (1993), the definition of *shi* is as follows. 'City (Shi) having 50,000 or more inhabitants with 60 per cent or more of the houses located in the main built-up areas and 60 per cent or more of the population (including their dependants) engaged in manufacturing, trade or any other urban type of business. Alternatively, a *shi* having urban facilities and conditions as defined by the prefectural order is considered urban'. Local authorities that do not satisfy these conditions are treated as rural areas. This classification is the most common and widely accepted definition of the rural/urban split and has been used since the first Population Census of Japan in 1920.

Another definition of urban area is Densely Inhabited District (DID). This urban definition was developed in the Statistics Bureau and first appeared in the 1960 Population Census of Japan. The DID definition focuses on the population size and density. According to the 1990 Population Census of Japan, the DID is defined as follows: 'A DID is an area within a shi (city), ku (ward), machi (town) or mura (village) that is composed of a group of contiguous enumeration districts each of which has a population density of 4,000 inhabitants or more per square kilometre, and whose total population is 5,000 or more as of the date of the census-taking'.

The Town and Village Merger Acceleration Law, established in 1953, brought about the rise of the DID definition. The main aim of this Law was to enlarge *shi* areas through the absorption of neighbouring *machi* and *mura* as well as to increase the number of *shi* due to the amalgamation of former *machi* and *mura* into *shi*. Japanese local authorities were reorganised under this law. As a result of the reorganisation, many *shi* areas tend to contain sparsely inhabited agricultural areas in their jurisdiction. Therefore, it is not correct to treat these cities as real urban areas.

In addition, it is observed that some *shi* areas should not be treated as urban areas in terms of population size. According to the 1990 Population Census of Japan, 228 *shi* areas did not satisfy the standard population size of *shi* areas, 50,000. This means that one-third of administratively defined urban areas could not satisfy the standard size for urban area. There are several reasons for this complicated situation. The first is caused by the stagnation of population growth of *shi*. Some areas can be classified as *shi* if the government expects these areas to attain a standard city size in the near future but some *shi* areas do not satisfy the standard city size. In this sense, it appears that the definition of *shi* is not clearly defined by the government but utilised only as a guideline.

In addition, some *shi* areas face a massive population loss. An extreme example is Utashinai in Hokkaido, that is the smallest city in Japan. Utashinai had only 8,271 residents in 1990. The main industry of Utashinai is coal mining and the massive population loss has followed from the decline of this industry. The number of residents in Utashinai is considerably smaller than that of many towns and villages. However, there are no signs that this area will be downgraded to a *machi* or *mura* in the future. On the other hand, there are some towns that satisfy both criteria of *shi*, i.e. they containing 50,000 or more inhabitants and a workforce engaged in the secondary or tertiary sectors, e.g. financial service. In 1990, there were ten towns, which contained a population of 50,000 or more. From the size of population threshold, they could be treated as urban areas. In addition, all of these ten towns satisfied the condition of large proportions of the work force engaged in the non-primary sector. These areas can be treated as potentially urban areas, but they are not automatically upgraded to urban areas in the political context, and it takes time to upgrade from rural areas to *shi* areas.

2.3. Japanese Urbanisation

As a first step in the analysis of the Japanese settlement, its pattern of urbanisation is investigated. To examine the degree of urbanisation, the word 'urbanisation' should be clarified. Commonly, this word means the process of rural areas changing into urban areas, and the proportion of urban population to national population is an important index to examine the degree of urban development.

2.3.1. The Process of Japanese Urbanisation

Table 2-1 and Figure 2-2 illustrate the rate of increase of the urban population of Japan with two definitions. From the analysis based on the *shi-cho-son* division, the Japanese urbanisation has experienced three stages since 1920. The first stage was between 1920 and 1955, before the period of rapid economic growth. In 1920, the urban population in Japan represented only 18.6% of the total. Although the percentage of the national population in *shi* areas declined during WWII, it increased to 56.1% in 1955. Between 1955 and 1975, the percentage increased to 75.9%. Since 1975, the percentage has remained stable. In 1990, it was 77.4%. On this definition, therefore, the rate of urbanisation of Japan increased by four times in fifty years.[9]

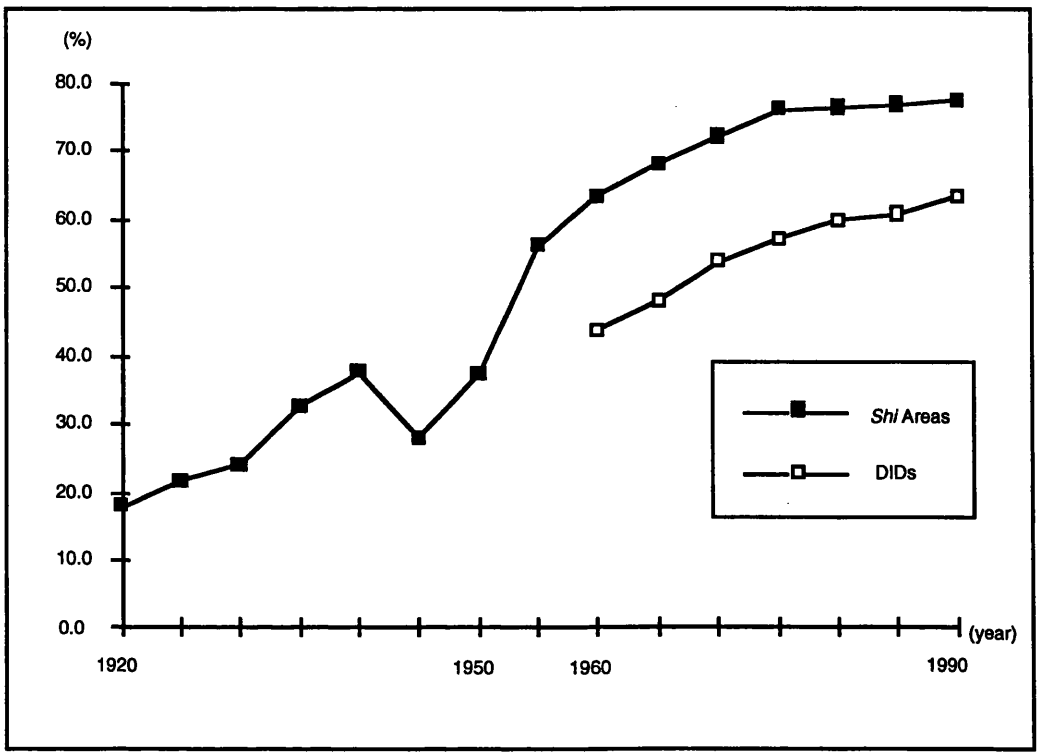
Table 2-1: Japan: Urban Population as % of Total Population (1920-90)

	Shi Areas	DIDs
1920	18.0	-
1925	21.6	-
1930	24.0	-
1935	32.7	-
1940	37.7	-
1945	27.8	-
1950	37.3	-
1955	56.1	-
1960	63.3	43.7
1965	67.9	48.1
1970	72.1	53.5
1975	75.9	57.0
1980	76.2	59.7
1985	76.7	60.6
1990	77.4	63.2

Source: The 1990 Population Census of Japan

[9] According to the 1995 Population Census of Japan, this percentage increased to 78.1%

Figure 2-2: Japan: Urban Population as % of Total Population (1920-90)



Source: The 1990 Population Census of Japan

However, this analysis is questionable. As mentioned in the previous section, a large part of the increase of *shi* areas between 1950 and 1955 could be considered to be a result of the 1953 Law. Therefore, the analysis based on the DID definition must also be examined. According to the analysis on the basis of the DID, the urban population percentage was only 43.7% in 1960, 15% lower than indicated by the measure based on *shi* areas. The population of the DID areas compared to the national one had increased to 63.2% by 1990.[10]

Although the ratio of the urban population, compared to the national total, has increased by both definitions, as shown above, a substantial difference in the ratio results from the definition of the urban population used. To analyse Japanese urbanisation, results based on the DID definition seem to be more accurate because

[10] According to the 1995 Population Census of Japan, this percentage increased to 65.7%.

the DID definition is based on an urban character, i.e. high density. However, analysis based on *shi* areas has one great advantage over that based on the DID. This concept of *shi* is widely accepted and it has a longer history. As a result, the ratio based on *shi* areas is commonly used.

2.3.2. Structural Change of Japanese Settlements

Kuroda (1990) examined the structural change of the Japanese urban settlements based on *shi* areas. He classified all shi areas into three types on the basis of their size; i.e. large cities, medium-sized cities, and small cities. The thresholds of these cities were as follows. Large cities were those that contained of a population of over 500,000. Medium-sized cities were those between 100,000 and 499,999, and small cities had a population of less than 99,999.

Table 2-2 shows urban population proportion arranged by settlement size. The first finding is that the three categories show different patterns of change. Small cities decreased their proportion to the total since 1960 although they had previously increased. Large cities have shown a stable pattern since 1965, although they showed a massive decrease between 1950 and 1955. The proportion of urban population of medium-sized cities increased continually from 32.3%, in 1950, to 42.5%, in 1990. On the other hand, the proportion of small cities decreased since 1960, and they occupied less than 25% of the total *shi* population in 1990. From these patterns, it seems that 1960 was a turning point for the urban structure. Why are there differences between the period before 1960 and that after it? It can be said that the 1953 Law affected this urban structure. Through aggregations of local authorities, villages and towns upgraded mainly to small cities, and small cities with old rural areas upgraded to medium-sized cities.

Table 2-2: Structural Change of Urbanisation to the Total Urban Population Arranged by City Size 1950-1990 (%)

Year	Large Cities	Medium-Sized Cities	Small Cities
1950	35.7	32.3	31.9
1955	29.1	32.7	38.1
1960	31.0	32.7	36.3
1965	33.9	34.4	31.7
1970	33.7	37.7	28.6
1975	32.7	39.8	27.6
1980	32.5	41.6	25.9
1985	33.3	41.7	25.0
1990	33.1	42.5	24.3

Source: The 1990 Population Census of Japan

The second finding is a changing structure of urbanisation. The category that had the largest contribution to the total urban population changed between 1950 and 1990 from large cities in 1950 to medium-sized cities since 1965, via small cities in 1955 and 1960. After 1965, the population of medium-sized cities increased remarkably. From these results, Kuroda concluded that Japanese urbanisation over the period he studied was promoted, mainly, by the growth of medium-sized cities.[11]

2.3.3. Localities of Japanese Urbanisation

In the previous section, the characteristics of the Japanese urban population were examined. Are there any spatial characteristics in the Japanese urbanisation? To make this more clear, the urban population at each prefectural level between 1970 and 1990 is examined in this section. This analysis is based on the DIDs

[11] However, as discussed in Rosen and Resnick (1980) and Ades and Glaeser (1995), this tendency is also observed in other countries. Therefore, it is difficult to say that this is a specific characteristic of Japanese urbanisation.

instead of *shi* areas as the analysis based on the DID shows the patterns of urbanisation more clearly.

Figure 2-3A illustrates the prefectural level of urbanisation in 1990 and shows several points. The first is that only Hokkaido, Fukuoka and prefectures of the three metropolitan areas recorded a higher rate of urban population than the national average in 1990. In addition, some prefectures of the Tokyo and Kansai dominant metropolitan areas recorded the highest level of the DID population compared to the prefectural total. The second is that every region contains at least one or more prefectures that showed a relatively higher rate of the DID population, compared to the prefectural total, than the rest of regions. Miyagi, Shizuoka, Hiroshima, Okayama, Ishikawa, Ehime and Fukuoka can be regarded as being in this category. These prefectures can be regarded as regional centres. The rest of Japan shows a considerably lower level of urbanisation.

Figure 2-3B focuses on the growth rate of the DID population. Different characteristics are found from this figure. The first is that every region contains the prefectures whose DID population increased faster than the national average level in relative terms. This emphasises the characteristic that was seen in Figure 2-3A. The second is that the growth rate of the Kansai and Nagoya metropolitan areas is not as high as the regional centre prefectures. However, Kanto and the southern part of Tohoku have shown high growth rates of urbanisation over the last two decades. This growth is notable and should be further examined by different indices.

Figure 2-3: Urbanisation in Japan (DIDs)

Figure 2-3A: % of Population in DIDs (1990)

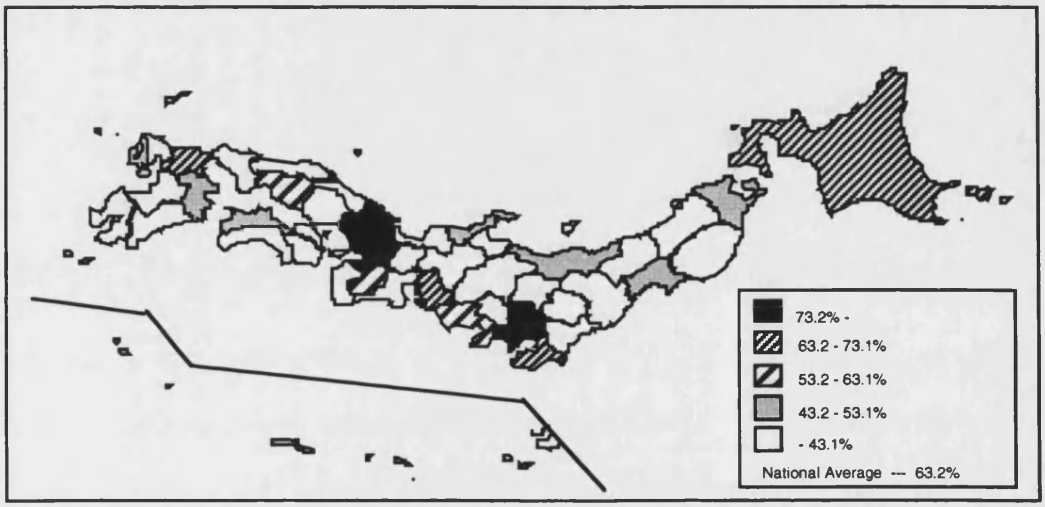
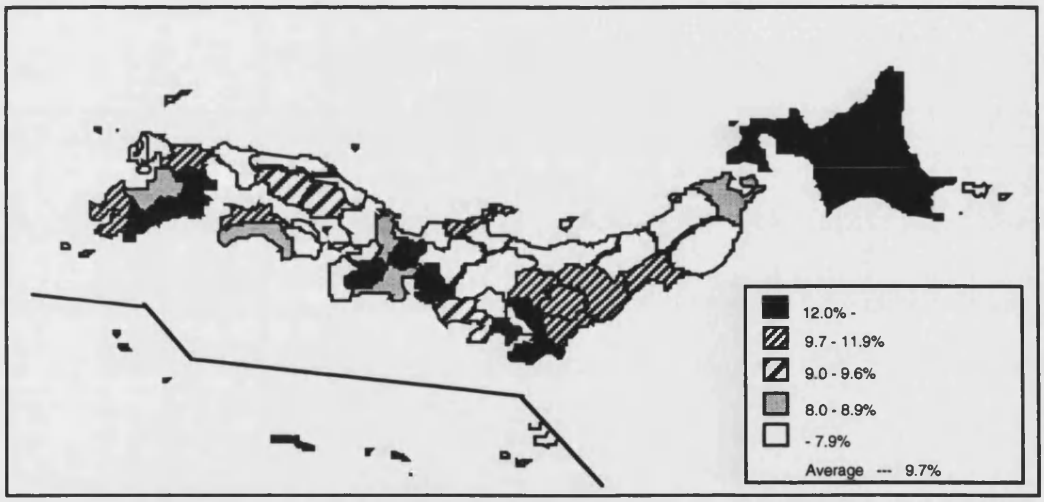


Figure 2-3B: Growth Rate of DID Population (1970-90)



Source: The 1990 Population Census of Japan

2.4. Internal Migration in Japan

This section examines the internal migration pattern of Japan. This is because internal migration causes direct effects on the population distribution. The section consists of four parts. Firstly, the general trends of internal migration, in the international context, will be briefly reviewed. Secondly, the definition of Japanese internal migration will be outlined, and then the changing number of its migrants will be clarified, and the changing migration pattern in the spatial context will be investigated. Finally, the main destination areas of internal migration from other places will be examined.

2.4.1. General Trends of Internal Migration - from the International Context, and Topics from Previous Studies for the Japanese Settlement System

When a city grows, this frequently reflects a direct movement of population from rural areas to the city. This phenomenon is called the 'rural-urban' shift of population, and is widely observed. When the three largest Japanese metropolitan areas grew during the rapid economic growth, 1955-1970, a massive population shift, from rural areas, was observed.

On the other hand, a new phenomenon of the population movement was found among the developed nations since the 1970s. Vining and Pallone (1982) examined the migration pattern in the 1970s and found that migration from core areas to peripheral areas. This 'urban-rural' shift of migration was also confirmed by many researchers. For example, Champion (1987) examined the UK settlement system, and Fielding (1982, 1986) examined Western Europe. Nanjo, Kawashima

and Kuroda (1982) demonstrated that this urban-rural shift was also observed in Japan in the 1970s.[12]

However, although the 'urban-rural' shift was widely observed among the developed countries in the 1970s, this was not a long-term trend. Berry (1988) examined the internal migration pattern in the early 1980s, and concluded that the rural-urban shift was, once again, observable. This is associated with the 'urban renewal' and in the UK case which was examined by Champion (1989, 1992). In Japan, this tendency was observed as a 'unipolar concentration into the Tokyo area' (National Land Agency, 1987; Takahashi ed., 1988, Hatta ed., 1994).

2.4.2. The Definition and the General Internal Migration Trends of Japan

How is a 'migrant' defined in the context of the Japanese settlement system? The Statistics Bureau of Japan defines the word 'migrant' as a person who changes his or her address across municipality boundaries. However, there are four potential types of migrants who are exceptions in Japan. (1) There are people who move within the same municipality,[13] (2) people who migrate internationally, (3) people who do not have Japanese nationality, and (4) people whose previous addresses were not known. In addition, internal migration can be divided into two types: intra-prefectural migration and inter-prefectural migration. The former occurs where the change of address is across boundaries of local authorities within the same prefecture. The latter describes the change of address across prefectural boundaries. Therefore, the latter represents a relatively longer distance movement.

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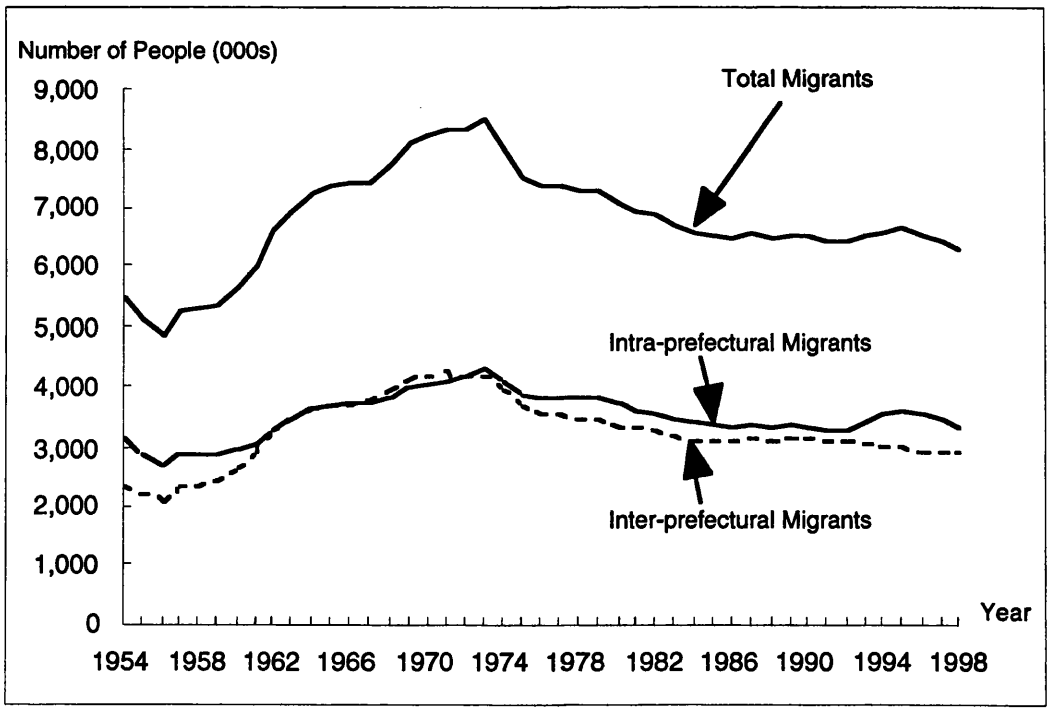
[12] Furthermore, Kuroda (1979) examined the migration called the 'U-turn' pattern; i.e. the population movement from the three metropolitan areas to the non-metropolitan areas of origin, and vice versa.

[13] Therefore, it is excluded from the migration when people change their residential address but remain within the same local authority.

In addition, the Statistics Bureau classified migrants into two categories, 'in-migrant' and 'out-migrant'. The former means that person has moved into the prefecture from other prefectures, and the latter means that person has moved out of the prefecture to other prefectures. The difference between in-migrants and out-migrants for each area is called 'net-migration'.

Figure 2-4 shows the transition of Japanese net-migration since 1954. In 1954, the total number of migrants was almost five million, i.e. 5.5% of the national population. During the period of rapid economic growth, the number increased substantially, and it exceeded 8 million in 1971; this means that over 8% of the total population changed their residence in one year. After the oil crisis of 1973, the numbers of migrants declined and the total number remained stable at six million, or almost 6% of the total population in the 1980s.

Figure 2-4: Internal Migration (1954-98) (000s)



Source: Annual Report on Internal Migration Derived from the Basic Registers

The relationship of intra-prefectural and inter-prefectural migration is observed as follows. Until the early 1960s, intra-prefectural migration dominated, but between 1963 and 1972, inter-prefectural migration achieved a higher number than intra-prefectural migration (Murayama, 2000). Since the mid-1970s, the two are at a similar level.[14]

2.4.3. Long Term Change of Inter-prefectural Migration Pattern[15]

According to the previous studies such as Tsuya and Kuroda (1989), and Vining and Pallone (1982), the Japanese internal migration pattern changed from 'rural-urban' shift to 'urban-rural' shift in the 1970s. The Japanese spatial pattern of the internal migration will be examined on a prefectural basis. Figures 2-5A-H show prefectures by two types of migration pattern; 'in-migrants oriented pattern' prefectures, and 'out-migrants oriented pattern' prefectures. The former means there was net in-migration; the latter that there was net out-migration.

Figure 2-5A exhibits the internal migration pattern in the early 1950s, i.e. the period of recovery from WWII. There were only seven prefectures that showed the in-migrants oriented pattern. These prefectures were Hokkaido, Tokyo, Kanagawa, Aichi, Kyoto, Osaka, Hyogo and Fukuoka. They are the core prefectures of the three metropolitan areas and the centres of their regions. Most prefectures experienced population outflows. The prefectures in Tohoku and Shikoku regions suffered the most, with over 5% of their total population migrating to other prefectures (The 1990 Population Census of Japan). This tendency is a reflection of the restructuring of the Japanese industry. Fukuoka is the centre of the steel industry, and the three metropolitan areas constitute the Pacific Coastal Belt

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[14] Kuroda (1990) explained this tendency as related to the economic climate. In a good economic climate, inter-prefectural migration grew faster, with an opposite tendency occurring during the poor economic climate.

[15] This section is based on Glickman (1979) and author expanded target period.

Zone, i.e. the largest industrial centre of Japan.[16] Therefore, people moved to these prefectures in order to find employment. This is a classical rural-urban shift pattern associated with the economic development.

Figure 2-5B illustrates the population movement pattern in the late 1950s, i.e. the beginning of the period of rapid economic growth, when the tendency of concentration into the three metropolitan areas was accelerated. At that time, only the prefectures of the three metropolitan areas showed an in-migrant oriented pattern. Additionally, the Tokyo area faced a new stage of development. This manifested itself in not only in Tokyo and Kanagawa, which contains the largest cities, but also in the neighbouring prefectures, Saitama and Chiba, absorbing migrants from the outside. Chiba and Saitama thus turned into in-migrants oriented patterns. This change can be understood as a result of the rapid expansion of the Tokyo area. On the other hand, Hokkaido, Kyoto, and Fukuoka lost their residents by out-migration. These tendencies make clear why the concentration into the three metropolitan areas took place.

The changing migration patterns in the early 1960s are found in figure 2-5C. Firstly, we find that Nara, the neighbouring prefecture of Osaka, started an in-migrants oriented pattern. This shows that the Kansai area had a pattern of rapid expansion like the Tokyo area in the late 1950s. Tokyo did not show such a high growth rate in the early 1960s, but the surrounding prefectures showed a rapid growth rate. Two prefectures outside the three metropolitan areas, Hiroshima and Shizuoka, also had an excess of in over out. As a result, the Pacific Coastal Belt Zone on this figure stands out from that of the Japan Sea side.

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[16] For detailed information, see Chapter 7.

Figure 2-5: Internal Migration Pattern 1950-90

Figure 2-5A: 1950-55

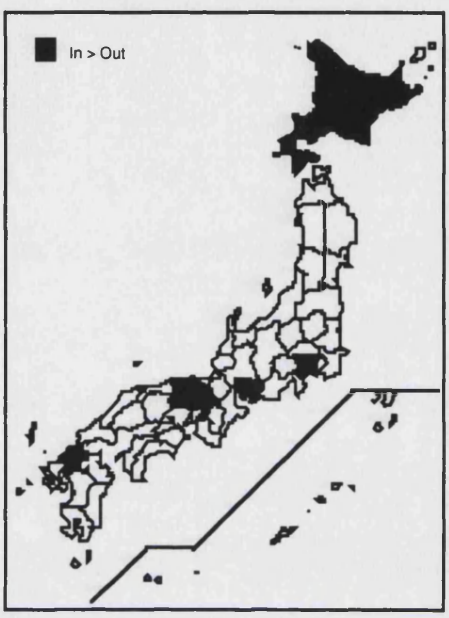


Figure 2-5B: 1955-60

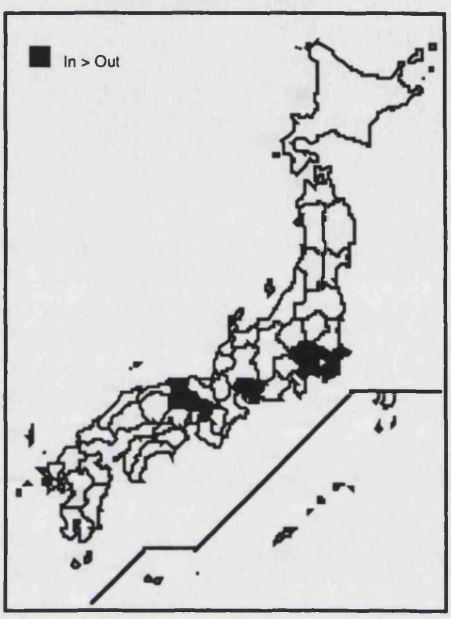


Figure 2-5C: 1960-65

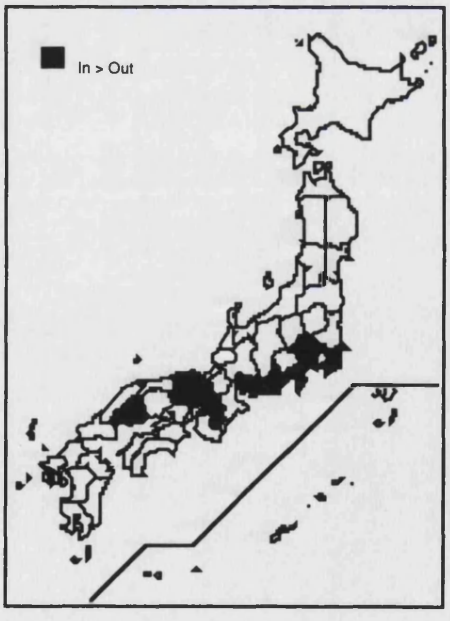
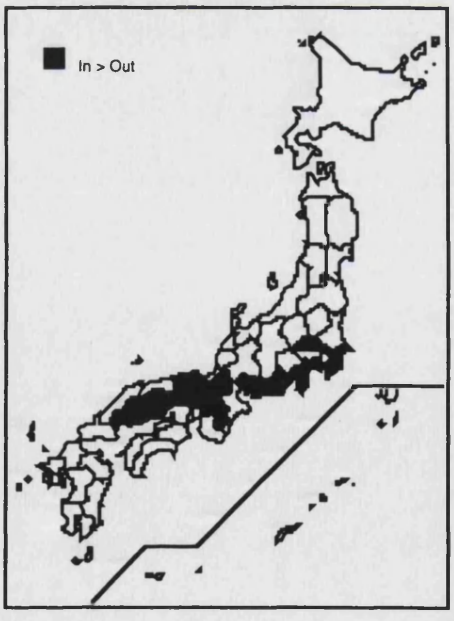


Figure 2-5D: 1965-70



Source: The 1990 Population Census of Japan

Figure 2-5: Internal Migration Pattern 1950-90 (Continued)

Figure 2-5E: 1970-75

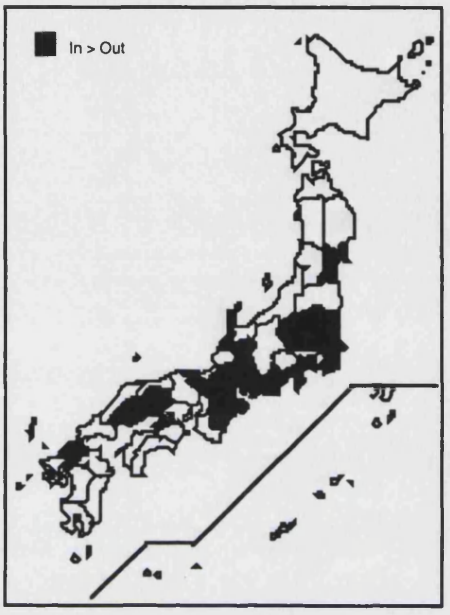


Figure 2-5F: 1975-80

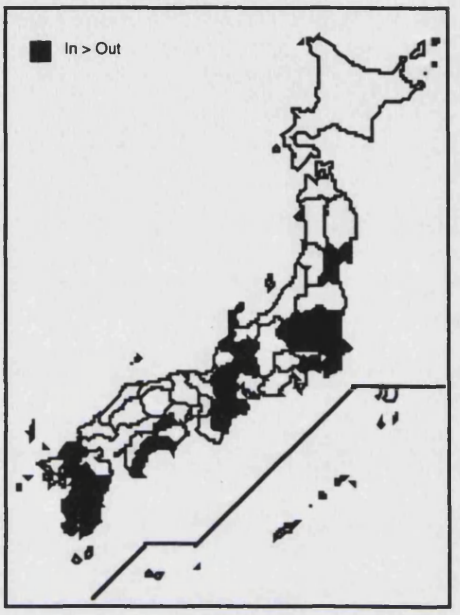


Figure 2-5G: 1980-85

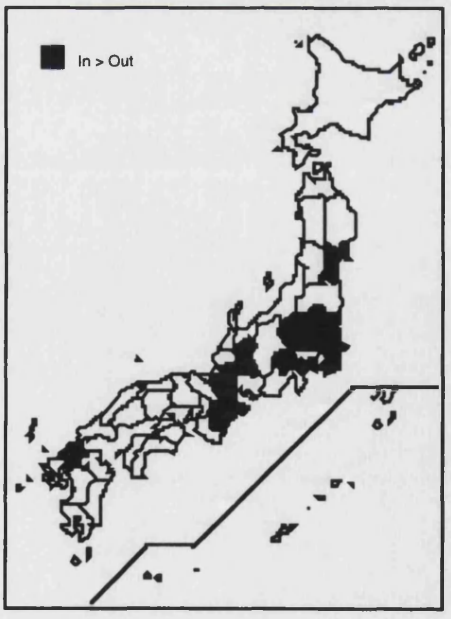
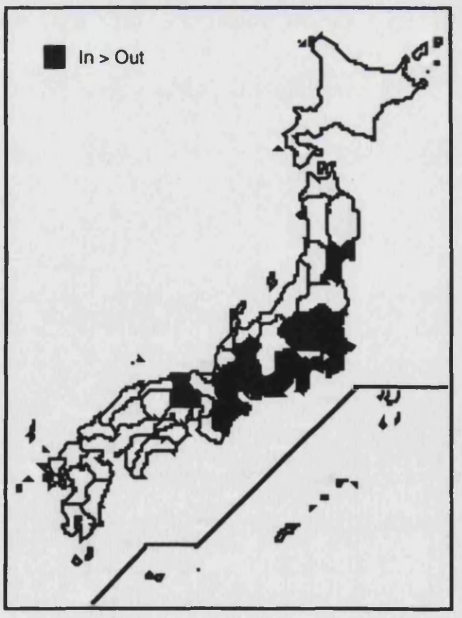


Figure 2-5H: 1985-90



Source: The 1990 Population Census of Japan

In the late 1960s, there were two important findings on the internal migration (Figure 2-5D). Firstly, Tokyo-to turned into an out-migrants oriented pattern in the late 1960s, despite the fact that the surrounding prefectures had absorbed a huge number of migrants from others. Secondly, the expansion of the Pacific Coastal Belt Zone was emphasised by some prefectures, such as Shiga and Okayama that turned into an in-migrant oriented pattern.

From Figure 2-5E, it was found that the migration pattern started to change in the early 1970s. Until the 1960s, the Japanese migration pattern can be understood as a concentration into the three metropolitan areas. In the early 1970s, most regions had one prefecture that absorbed migrants from outside. Miyagi, Ishikawa, Kagawa, Fukuoka, and Okinawa are good examples. Although the three metropolitan areas still absorbed migrants from outside, it is clear that their growth had slowed down. It has to be emphasised that the northern prefectures of the Kanto region (Ibaraki, Tochigi, and Gunma) grew strongly during this period. They turned from an out-migrants oriented pattern into one which was in-migrants oriented, from the early 1970s. At the same time, the number of out-migrants from Osaka was higher than that of its surrounding prefectures which continued to absorb migrants for its core.

As shown in Figure 2-5F, the tendency in which prefectures outside the three metropolitan areas exhibited the in-migrants oriented pattern, continued and accelerated in the late 1970s. Many prefectures of the three metropolitan areas suffered from out-migration to other prefectures. In particular, Tokyo lost over 5% of its total population. In addition, 18 prefectures gained migrants in 1980 (Statistical Bureau, 1981).

In the 1980s, settlement patterns experienced another major change from that of the 1970s (Figure 2-5G). The first is that most prefectures outside the three metropolitan areas turned, once more, to an out-migrants oriented pattern, with Miyagi and Fukuoka being the only exceptions. The second is that prefectures of three metropolitan areas started to grow again as a result of the internal migration pattern. However, this pattern was slightly different from that of the period before 1970. The form it took was that the prefectures of the three metropolitan areas, (except Tokyo Aichi, Kyoto, Osaka and Hyogo) showed a faster growth than the core of their metropolitan areas. Thirdly, some prefectures, i.e. Miyagi, three prefectures in northern-Kanto region, and Fukuoka, showed an in-migrants oriented pattern.

Figure 2-5H shows the pattern of the late 1980s. Its characteristics are: the first that some core prefectures of the three metropolitan areas, Aichi and Hyogo, recovered from their heavy pattern of out-migrants oriented pattern to an in-migrants oriented pattern. The second is that the Kanto region showed a stable pattern in its absorption of in-migrants from outside. In addition, Fukuoka turned into an out-migrants oriented pattern. As a result, the prefectures that were in-migrants oriented are concentrated between the three metropolitan areas and their surrounding areas. The pattern of concentration of migrants into three metropolitan areas is clearly confirmed.

2.4.4. Prefectures as the Main Destination of Internal Migration from Other Prefectures

To further investigate the Japanese internal migration, this section examines the characteristics of the prefectures that have been the main destination of the out-migrants from other prefectures. This topic is investigated and updated annually by the Japanese Statistics Bureau. Figure 2-6 shows the relationship between each

prefecture and reveals the prefectures which were the main destination of internal migration in three different periods, 1971, 1981, and 1991. From the figure, several characteristics of the prefectures of main destination are observed.

The first characteristic is that prefectures that were the main destination for other prefectures were not interactive but polarised. In 1971 and 1981, the prefectures of main destination were Miyagi, Tokyo, Kanagawa, Gifu, Aichi, Kyoto, Osaka, Hyogo, Hiroshima, Yamaguchi, and Fukuoka. In 1991, Ishikawa was added to the above 11 prefectures. The second finding is related to the regional distribution. At least one or more prefectures existed as the main destination for other prefectures in every region except the Shikoku region. The Shikoku region does not contain any prefectures that were treated as a main destination for other prefectures. Although Ehime shows the best performance in terms of migration pattern in the Shikoku region, it seemed not so attractive for other prefectures of the region. Therefore, Osaka was the main destination for all prefectures in the region.

In addition, it should be mentioned that Tokyo and Osaka had had a strong tendency to be the main destinations for other prefectures during the target periods, although these prefectures recorded an out-migrant oriented pattern since the late 1960s (section from an employment point of view, 2.4.3.). On the other hand, Aichi, the centre of the Nagoya metropolitan area, did not seem as attractive a destination for other prefectures.

Figure 2-6: Destination of Major Migration from Each Prefecture (1971, 1981, 1991)

Figure 2-6A:1971

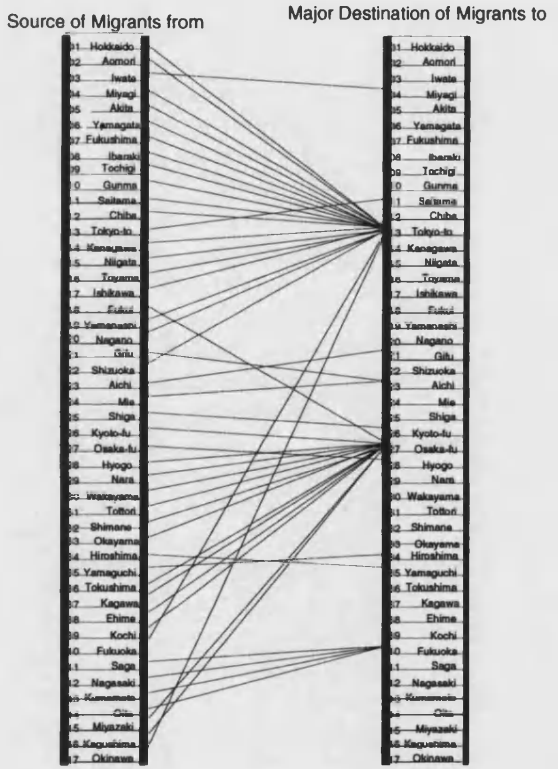


Figure 2-6B:1981

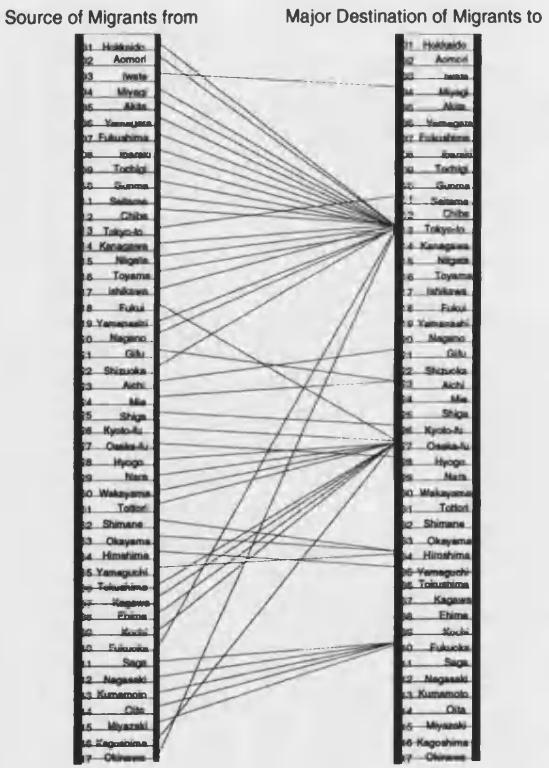
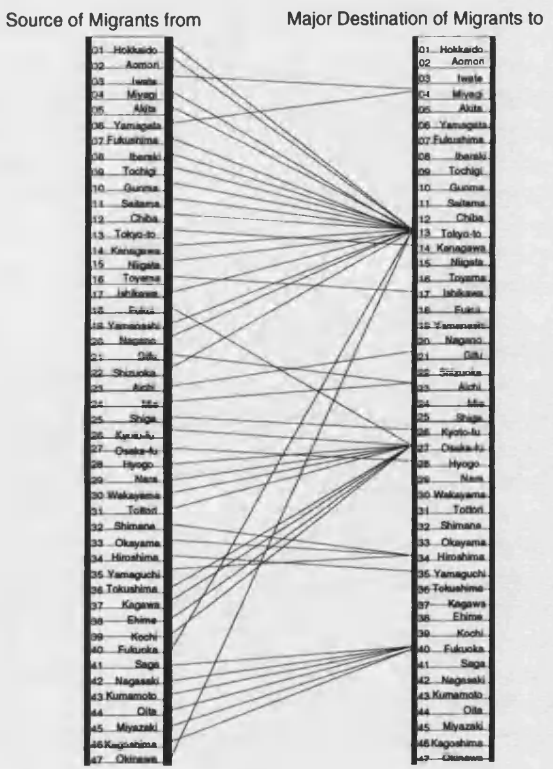


Figure 2-6C:1991



Source : Annual Report on the Internal Migration in Japan Derived From The Basic Resident Registers 1971,1981,1991

Another important finding is that some prefectures outside the three metropolitan areas had a role as major destinations for other prefectures in their region, and this was clearly found by comparing the three figures of three different periods. Fukuoka and Hiroshima are good examples. Fukuoka was regarded as a main destination for four prefectures in northern Kyushu in 1971 and 1981. In 1991, six prefectures, all in Kyushu, treated Fukuoka as a main destination for the migrants from these prefectures. Two prefectures that were added in 1991 changed from Osaka to Fukuoka. Hiroshima was a main destination only for Okayama's migrants, in 1971. In 1991, four prefectures regarded Hiroshima as their main destination.

2.5. Comments for the Urbanisation and Internal Migration - before Focusing on the Three Metropolitan Areas

From section 2.3 and 2.4, the Japanese prefectures showed several characteristics as follows. The first salient finding was the gap between the Japanese metropolitan areas and the other prefectures. The three metropolitan areas recorded a higher degree of the urban population and they showed a population gain by in-migrants from outside. Secondly, it was found that the northern part of the Kanto region, i.e. Ibaragi, Tochigi, and Gunma, showed a rapid growth in terms both of urban population, and from internal migration. Thirdly, when the non-metropolitan areas were examined, it was found that some areas recorded a better growth than others. These growing areas contained the largest cities of their region. Miyagi is a good example. This prefecture contains Sendai, the largest city of the Tohoku region. This prefecture recorded a population gain, by migration from other prefectures, for the last ten years.

2.6. The Three Metropolitan Areas

In the early sections, the discussion on urbanisation trends and internal migration in Japan were based on a prefectural level. Although there are three metropolitan areas in Japan, the previous section did not pay too much attention to them. Therefore, this section will examine the basic characteristics of the three largest Japanese metropolitan areas in terms of their population change and internal migration.

2.6.1. Population Distribution

As seen in section 2.3, all central prefectures of the three metropolitan areas show a high level of urbanisation. Since 1920, six prefectures of the three metropolitan areas (i.e. Tokyo, Kanagawa, Aichi, Kyoto, Osaka, and Hyogo) have had a higher ratio than the national average of population in the *shi* areas. Since 1970, Chiba and Saitama have achieved the same level, showing that the surrounding areas of Tokyo metropolitan area have grown. On the other hand, the surrounding areas of the Kansai and Nagoya metropolitan areas have not experienced a similar growth.

The population of the three metropolitan areas increased from 29.2 million in 1950, to 60.5 million in 1990. To emphasise the increase of the population in the three metropolitan areas, we focused on their proportion of population compared to the total. This was 35.1% in 1950, and increased to 48.9% in 1990. It should be emphasised that this proportion has never decreased. The figures for each metropolitan area are also shown in Tables 2-3 and 2-4. Between 1950 and 1990, Tokyo metropolitan area grew from 15.7% to 25.7% of Japan's total population. The Kansai metropolitan area showed a much smaller increase of share, and the

Nagoya metropolitan area was almost stable, at 8%. Moreover, Kansai metropolitan area stopped its growth relative to the country as a whole by 1970.

Table 2-3: Population of the Three Metropolitan Areas (000s and %)

Area / Year	Tokyo Metropolitan Area		Osaka Metropolitan Area		Nagoya Metropolitan Area		Three Metropolitan Areas		Rest of Japan		Japan	
	000s	%	000s	%	000s	%	000s	%	000s	%	000s	%
1950	13,051	15.7	9,764	11.7	3,696	4.4	26,511	31.9	56,689	68.1	83,200	100.0
1955	15,424	17.3	10,951	12.3	6,838	7.7	33,214	37.2	56,062	62.8	89,276	100.0
1960	17,864	19.1	12,186	13.0	7,330	7.8	37,379	40.0	56,039	60.0	93,418	100.0
1965	21,064	21.4	13,896	14.1	8,014	8.2	42,973	43.7	55,302	56.3	98,275	100.0
1970	24,113	23.0	15,469	14.8	8,688	8.3	48,270	46.1	56,395	53.9	104,665	100.0
1975	27,042	24.2	16,773	15.0	9,418	8.4	53,233	47.6	58,707	52.4	111,940	100.0
1980	28,699	24.5	17,355	14.8	9,869	8.4	55,922	47.8	61,138	52.2	117,060	100.0
1985	30,273	25.0	17,838	14.7	10,231	8.5	58,342	48.2	62,707	51.8	121,049	100.0
1990	31,797	25.7	18,118	14.7	10,550	8.5	60,464	48.9	63,147	51.1	123,611	100.0

Source: The 1990 Population Census of Japan

Table 2-4: Population Growth in the Three Metropolitan Areas (000s and %)

Area / Period	Tokyo Metropolitan Area		Osaka Metropolitan Area		Nagoya Metropolitan Area		Three Metropolitan Areas		Rest of Japan		Japan	
	000s	%	000s	%	000s	%	000s	%	000s	%	000s	%
1950-55	2,374	18.2	1,188	12.2	3,142	85.0	6,703	25.3	-627	-1.1	6,076	7.3
1955-60	2,440	15.8	1,234	11.3	491	7.2	4,165	12.5	-23	0.0	4,143	4.6
1960-65	3,200	17.9	1,710	14.0	684	9.3	5,594	15.0	-737	-1.3	4,857	5.2
1965-70	3,050	14.5	1,573	11.3	675	8.4	5,297	12.3	1,093	2.0	6,390	6.5
1970-75	2,928	12.1	1,305	8.4	729	8.4	4,962	10.3	2,312	4.1	7,274	7.0
1975-80	1,657	6.1	582	3.5	451	4.8	2,690	5.1	2,431	4.1	5,121	4.6
1980-85	1,575	5.5	483	2.8	362	3.7	2,420	4.3	1,569	2.6	3,989	3.4
1985-90	1,524	5.0	280	1.6	319	3.1	2,122	3.6	440	0.7	2,562	2.1

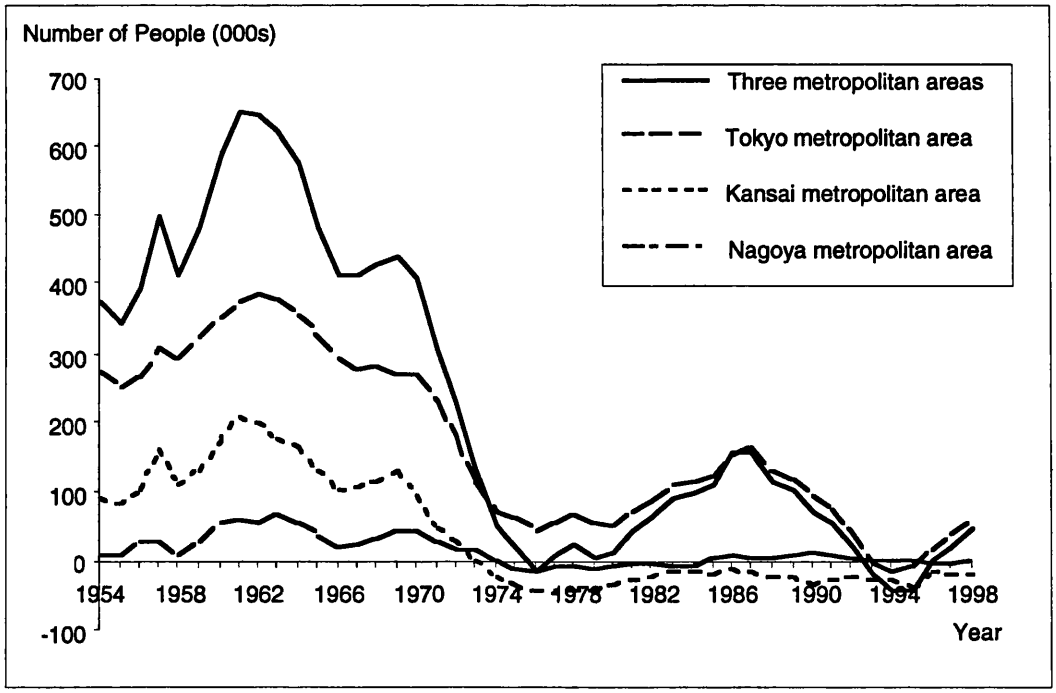
Source: The 1990 Population Census of Japan

2.6.2. Migration Pattern (1954-98)

Figure 2-7 shows the balance between in and out-migrants to the three metropolitan areas between 1954 and 1998. When the three metropolitan areas are treated as one group, it was found that the number of in-migrants to these areas

rapidly increased during the 1950s, and reached its peak in 1961 when their number was recorded as 650,000. After 1961, the total number of in-migrants in the three metropolitan areas declined, falling to 400,000 annually in the late 1960s and early 1970s. After 1973, the year of the oil crisis and the end of the period of rapid economic growth, the number of in-migrants dropped rapidly, and by 1976 the three metropolitan areas lost population through out-migrants. This was the only time this occurred during the whole period. Since the late 1970s, the number of in-migrants to these areas has recovered, and achieved a second peak in 1987. The scale of this peak was much smaller than that of the first one but a net-migration gain of 150,000 migrants was recorded in that year into the three metropolitan areas combined. Recently, net in-migration has declined again steeply, and the three metropolitan areas lost net residents by out-migration between 1994 and 1996. This was the first significant period of loss since after WWII but from about 1995 the trend again turned to net gain from migration.

Figure 2-7: Net-Migrants of the Three Metropolitan Areas (1954-98)



Source: Annual Report on Internal Migration in Japan Derived from the Basic Registers

There seem to be two different reasons for the two peaks of internal migration in the three metropolitan areas. Until the late 1970s, each metropolitan area experienced a similar pattern of net-migration, although the scale for each one of them was different. However, each one of the three metropolitan areas started showing a different pattern from the late 1970s. Internal migration in each one of them will be examined separately for the more recent period.

Tokyo metropolitan area as a whole never lost population as a result of net migration until the mid-1990s. Although Tokyo-to itself lost residents to out-migration from the late 1960s, Saitama and Chiba gained a large volume of migrants from Tokyo and from other regions. This tendency continued in the 1980s. In 1987, the Tokyo metropolitan area achieved its second peak, gaining 158,000 migrants from other regions. Although the peak passed, Tokyo metropolitan area still gained about 50,000 migrants per year albeit on a falling trend in actual migration loss in the mid-1990s. However, this was not a long-term trend and the area restarted its in-migrant oriented pattern again.

In contrast, the Kansai metropolitan area has suffered from an out-migrant oriented pattern since the mid-1970s. In spite of the growth of the surrounding prefecture of this metropolitan area, such as Nara, in the1980s, this metropolitan area kept on losing residents by out-migrants from its core area, i.e. Osaka Prefecture. Even in 1987, the best year for Kansai metropolitan area of the 1980s, in and out migrants only just balanced. After 1987, this metropolitan area had a population loss by out-migrants of over 50,000 residents every year, and this tendency had not changed.

During the 1980s, Nagoya metropolitan area recovered gradually in migration terms, gaining migrants from outside from 1984. However, the growth pattern of this metropolitan area changed. Until the 1970s, it had a metropolitan pattern like Tokyo, but in the 1980s, it drew a similar pattern to that of the regional

core prefectures, e.g. Miyagi. If migration patterns are a guide, Nagoya metropolitan area appeared to change its role, from being a metropolitan area of Japan to being a regional core area.

2.6.3. The Three Metropolitan Areas as the Main Destination of Migrants

To clarify the characteristics of the internal migration of the three metropolitan areas, their pulling power as a main destination of internal migration for other prefectures will be examined in this section. This topic is based on the examination in section 2.4.3, but the investigation was rearranged for this section. This is a simple procedure where each one of the three metropolitan areas is examined as a single destination of a single prefecture; the main destination of prefectures outside the three metropolitan areas was examined as well.

Figure 2-8 exhibits the result of the examination, and shows several features. The first is that only two of the metropolitan areas, i.e. Tokyo, and Kansai, and two prefectures, Hiroshima and Fukuoka, were treated as main destinations from other prefectures. The results for 1971 and 1981 were as follows; Tokyo metropolitan area had 21 prefectures; Kansai metropolitan area had 14 prefectures; Hiroshima had one and Fukuoka had two. On the other hand, the results in 1991 were as follows; two prefectures were added to Tokyo's list, Kansai metropolitan area lost four prefectures, there was no change for Hiroshima, while Fukuoka increased from two to four prefectures. Additionally, the second main destination of prefectures whose migrants primarily went to Hiroshima, and Fukuoka was examined. The result of this was that the second major destination for all prefectures in all three periods was Tokyo metropolitan area. From this it can be said that the Tokyo metropolitan area had a strong attractiveness to migrants from a wide area.

Figure 2-8: Main Destination of Prefectures outside the Three Metropolitan Areas

Figure 2-8A: 1971

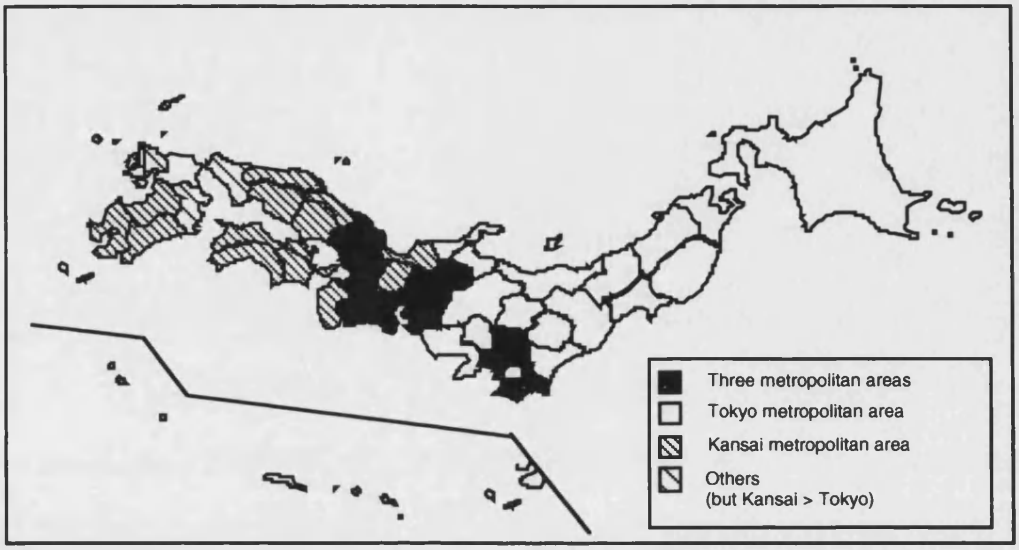
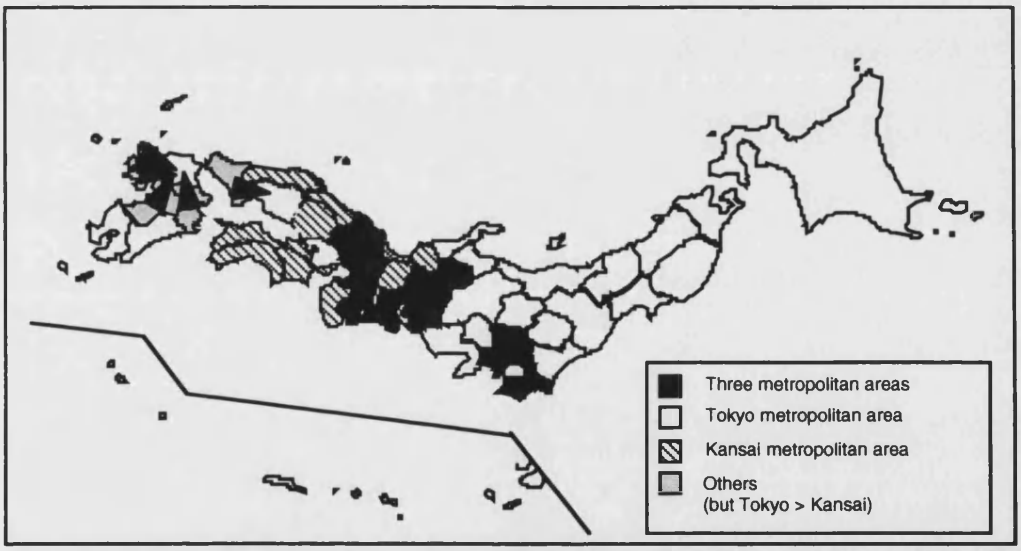


Figure 2-8B: 1981 and 1991



Source: Annual Report on Internal Migration in Japan Derived from the Basic Registers

2.6.4. Internal Migration of the Three Metropolitan Areas

As a further examination of the internal migration pattern to the three metropolitan areas, the annual balance of migrants for each one of the three metropolitan areas for each prefecture was calculated in the three different years, i.e. 1971, 1981 and 1991. Figures 2-9, 2-10 and 2-11 exhibit the results for each one of the three metropolitan areas. From these figures, the changing pattern of each one of the three metropolitan areas will be observed as follows.

Figure 2-9 shows that the Tokyo metropolitan area attracted a large number of migrants from the whole area of Japan. Most prefectures recorded a loss of over 1,000 residents by net-migrants to the Tokyo metropolitan area, in 1971. Especially, Tohoku recorded a massive population loss by out-migrants towards Tokyo metropolitan area. For example, Yamagata recorded a loss of 13,000 in 1971. This massive population loss was observed, although the loss had decreased in 1981 and 1991. Secondly, it is clearly found that the limited prefectures showed in-migrants oriented pattern to the Tokyo metropolitan area. Except Okayama in 1971, all prefectures that showed an in-migrants oriented pattern were neighbouring prefectures of Tokyo metropolitan area.

Figure 2-9: The Difference of Migrants (towards Tokyo Metropolitan Area)

Figure 2-9A: 1971

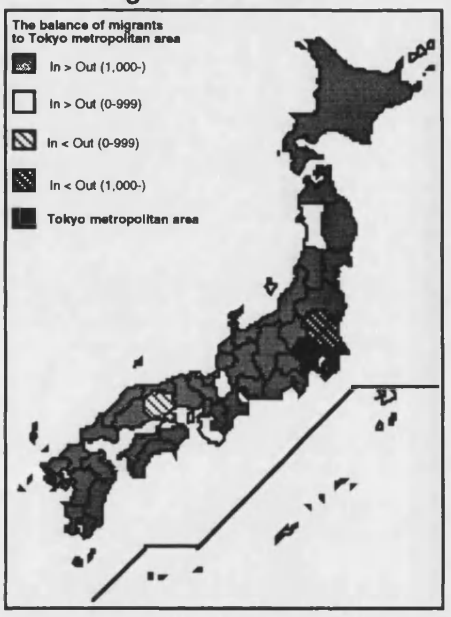


Figure 2-9B: 1981

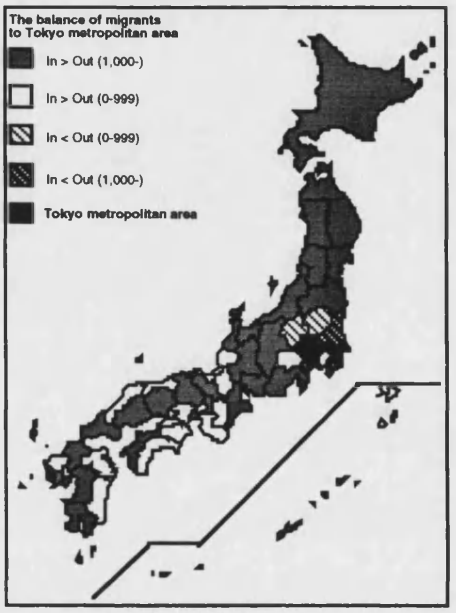
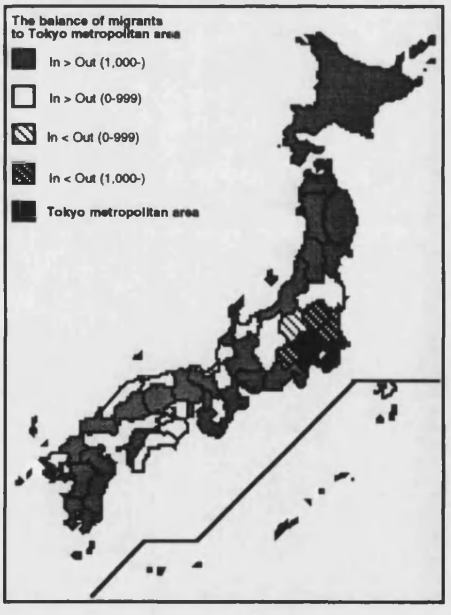


Figure 2-9C: 1991



Source: Annual Report on Internal Migration in Japan Derived from the Basic Registers

Figure 2-10: The Difference of Migrants (towards Kansai Metropolitan Area)

Figure 2-10A: 1971

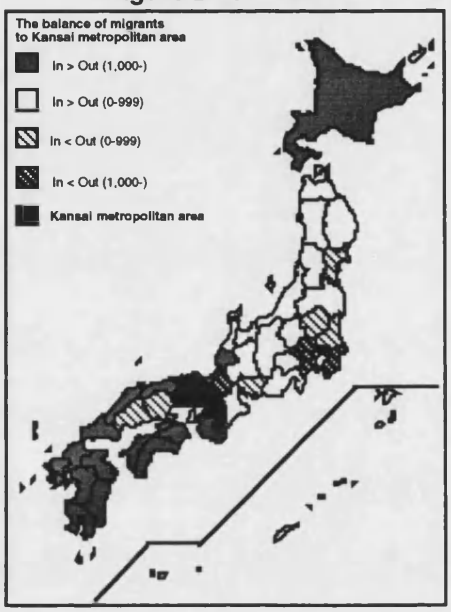


Figure 2-10B: 1981

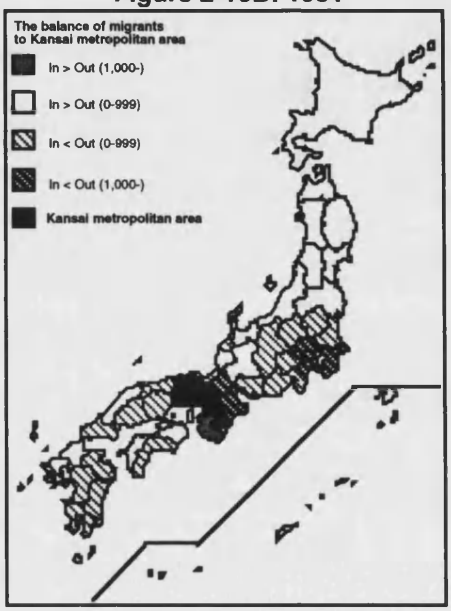
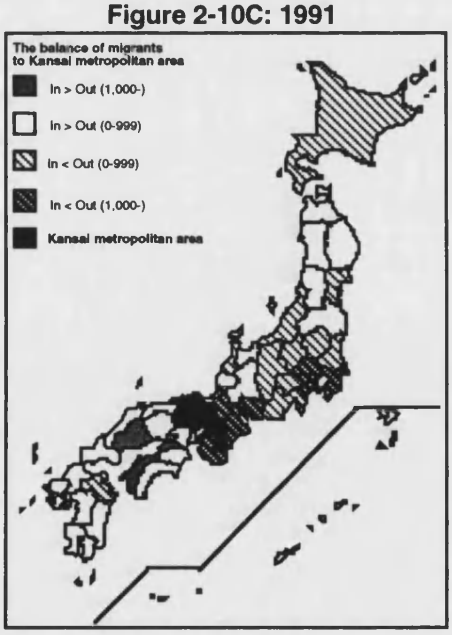


Figure 2-10C: 1991



Source: Annual Report on Internal Migration in Japan Derived from the Basic Registers

Figure 2-11: The Difference of Migrants (towards Nagoya Metropolitan Area)

Figure 2-11A: 1971

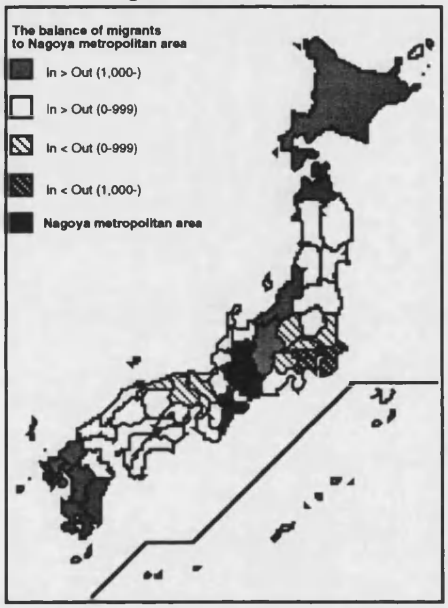


Figure 2-11B: 1981

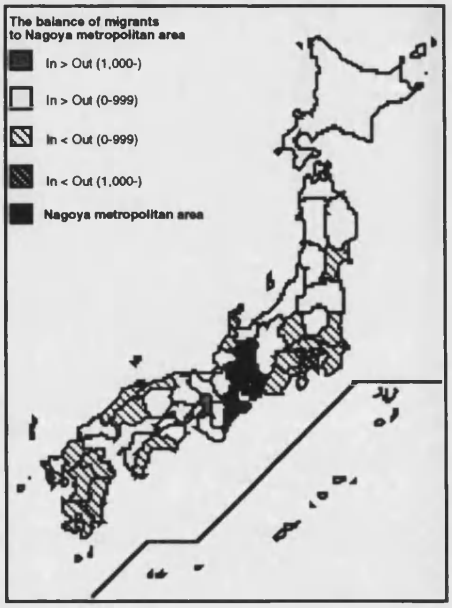
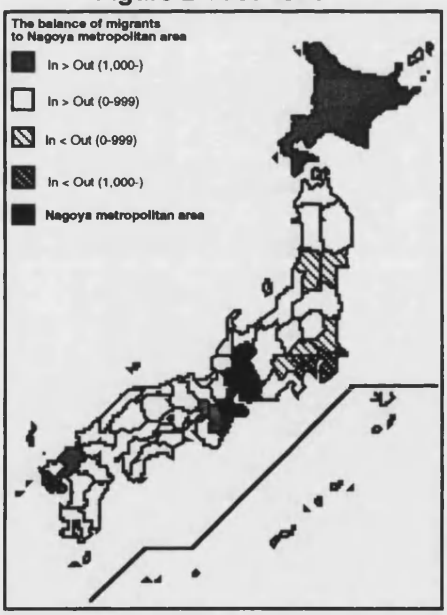


Figure 2-11C: 1991



Source: Annual Report on Internal Migration in Japan Derived from the Basic Registers

The Kansai metropolitan area showed a decrease of its attractiveness for other prefectures in the last twenty years. In 1971, seventeen prefectures recorded a population loss of 1,000 or more in terms of the balance of the migrants to Kansai metropolitan area. In 1981, only Wakayama recorded the difference to Kansai metropolitan area of a loss of 1,000 or more. In 1991, there were three prefectures in the group, although, the number of prefectures was still not as great as that of 1971. The Kansai metropolitan area showed a relatively heavy out-migration oriented pattern compared to the other two metropolitan areas, Tokyo, and Nagoya in 1981, and 1991. In addition, some other prefectures recorded an in-migrants oriented pattern towards the Kansai metropolitan area. The first category includes the prefectures located in central Japan, like Nagano. These areas recorded this pattern in both 1981, and 1991. In 1981, prefectures of the western part of Japan recorded population gains by migrants from the Kansai metropolitan area. This tendency meant that this area lost its residents from migration from the outside as previous patterns reversed and past migrants returned to their place of origin, this is called a 'U-turn' pattern. From these characteristics, it can be said that the Kansai metropolitan area had shrunk.

The Nagoya metropolitan area showed a similar pattern to that of the Kansai metropolitan area but it was not so extreme. However, it can be said that the effects on the Kyushu region in 1971 were not observed in 1981 and 1991. This metropolitan area also lost its migrants to the Tokyo metropolitan area in these three periods. In addition, this area also displayed an out-migrants oriented pattern in Kyushu region, in 1981.

2.6.5. Short Comments for the Three Metropolitan Areas of Japan

In this section, the various investigations of the three metropolitan areas in terms of the internal migration and population change were carried out. Looking at the expansion of the Tokyo metropolitan area in terms of the internal migration pattern, this area showed a stronger attractiveness than any other areas. On the other hand, the Kansai metropolitan area did not show a strong tendency to grow by migration. It was clearly found that the Kansai metropolitan area had relatively declined, losing its relative position within the national settlement system. Although the pattern of population change in the Nagoya metropolitan area was not as clear as that of Kansai, this also showed a decline in its position within the national settlement system.

2.7. Conclusion

Japan experienced a rapid urbanisation during the 20th century. Analysis on the basis of the administrative division shows that the proportion of urban population increased rapidly over the last fifty years. Three quarters of the total population of Japan lived in urban areas by 1990. This chapter also examined the degree of urbanisation based on another definition of 'urban area' called DID. The analysis based on the DID definition is precise, and it shows more modest rates of urbanisation. During the process of Japanese urbanisation, structural change occurred, i.e. from a large city oriented pattern to a pattern oriented more towards medium-sized cities.

It can be said that the mechanism in the most important, massive urbanisation, of Japan was internal migration, from rural to urban area. Since 1950, Japan has faced three phases of internal migration; concentration into the three

metropolitan areas; relative decline of the three metropolitan areas and the growth of regional centres, and re-concentration into Tokyo metropolitan area. Two features, or results, of migration are clear. The first is the geographical expansion of Tokyo, and Kansai metropolitan areas. The second is the appearance of regional core prefectures. These features are clarified by demographic indices.

From the more detailed study of the three metropolitan areas, it is clear that each one of these areas has different patterns of growth, especially since the 1970s. The Tokyo metropolitan area had attracted migrants from the whole of Japan and this contributed to its growth, in the 1980s. On the other hand, the economic attractiveness of the other metropolitan areas, in terms of in-migrants from outside, declined during the 1980s. This difference caused a 'unipolar concentration to Tokyo area', in the late 1980s.

Chapter 3: Defining the Japanese Functional Urban Area (JFUA)

3.1. Introduction

Whenever the urban settlement system is investigated, it is necessary to consider the 'basic spatial unit'. This consideration is necessary because of the difference between the administratively defined urban area and the functional urban area. The increasing distance between the workplace and the place of residence is the cause of this difference. Although distance between the workplace and the place of residence was not great in historical times, the improvement of urban transport has made it greater.

In Japan, statistical data collection is based on the municipal level. Simple usage of this data cannot be relied upon for urban analysis where long distance commuting across administrative boundaries occurs. To overcome this problem, it is necessary to define the functional urban region if we are to understand how cities actually work. There are several functional definitions of an urban region. Some of them are defined by the government and some are determined by academic researchers. They all need to be examined in order to understand the basic concept.

Therefore, there are two main parts of this chapter. The first part reviews the investigation of the definitions of the functional urban region for the UK, the US and Japan. The second part establishes an appropriate functional definition for the Japanese urban settlements.

3.2. Definitions of Functional Urban Region in the US, UK and Europe

Since the US government first defined the urban region using functional criteria in 1949 (Frey, 1989; the US Census Bureau, 2000), this approach has spread worldwide. The functional urban region concept has been adapted to each country's circumstances. It is useful to examine the development of the definition in one country in order to gain an essential understanding of the concept of the functional urban region and its criteria. Therefore, the definitions of functional urban regions in the US, UK and Europe are examined in this section.

3.2.1. The Development of the Official US Definitions - Standard Metropolitan Statistical Area (SMSA) and Metropolitan Areas (MAs)[17]

In 1949, the US government introduced the concept of functionally defined urban regions called the Standard Metropolitan Area (SMA) (the US Census Bureau, 2000). This definition was developed into Standard Metropolitan Statistical Area (SMSA) from 1958 (Drewett, 1967; Frey, 1989). The SMSA definition is treated as the reference model of the functional urban regions when the functional urban regions are defined in other countries. Therefore, it is important to understand the SMSA definition, so its criteria are outlined as follows.

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[17] Original definition for six states of New England, i.e. New England County Metropolitan Area (NECMA), will not be discussed in this thesis. This distinction between New England definition and those elsewhere reflects the different spatial units of administration in New England.

To define the SMSAs, the spatial unit for the data set is based on the US administrative unit called a county. The definition of a SMSA involves two considerations. The first one is to identify a city with a specified population, called the central city, and then identify the county in which it is located as its central county. The second one is to identify the economic and social relationships with contiguous counties, which are metropolitan in character, so that the periphery of the functional metropolitan area may be determined. The SMSA may cross state lines, if necessary, in order to include qualified contiguous counties. Therefore, these considerations mean that a SMSA consists of two kinds of areas: the 'core area' and the 'ring area'.

There are two basic criteria for the SMSA core using this definition. The first is that the SMSA core place should be a central city of at least 50,000 population, or twin cities totalling 50,000. This is focused on the population scale. The second is that 75% of the labour force of each county included should be non-agricultural and live in contiguous minor civil divisions with a population density of at least 150 persons per square mile. This criterion focuses on urban character.

After determining the core area, the ring area can be defined. In this case, the US government paid attention to the commuting population because commuting is connected with economic activity and is a good index of the interconnectedness of counties. After calculating an approximate level of the commuting population to the total population of residential workers, a cut-off point for the ring area is determined. The definition of the ring area used was that at least 15% of the workers in each county to be included must commute to the central city.

The US government updated the SMSA definition for the census data until 1980. Since 1983, the Metropolitan Area (MA), which is based on the 1980 SMSAs, has replaced the SMSA definition. The MA criteria contains three criteria of the functional urban regions; Metropolitan Statistical Area (MSA), Consolidated Metropolitan Statistical Area (CMSA) and Primary Metropolitan Statistical Area

(PMSA)[18]. The MSA is the basic statistical area and the PMSA has a larger population size than that of the MSA. According to the 1999 definition of the US Census Bureau, the US contains 261 MSAs, 19 CMSAs and 76 PMSAs.

According to the US Census Bureau, the criteria of the MSA are as follows. The MSA definition consists of a core area with a large population centre and neighbouring communities that have a high degree of economic and social integration with their core area. For a MSA, a city should have 50,000 or more inhabitants, or an Urbanized Area[19] and a total population of at least 100,000[20]. The county or counties that contain the largest city, and surrounding densely settled territory, are called central counties of the MSA. In addition, outlying counties qualify to be included in the MSA when these counties meet certain other criteria of metropolitan character, such as a specified minimum population density or percentage of the urban population. MSAs in New England are defined in terms of cities and towns, following rules concerning commuting and population density.

The definitions of the CMSA and PMSA are as follows. PMSA is defined when an area meets one of two requirements as follows; (1) a MSA has a population of one million or more, or (2) two or more MSAs may be defined as PMSAs if the appropriate statistical criteria are met and local authorities favour the designation. A PMSA consists of a large urbanised county or a cluster of counties that show the interchange in terms of commuting. When one or more PMSAs are established, the larger area containing them is designated as a CMSA.

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[18] For detailed information of the definitions of these three types of metropolitan areas, see government's web page (http://www.census.gov/population/www/estimates/mastand.html).

[19] According to the Census Bureau (2000), the Urbanized Area is an 'area identified by the Census Bureau that contains a central place and the surrounding, closely settled incorporated and unincorporated area, that has a combined population of at least 50,000.'

[20] Six states in New England have a smaller population threshold of 75,000 instead of 100,000.

3.2.2. Daily Urban System (DUS)

Berry (1973) used a definition of functional urban regions called the Daily Urban System (DUS) for analysis of the US settlement system. This definition was developed by the Office of Business Economics, US Department of Commerce. With the DUS definition, US settlement divided into 173 areas.

The definition is decided according to the following procedure. The first step is to identify the economic centre. SMSAs were chosen whenever possible because each SMSA has a large city at its centre that plays a role as a commercial and labour market centre. However, some SMSAs were excluded from economic centres because of integration to larger metropolitan complexes. In rural parts of the US, where there were no SMSAs, the economic centre of the DUS was determined according to the following procedure. When cities with between 25,000 and 50,000 population satisfied the two following criteria, they were utilised as economic centres. The first criterion was that the city formed a wholesale trade centre for the area. The second one was that the area as a whole had a minimum population of about 200,000 residents.

After identifying economic centres, the rest of the counties were allocated to the centres. This assignment was determined primarily on the basis of the journey to work pattern around the economic centres. The journey to work pattern was estimated according to the following conditions; comparative time and distance of travel to the economic centres, the interconnection between outlying counties and the road network. Additionally, the following conditions were used to determine placement of peripheral counties into the appropriate economic area: the linkages of counties by such other economic ties as telephone traffic, bank deposits, television viewing, newspaper circulation and topography.

3.2.3. Standard Metropolitan Labour Area (SMLA) and Metropolitan Economic Labour Area (MELA)

Hall et al. (1973) introduced two proposals for defining the functional urban region in the UK, the Standard Metropolitan Labour Area (SMLA) and the Metropolitan Economic Labour Area (MELA). These modified and expanded SMSA concepts used for measuring urban settlements in England and Wales.

The concept of the SMLA is similar to the SMSA definition; the SMLA consists of a SMLA core and a SMLA ring. Hall defined the SMLA core as an administrative area or a number of contiguous areas with a density of five workers per acre, or a single administrative area with 20,000 or more workers. These criteria are different from those of the SMSA core. Although the US government pays attention to total population and density, Hall focused on the number of jobs and their density. In addition, Hall dropped the criterion related to the industrial type of labour of the SMSA core because this type of criterion was not useful in the UK case (Hall et al., 1973).

A SMLA ring consisted of those administrative areas contiguous to the core and sending at least 15% of their residential employed populations to the core. This criterion is the same as the US definition. Each SMLA should have more than 70,000 population. According to the SMLA analysis, England and Wales had 126 SMLA areas in 1961. At this time, the total population of all SMLA covered 80% of the national population, and, in addition, 50% of that was in the core areas.

The MELA is an expanded idea of SMLA; it consists of a SMLA core and a SMLA ring. The MELA adds the concept of an 'Outer Area'. The 'Outer Area' is the remainder of the MELA, which takes in all administrative areas not included in the SMLA core or SMLA ring, but is contiguous with both, and sending more of their employed residential population to the SMLA core than to some other SMLA core. Included here will be any area which sends any commuters to the SMLA

core, provided it does not send more commuters to another SMLA core. The Outer Area shows the maximum expansion of the SMLA. An area is classified as a MELA only if the SMLA contained within it has an enumerated population of 70,000 or more. Clearly the SMLA will always fit within the MELA.

3.2.4. Labour Market Area (LMA) and Travel-To-Work Area (TTWA)

Smart (1974) proposed a definition of Labour Market Areas (LMA). This definition was established for British settlement analysis of employment. The definition of LMA was based on the composite of home-workplace relationships involving two ideas. The first one comprised the extent to which a given area is self-contained, which can be evaluated by the proportion of its resident employed population working locally, and of its day-employed population residing locally. This idea leads to a second concept, focusing on the commuting relationships of one area with other areas. The purpose of this concept was to determine the degree of self-containment.

Given these two concepts, the definition of LMAs is simple. The LMA is defined as any area which is 75% self-contained. In other words, 75% or more of the labour force live and work within the LMA. The local authority area is used as a base unit, and the areas are contained within the contiguous local authority.

The Department of Employment has introduced the 'Travel-To-Work Area' (TTWA), a developed version of the LMA. The Difference between the LMA and TTWA is very simple; the extent of self-containment. According to the LMA definition, 75% is the cut-off point, whereas 70% is the cut-off point for the TTWA, i.e. 5% lower than LMA standard requirement (Green and Owen, 1990; Green, Owen and Hasluck, 1991). The TTWA is used for understanding the situation of employment.

3.2.5. 166 Settlements of Great Britain in Hall and Hay (1980)

In the context of international comparative study of European countries, Hall and Hay (1980) proposed a revised concept of functionally defined urban region – the Functional Urban Region (FUR) and showed that Great Britain was divided into 166 such FURs. This division was used in Hall and Hay (1980) and also in Cheshire and Hay (1989) and Cheshire (1995).

To set up functional urban regions for the whole area of Great Britain, Hall and Hay developed from the SMLA concept. There are several changes from the original SMLA definition that appeared in Hall et al. (1973). The first is that Hall and Hay used 1971 data instead of 1961 data to define their FURs. The second is that they applied the definition for wider areas. The original SMLA was applied for England and Wales only but the concept of FURs applied to the whole area of Great Britain. In addition, Hall and Hay changed the minimum population size. The minimum size of FUR was 60,000 in 1971, which was smaller than that of MELA, 70,000. 138 FURs were defined in Great Britain: 125 areas in England and Wales and 13 areas in Scotland.

Although Hall and Hay applied the concept of FURs for the whole area of Great Britain, this concept could not in fact include the whole of Great Britain, e.g. a part of Scottish Highland. To treat non-metropolitan regions functionally, they used the concept of non-centralised labour market areas developed by Smart (1974) for determining non-metropolitan areas of Great Britain. From this operation, 28 non-metropolitan regions were developed in Great Britain.

3.2.6. Functional Urban Regions in van den Berg et al. (1982)

When van den Berg et al. (1982) examined the European urban settlement between 1950 and 1975, they used the Functional Urban Regions (FUR). This study covered fifteen European countries and the definition contains three criteria that are shown below. From these criteria, 189 FURs in European countries were defined. Great Britain contained 43 FURs.

The van den Berg et al. FUR consists of the core and the ring areas, and there are three criteria for a FUR. The first criterion of a FUR is the settlement size of the core city. In 1970, all urban regions should be organised around core cities with populations of over 200,000 inhabitants. The second criterion is to add smaller settlements to a FUR core that cannot meet the first criterion for the FURs. When a city's regional function within the national urban hierarchy is more important than its absolute size, that city in some systems may be functionally comparable with larger ones in others. As a result, some regions, around regional centres of less than 200,000 inhabitants, were also counted as FURs. The third criterion is to define the ring area of a FUR. In it, all contiguous and surrounding municipalities having a commuting rate of 15 % or greater to the core city were included. When commuting data were not available, other interaction variables were used or official agglomeration definitions were accepted.

3.2.7. Local Labour Market Area (LLMA)

Coombes et al. (1982) developed a new definition for the urban area called the Local Labour Market Area (LLMA). Since then Champion, Coombs and

Openshaw (1983) defined 280 LLMAs[21], and a series of studies by Champion used 280 LLMAs as the basic spatial units of the UK settlement system.

Their basic approach was to establish a set of urban centres and determine their commuting fields, like SMLAs. Firstly, to identify the core, urban centres were defined by two indexes; i.e. concentration of employment and retail activities. The former index is used to define employment centres, and the latter is used to define shopping centres. To avoid using the population threshold as a criterion of the core area, this LLMA examines a minimum degree of employment and retail employment. Secondly, urban cores were established by extending their boundaries outwards to surround the whole of the main settlement's continuously built-up-area. Thirdly, those adjacent centres which were closely and functionally interlinked were determined, and the number of separate 'places' that could be identified in each part of the country was determined.

After defining the cores, their commuting fields were defined. This definition is the same as for SMLAs - areas in which at least 15% of their employed residents commute to core areas. The core and ring of any place is called the 'Daily Urban System', where the main population concentrate. This is the primary area within which the daily patterns of movement take place. Finally, the remaining parts were allocated as outer areas to the urban centres to which they were most closely tied by commuting.

In addition, the LLMA examined the threshold for classification of the LLMA type. From calculation of the threshold, it was determined that the threshold population size included 50,000 inhabitants. When a LLMA contains over 50,000 people, that area is treated as an urban area. If the population size of a LLMA is less than 50,000, the area is treated as rural. The outcome was the derivation of a set of 280 LLMAs. 52 small LLMAs, which contained less than 50,000 people in

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[21] Original definition, established by Coombes et al. (1982), showed 281 functional urban regions.

1971, were named Rural Areas, and the remaining 228 LLMAs were termed urban regions.

Furthermore, the LLMA definition also examined the relationship between 228 LLMAs. When the 7.5% or more workers of a LLMA commute to another LLMA, that LLMA is treated as the sub-dominant LLMA, and the LLMA of the destination is treated as the 'dominant LLMA'. In the UK, 20 LLMAs are categorised as the 'dominant LLMA' and 95 LLMAs are treated as the 'sub-dominant LLMA'. The other 115 LLMAs are the 'freestanding LLMA'.

3.3. Various Definitions of Functional Urban Regions in the Japanese Settlement System

Because of differences in economic activities, commuting habits, administrative practices, and patterns of urbanisation, the definition of a functional urban region appropriate in one region or nation will not necessarily be useful in another (Hall and Hay, 1980). Therefore, the method of defining functional urban regions for Japan may be different. To define the best spatial units for an economic analysis of urban settlements, the Japanese government and academics have established various definitions of the Japanese functional urban regions. In this section, seven of these will be discussed. The first three definitions were defined by the national government, and the last four definitions were developed by Japanese academics.

3.3.1. Major Metropolitan Area (MMA) and Metropolitan Area (MA)

The Japanese Statistics Bureau established the Major Metropolitan Area (MMA) since the 1960 Population Census of Japan for understanding the rapid expansion of the largest Japanese cities since the 1950s. The MMA concept was based on the SMSA concept. Each MMA consists of a central city or central cities and a ring area; a minimum unit of MMAs should be based on local authorities, *shi-cho-son*. The criteria of MMA and MA were updated to reflect the changing circumstances of the Japanese urban population size. The 1990 definition of MMA and MA is as follows.

According to the 1990 Population Census of Japan, only 13 areas were treated as the central cities of the MMAs; Ku-Areas (special wards area) of Tokyo-to and the 'Cities designated by the Cabinet Order'[22]. In addition, it is noted that the MMAs are not established separately but linked together, e.g. in the case where two or more central cities are located close to each other. This criterion composes the Keihin Major Metropolitan Area which is made up of Tokyo, Yokohama, Kawasaki and Chiba, the Keihanshin Major Metropolitan Area which contains Osaka, Kyoto and Kobe, and the Kitakyushu-Fukuoka Major Metropolitan Area where Kitakyushu and Fukuoka are located. There were seven MMAs in 1990: Sapporo, Sendai, Keihin, Nagoya, Keihanshin, Hiroshima and Kitakyushu-Fukuoka.

When a local authority satisfies the following criteria, it is treated as a ring area of the MMA. Firstly, the number of resident workers and students of 15 years of age and over commuting to the central cities should be 1.5% or more of its total resident population. Secondly, the area should be contiguous to the central cities or

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[22] These cities have a wider range of administrative power than that of ordinary cities. To designate these cities, settlement size is the one of the most important index and, its size includes one million and more residents. There were twelve such cities in 1995: Sapporo, Sendai, Chiba, Yokohama, Kawasaki, Nagoya, Kyoto, Osaka, Kobe, Hiroshima, Kitakyushu, and Fukuoka.

to an area defined as part of the ring area. Additionally, the area that does not satisfy the conditions can be treated as a ring area if it is entirely enclosed by the areas defined as ring areas.

The Metropolitan Area (MA) has been set up since the 1975 Population Census of Japan to understand the degree of expansion of large cities outside MMAs. In contrast to the MMAs of central cities, the population size of a MA of a central city was smaller. The central city of any MAs should have a population of 500,000 or more inhabitants and it was not included in the MMAs. In addition, there was no need to combine it with the other MMA or MA central city (or cities). The MA concept shares the definition of their ring areas with the MMA concept, as outlined above.

Both definitions have been used since the 1975 Population Census of Japan. According to the 1990 Census, there were seven MMAs and five MAs in Japan. These areas covered 56.9% of the Japanese national population.

3.3.2. Regional Living Zone (RLZ)

The concept of MMA and MA cannot cover the whole country of Japan and additional concepts are required. The Regional Living Zone (RLZ) was defined by the Ministry of Construction in 1969. This definition was established to understand the extent of distribution of urban functions in local areas and was not intended for the definition of large cities. It involved grouping local authorities, and the ministry asked the prefectures to undertake this grouping (Institute of Areal Study, 1994).

According to the draft for the 1969 RLZ definition, each RLZ was to consist of a core city and its surrounding area. The rough guidelines for defining core

areas were as follows: the first was that the DID[23] population in the city was 15,000 or more inhabitants, in the 1965 Population Census of Japan. This condition focuses on the population scale of the core city in terms of population in the high density area. The second was that the commuting population from outside towards the city was greater than the out-commuting population from the place, in the 1965 Population Census of Japan. The next guideline was that the total sales per person of the retail sector[24] in the city in 1964 were higher than the prefectural average. Finally, in 1965, the proportion of employees engaged in the service sector in the core city (work place base) should be greater than the prefectural average. These last two conditions focused on the urban function and its character.

According to the guidelines, the surrounding areas were to be identified as follows: the standard size of a local daily urban system was to be a circle of which the radius was 20 to 30 km and its average population range was between 150,000 and 300,000 residents. The distance from the core city and the total population range of each RLZ were the most important but were not clearly defined.

The RLZ was not to contain areas that were parts of any MMA or MA. Some areas would be treated as the central city of a RLZ in the case of no approximate core city in the area. Except for such cases, all administrative areas belong to just one local daily urban system not two or more. As a result of that, the combination of RLZ, MMA, and MA concepts cover the whole of Japan.

The RLZ has been modified over time because changes have occurred in average settlement size and economic activities. According to the 1994 edition, there were 179 RLZs (Institute of Areal Study, 1994).

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[23] DID = Densely Inhabited District (Chapter 2)

[24] Except restaurants.

3.3.3. Wider Area Community (WAC)

The Ministry of Home Affairs established a Wider Area Community (WAC) in 1969 (Ministry of Home Affairs, 1991, 1995). The aim of this concept is similar to that of the RLZ. The WAC was established for most local authorities except for the largest cities, i.e. Keihin, Keihanshin and Nagoya MMAs. Like the RLZ, the WAC has guidelines for the prefectural government to group municipal authorities.

The standard size of population per area was of 100,000 inhabitants in 1965. This contained several local authorities, and each WAC should have a 'satisfactory' level of urban functions. Normally, the core city should have various urban functions. According to the guidelines, basic urban functions were as follows: offices, shopping, medical services, education, sports and entertainment.

The surrounding area was determined by connectability to the core place in terms of transport and telecommunication network. All local authorities have to belong to one area and not to two or more areas like the RLZ. According to the 1994 edition, there were 362 WACs (Ministry of Home Affairs, 1995).

3.3.4. Japanese Standard Metropolitan Statistical Area (J-SMSA) and Functional Urban Region (FUR)

Kawashima (1977) defined a functional urban region called Japanese Standard Metropolitan Statistical Area (J-SMSA). This definition modified the SMSA concept for Japanese settlements. An individual J-SMSA should contain a core area and a ring area. Data for the 1970 Population Census of Japan was used to identify these urban regions.

Kawashima's criteria for the selection of the core area were as follows. Firstly, prefectural capital cites were automatically selected as core cities. This

criterion focused on the urban function, especially the political function, of the prefectural capital city. For other core areas, the following three conditions had to be satisfied. The first was that the minimum population should be equal to or greater than 100,000 inhabitants. This condition focused on settlement size. The second was that the daytime to night-time ratio of population should be greater than 1.0. This condition was to clarify the urban character and eliminate dormitory suburbs. The third was that 75% of ordinary households in the place had to be either "non-agricultural workers' households" or "agricultural and non-agricultural workers' mixed households". Additionally, if the distance between any two core cities was less than 20 km, then those core cities were regarded as composing a multiple-core city. This criterion served to overcome the problem of arbitrary administrative divisions of cities that are, in fact, functional units.

After the determination of the cores, the ring area was defined as follows. The first condition was that the number of commuters from the local authority to the core city had to be greater than 500. Secondly, the number of commuters from the local authority to the core city had to be greater than 5% of the total employment in that locality. Thirdly, if a local authority was eligible to be combined with more than one core city, then it should be combined with the core city to which the number of its commuters was the largest among the candidate core cities. Finally, 75% of ordinary households in the place had to be either "non-agricultural workers' households" or "agricultural and non-agricultural workers' mixed households". With this definition, Kawashima was able to divide Japan into 85 J-SMSAs, in 1970.

Kawashima et al. (1993) revised this definition, and renamed it the Functional Urban Region (FUR). The main purpose of the 1990 version was to catch up with the changes which had occurred over fifteen years. There were two main changes to the definition: the modification of some criteria, and the application of the modified criteria to the new data set.

The 1990 version dropped the following two criteria for urban cores. Prefectural capital cites were not automatically to be selected as core cities and it was no longer required that 75% of ordinary households had to be either "non-agricultural workers' households" or "agricultural and non-agricultural workers' mixed households". On the other hand, the only change to the definition of the ring area was the deletion of the condition about the proportion of non-agricultural households, as for the core area.

They tried to carry out all calculation using the 1990 census data, although some indices were taken from the 1985 Population Census of Japan because the full 1990 Census data was not yet available. In the 1990 version, Japan was divided into 88 FURs and they covered 85% of the national population.

3.3.5. Regional Economic Clusters (REC) and Standard Consolidated Areas (SCA)

The Regional Economic Clusters (REC) and the Standard Consolidated Areas (SCA) were established by Glickman (1979). These were based on the SMSA concept, but Glickman made modifications to apply it to the Japanese settlement system. This definition was developed from the J-SMSA, in collaboration with Kawashima (1977).

Each REC had a core area and a ring area. Core cities had to meet the following criteria: the first criterion was that the population in a core city had to be greater than 100,000 inhabitants in 1970. This criterion was about the scale of settlement size of the core area, and it was useful as a means of eliminating small cities. This restriction approximately reduced the potential central cities to 150. The second criterion was that the ratio of daytime to night-time population must be greater than 1.0. This was decided in order to eliminate dormitory cities and was the original criterion for Japanese urban analysis. The third criterion was that 75%

of economic households were employed in non-agricultural or "mixed" non-agricultural-agricultural pursuits. According to Glickman (1979), attractiveness had a substantial urban character and this criterion distinguished the functional urban city from the actual rural 'cities'. Additionally, he modified criteria relating to the distance between twin cities, and the relationship between central and satellite cities. If there were potential cities where the distance between them was greater than 20 km, they were treated as independent core cities. On the other hand, if the distance was less than 20 km, then the central city was determined by the number of commuters from one place to another. The stronger city was treated as the core city and the other one was treated as a satellite city of the core.

After determination of core places, ring areas were defined. The first criterion was that the number of commuters from the satellite cities, towns or villages to the core area had to be greater than 500. This criterion eliminated many small cities, towns and villages from the commuting ring. The next was the ratio of commuters, in each local authority, to the core area. Glickman (1979) decided that the ratio compared to the total employment in each local authority should be 5% or more. This criterion could make some units be dual (or more) rings of RECs. In this situation, treatment of units had to be considered. In the case of REC, the town or village would be classified as part of a region, e.g. region A, if more commuters went to A rather than B. This means that one administrative unit could only be a part of one REC. Additionally, 75% of the economic households had to be employed in non-agricultural or mixed non-agricultural-agricultural pursuits. This criterion was the same as that of the core area. By these definitions, Japan was divided into 80 RECs, and rural areas; RECs covered 80% of the national population.

Moreover, Glickman defined the Standard Consolidated Areas (SCAs), a set of RECs. Although he did not mention the definition, it was based on the

metropolitan areas. He defined eight SCAs, Sendai, Nagoya, Kanazawa, Osaka, Tokyo, Okayama, Matsuyama and Kitakyushu.

3.3.6. Standard Metropolitan Employment Area (SMEA)

The SMEA definition was introduced by Yamada and was also used for the SMSA approach for Japanese urban settlements. Therefore, each SMEA should consist of a core and a ring. According to Yamada (1982), the definition of the SMEA is as follows.

The cores, or central cities, were composed of local authority areas with a total population of over 50,000 inhabitants, in which more than 75% of the resident-employed-population was non-agricultural. In addition, the core place had to meet the condition that daytime population was greater than night-time population. The ring areas were composed of contiguously located administrative areas with more than 75% of non-agricultural resident-employed-population and with more than 10% of the resident-employed-population in the local authority commuting to the core. The central city and the commuting hinterland were defined as a SMEA, and each SMEA contained 100,000 or more inhabitants.

The SMEA definition has been updated every ten years since 1965. According to Yamada and Tokuoka (1991), the number of the SMEAs was as follows; 87 SMEAs in 1965, 104 SMEAs in 1975 and 108 in 1985.

3.3.7. Daily Urban System (of Japan)

Tanabe (1982) proposed the Daily Urban System of Japan (J-DUS). This definition focused on the relationship between the work place and the place of residence. The percentage of outflow from each administrative unit was paid

attention to rather than the centrality of the core place. In other words, J-DUS focused on self-containment and set three types of J-DUS.

The first type of core had to satisfy the following two criteria. The first criterion for cores (whether cities, towns or villages) was that the number of workers who commuted into the core had to be greater than the number of workers who commuted from one place to another place. This condition means centrality was paid attention to for determination and that the place had a stronger centrality than other local authorities. The second condition was that the net inflow to the core place should be 1,000 or more inhabitants. The criterion of the ring area was that 5% or more of total workers commuted to a specific core place. The basic concept of the J-DUS was as above but an additional condition existed. In the 1975 Population Census of Japan, 323 first-level core places existed. According to Tanabe, the extent of self-containment of this type of J-DUS was 80% or over.

In the case of an area that did not meet the first criterion for a primary core, but met the second one, it could be treated as a second type of J-DUS core. This area had connectability with other areas. Moreover, Tanabe suggested a concept for a third type of J-DUS. This idea was that the out-commuting population from the place was greater than the in-commuting one into this place and there was no relationship among other administrative units. This means that the area did not have a central character and had no strong connectability to other areas. Although Tanabe suggested definitions for three types of J-DUS, he only carried out calculations for the first type of J-DUS.

3.4. A Critique of Previous Studies

3.4.1. Classification of the Functional Urban Regions

Figure 3-1 illustrates the development of the functional urban region with the classification of various definitions into two approaches. The first approach focuses on the centrality of the core area, and its method is to measure the relationship between the core area and the ring area. This approach is urban core-oriented and can be called the 'Top-down' approach. The origin of this approach is the SMSA in the United States. British geographers have modified and developed the SMSA concept as the SMLA. Functional regions defined by Hall and Hay (1980), and LLMA also used as their basis this type of approach for determining urban settlements. On the other hand, the LMA and TTWA did not focus on the core area: instead they focused on the extent of self-containment. This is the local dominant approach, often called the 'Bottom-up' approach. This approach was partly used for the Hall and Hay (1980) definition, and LLMA to define the non metropolitan areas.

The Japanese government's approaches are classified as follows. The MMA and the MA were established to measure the maximum expansion of large cities and these definitions are classified into the 'Top-down' approach. They focus only on large cities and these definitions cannot cover the whole country of Japan. For non-metropolitan areas of Japan, the RLZ and the WAC were good examples. They showed a similar approach that focused on self-containment. To sum it up, it can be said that the government's approaches used a mixture of definitions to cover the whole of Japan. Most proposals by academic researchers also tend to use the 'Top-down' approach for the Japanese national settlement. The basis of these definitions is the same but the criteria are different for each definition. On the other hand, J-DUS can be treated as a 'Bottom-up' approach because this

definition paid attention to the ring area. This approach is complicated because Tanabe established three types of J-DUS. J-DUS is a one-off definition and was never developed.

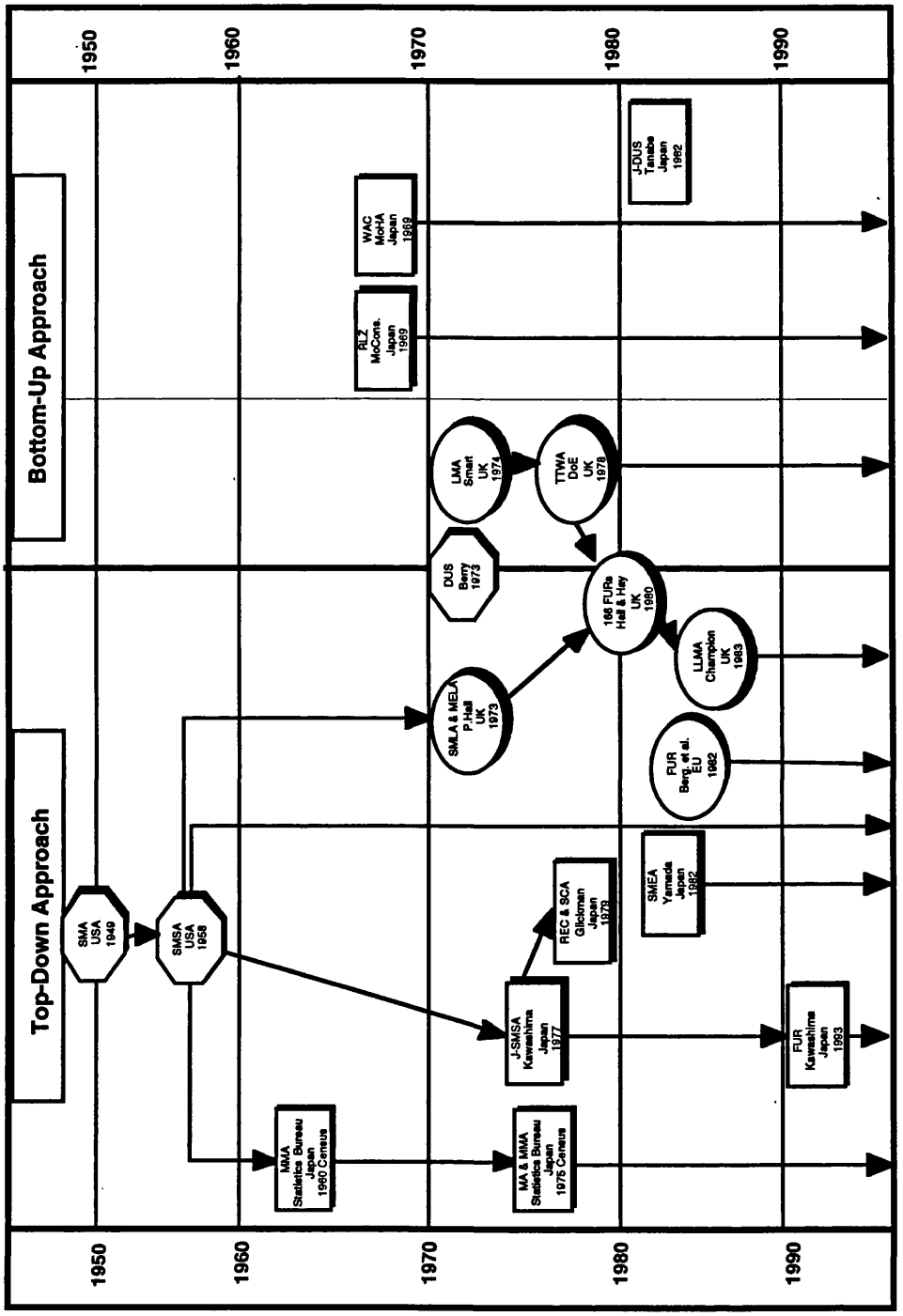

Figure 3-1: Development of Functional Urban Region

Source: Author

3.4.2. The Need for a New Definition of the Functional Urban Region

Previous definitions of the Japanese settlement system have various problems. These problems can be classified into the following five types.

The first is about the complication of the Japanese definitions. The definition of J-DUS is a good example. Although Tanabe mentioned three types of J-DUS, he did not try to estimate or apply either the second or third types of J-DUS.

The second is about the coverage of Japan as a whole. The Japanese government's approaches require a mixture of definitions. MMA and MA definitions focus on the largest cities and the WAC and RLZ focus on the area outside the three metropolitan areas (i.e. Keihin, Keihanshin, and Nagoya MMAs).

The third problem relates to the validity of some criteria of the functional urban regions. In Japan, most definitions were established by the early 1980s and some criteria are out-of-date for today's situation. A good example of such changes is shown in the REC definition. Glickman (1979) included as one condition that more than 75% of total economic households in the unit should be employed in the non-primary sector. Today, the proportion of population engaged in the primary sector in Japan is only 7%. In this situation, the criterion cannot be used to define a functional urban region (Kawashima et al., 1993). Another example is the WAC and the RLZ. These two definitions cannot allow the crossing of the prefectural boundary because these two definitions just showed guidelines and each area is decided by the prefectural government. This is a significant weakness because some places, which are in different prefectures, are deeply connected in terms of economic activity.

The fourth relates to the need to update the statistics. There is only one definition that has been calculated using the data of the 1990 Population Census of Japan. In this thesis, the base data set is the 1990 Population Census of Japan, and

the determination of the spatial unit should employ the 1990 Population Census of Japan in order to avoid errors that would arise if any attempt were made to use out-of-date spatial units. As mentioned in Chapter 2, Japanese administrative boundaries have changed since the 1950s. Although the number of local authorities that changed since 1970 has decreased, it is still happening.[25]

The last type of problem is about the clarity of the definition. Some criteria of the definition are not clear, and create some exceptions. For example, although Kawashima mentioned the distance between core areas, FUR cores are located too close to each other. For solving and avoiding these problems, a new definition for settlement analysis is required. The procedure will be shown in the next section.

3.5. Determination of Japanese Functional Urban Area (JFUA)

Although it is essential to determine the Japanese functional urban region, there is no suitable definition. Therefore, it was decided to determine an original definition for this thesis. It is called Japanese Functional Urban Area (JFUA). In this section, the procedure for the determination of JFUA will be explained.

3.5.1. Principles of JFUA Definition

Before discussing how to determine the criteria for defining the JFUAs, the following points should be examined; (1) 'fixed areas' and 'floating areas', (2) a minimum spatial unit for the JFUA definition, and (3) the 'Top-down' and 'Bottom-up' approach.

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[25] Kawashima's FUR examined the Japanese urban settlement system based on the 1990 Population Census of Japan but the definition used the 1985 Census data.

As noted in Hall and Hay (1980) and Fuguitt, Heaton and Lichter (1988), two types of spatial unit can be used for the statistical data analysis for the settlement system, fixed areas and floating areas. The former is fixed for the analytical periods and this is used in the European studies such as Hall and Hay (1980) and Kawashima's studies in Japan. On the other hand, the floating area means that the spatial unit should be defined for each data-taking period. This is used in US settlement studies and Yamada's studies in Japan. In this thesis, the JFUA definition is on the basis of fixed areas. According to Fuguitt, Heaton and Lichter (1988), the main tendency of settlement change can be observed through both definitions. Therefore, it can be said that the fixed area approach is simpler as we do not have to define the functional urban regions for each census period.

On the question of which period should be applied for the JFUA definition, this thesis uses the 1990 Population Census of Japan. The most important reason for this decision is that in Japan, local authorities have been continually merged for long periods. Thus, there were a smaller number of local authorities in the 1990 division than the 1970 division. In other words, the definition based on the 1990 division can be applied for the 1970 data, but the definition based on the 1970 division cannot be applied for the 1990 data.

Let us mention the minimum spatial unit for the JFUA definition. For defining JFUA, administratively defined local authorities, *shi-cho-son*, are the minimum units because they are the standard spatial units for official data collection. This follows the same logic as the SMSA based on counties and local authorities, e.g. as in the study by Hall and Hay (1980). As mentioned above, boundaries are based on the 1990 Population Census of Japan.

In defining the functional urban region, it is inevitable that we determine which approach, 'Top-down' or 'Bottom-up', will be used. From the foregoing review, all definitions can be classified into two approaches, 'Top-down' and 'Bottom-up'. The 'Top-down' approach is useful for understanding the national

settlement system. On the other hand, the 'Bottom-up' approach is useful for understanding what happens with each functional region, so this approach is used for understanding the unemployment of each area. Therefore, for this project, the 'Top-down' approach is more suitable than the 'Bottom-up' approach. According to the 'Top-down' approach, a basic spatial unit should comprise a core area and a ring area. To define the core area and ring area, focus is needed on economic activity. The urban core means work place and ring area means residential area.

Unlike other definitions that cover the whole national territory, the JFUA definition will cover only the urban settlements of Japan. As seen in Hall and Hay (1980), and in the Japanese government's approaches, the attempt to cover the whole area of the nation tends to lead to the use of two or more definitions, which inevitably makes definitions complicated. In addition, the primary purpose of this thesis is to examine the main changes of the Japanese urban settlement system and, therefore, defining urbanised areas will be sufficient for this purpose.

To define JFUAs with the 'Top-down' approach, there are three steps that need to be followed: (1) determining the JFUA core (candidates), (2) determining the JFUA ring, and (3) modifying the JFUA core. The following three sections will demonstrate these steps.

3.5.2. The Way to Define the JFUA Core

The first step in the determination of the JFUA is to define the core area. As seen in the other definitions of functional urban regions, the basic characteristics of the JFUA core are defined by the urban character and the size of settlements.

To define the JFUA core, it is necessary to find a suitable index to show urban character. For this purpose, the JFUA core should be an administratively defined urban area, i.e. *shi*. There are two main reasons to use this classification. The first is the core concept of the *shi* areas. The definition of *shi* was focused on

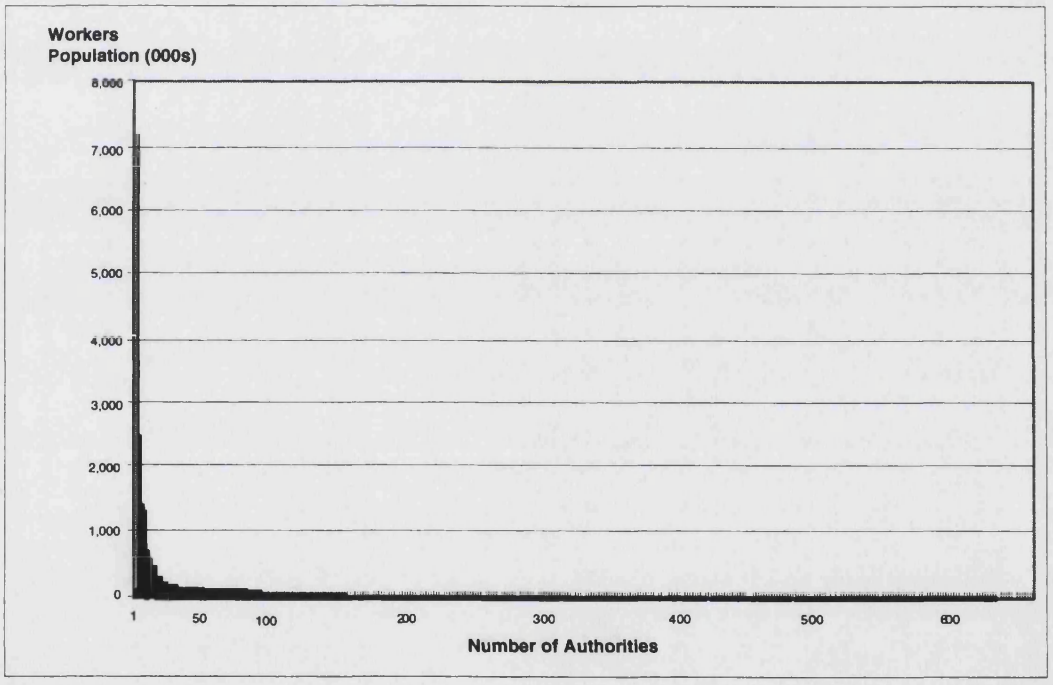
the industrial structure and population size and it can be said that *shi* should have an urban character clearer than the administratively defined rural area, i.e. *cho* and *son*. Although this definition is not perfect as discussed in Chapter 2, it is useful because it is difficult to find the proper index showing an urban character. To show the urban character of a settlement, the proportion of non-agricultural workers is one of the most widely used indexes in the world. In the US, the SMSA concept used this index. For example in the Japanese urban settlements, the J-SMSA and the REC set the criteria that 75% or more of economic households should be employed in non-agricultural pursuits. There must be concern, however, that this type of criteria does not work for the determination of JFUA cores because Japan has changed its industrial structure since the 1950s. The 1990 Population Census of Japan showed that only 7% of the national population belonged to the primary sector. For this reason, it can be said that the index of employment by industry can be excluded from the criteria of JFUA core. This reasoning is the same as Kawashima's revised FUR (Kawashima et al. 1993).

As shown in section 3.2, the value of settlement size in population is also important in order to define the urban core. Administratively defined urban areas, *shi*, by itself, do not perfectly satisfy the definition. As mentioned in Chapter 2, the population of *shi* areas shows a wide range. Therefore, criterion of settlement size should be tested. There are possibly two standards to define the value of settlement size in population terms: i.e. the total residential population, and the total number of workers based on the work place. The former is used in Kawashima's FUR definition and the latter is used in Peter Hall's SMLA definition. The JFUA definition pays attention to the relationship between the work place and residential place, and the latter statistic seems more suitable for definition.

To decide the population size of the JFUA core, a cut-off point should be determined. The procedure was as follows. In the first step, all *shi* areas were arranged by the number of jobs based on working place from high to low (Figure

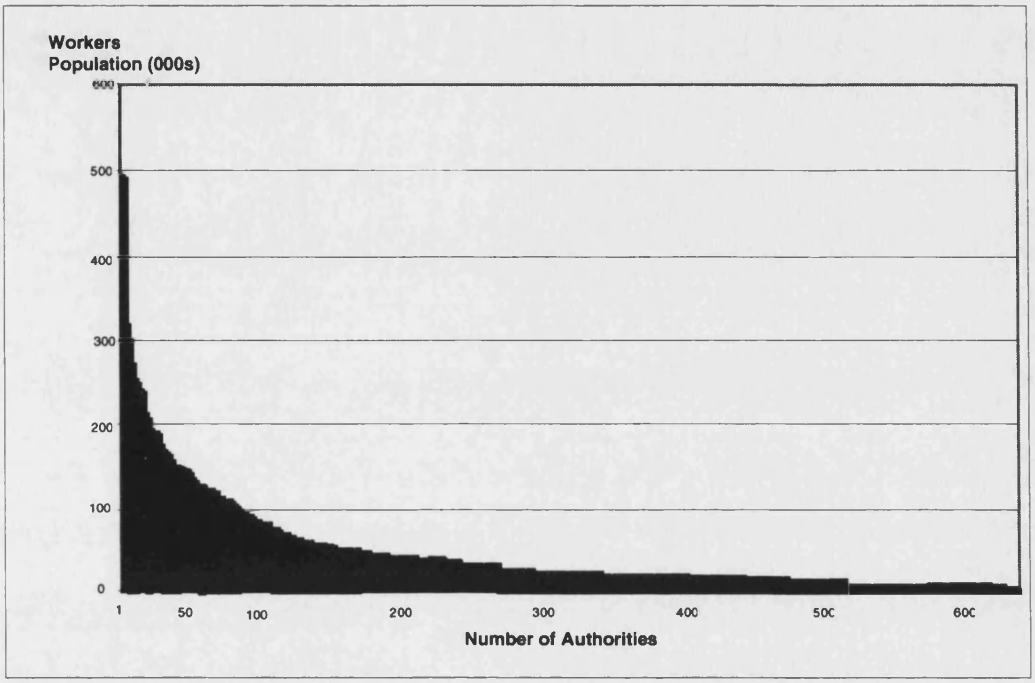
3-2 and 3-3). From Figures 3-2 and 3-3, it is difficult to find a cut-off point, therefore re-calculation was carried out using the following procedure. Figure 3-4 shows that the number of *shi* areas with less than 100,000 working population were grouped for every 10,000 population. From this graph, 30,000 seems the best cut-off point. A worker population of 30,000 can be treated as the minimum size for a JFUA core area. 305 *shi* areas out of 656 met this criterion.

Figure 3-2: Distribution of All *Shi* Areas



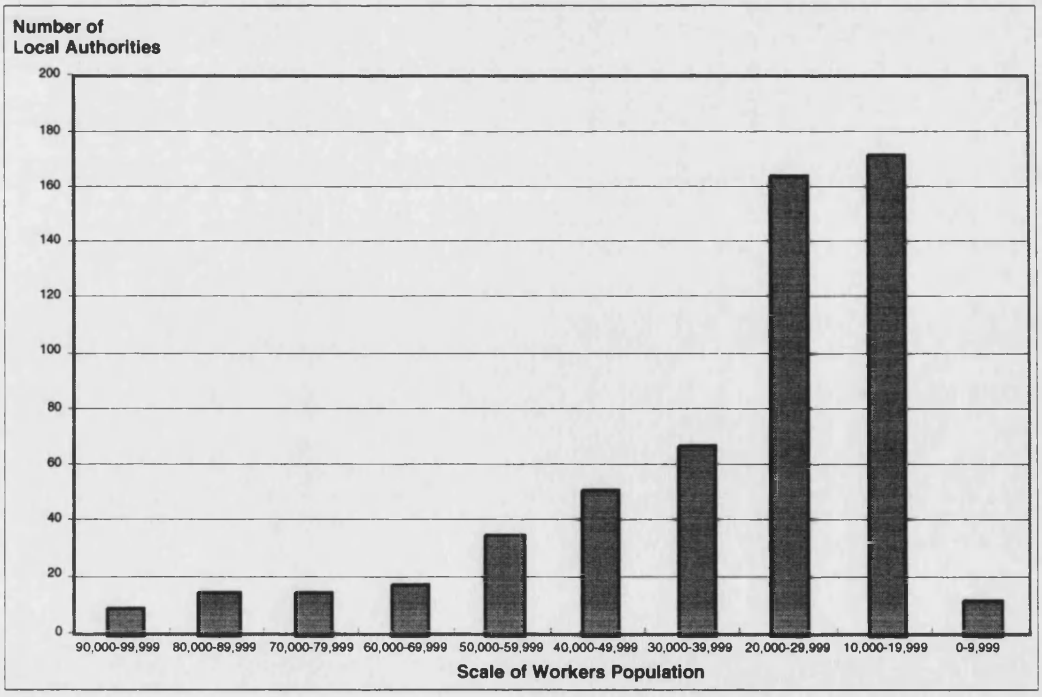
Source: Author

Figure 3-3: Distribution of *Shi* Areas (Population Size < 500,000)



Source: Author

Figure 3-4: Distribution of Small *Shi* Areas (<100,000) (Sorted for Defining JFUA Core)



Source: Author

The above two criteria were not enough for defining the JFUA cores because of the high degree of population concentration into large cities, like the Tokyo area. The 1990 Population Census of Japan showed that cities in the Kanto region meet these two criteria; however, most of its cities developed as the residential zone special wards areas of Tokyo-to (Miyao, 1994). Therefore, an additional criterion should be required.

To decide this additional criterion, another characteristic of the core, i.e. 'centrality', should be focused on. The word 'centrality' means that a place absorbs inflows from outside. In this case, the balance of commuting from other places to the core and commuting from the core city to the outside seems suitable because this is connected with the economic dominant factor.[26] This index is different from the ratio of daytime to night-time population that is frequently used for defining the Japanese functional urban region (Kawashima, 1977; Glickman, 1979; Yamada, 1982; Kawashima et al., 1993). The ratio of daytime to night-time population contains workers and students. The distance between the work place and residence is treated as a basic factor for determination, and students should be excluded from the definition.

From the application of the first and second criteria, 168 *shi* areas were identified. They were treated as the JFUA core candidates.

In some cases, researchers have unified two or more areas into a single combined core area for a functional urban region. For example, Hall and Hay (1980) examined specific cases to combine core areas into one for Great Britain. A series of studies by Kawashima added the criterion for the unified cores. As discussed below although many studies have grouped core areas, the JFUA definition did not create a criterion for grouping.

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[26] The Population Census of Japan investigates daily commuting population. According to the Census, the whole commuting population can be classified into two types, commuting people and schooling people. The commuting people refer to those people whose place of work and residence are different. The latter refers to students travelling to distant school.

The balance of commuting from other places to the core and commuting from the core city was used for the JFUA cores as an important part of the JFUA definition. Using this definition, an index was calculated for each local authority and each of them is treated as independent. Otherwise, this index could not be used for the JFUA definition because calculation will be complicated.

Although some JFUA core candidates were located close to each other, it was not suitable to unify these areas as into one area with simple criterion. The reason is that these administrative boundaries of Japan were based on many factors, e.g. historical background and natural environment. For example, the cities of Yamagata and Sendai are contiguously located but they could not be treated as a single area because each of them was a prefectural centre and they were not deeply connected with others. In addition, JFUA core candidates were located closely to other JFUA core areas. 47 out of 168 JFUA core candidates bordered on the others. No clear cut, single criterion could be defined to provide a principle for combining such twin cores.

3.5.3. The Way to Define the JFUA Ring

After the determination of the JFUA core candidates, their ring areas could be defined as follows. An index of in and out-commuting workers to the core was constructed, and the ring areas of the JFUA concept are similar to other definitions.

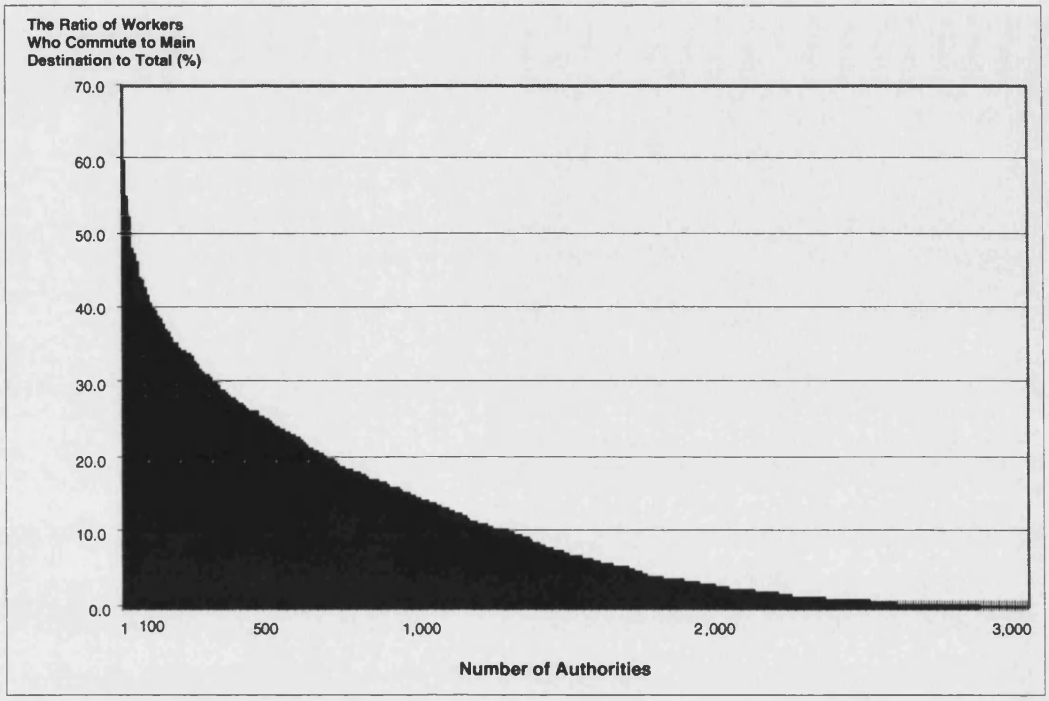
What is the proper ratio of workers who commute to the JFUA core compared to total residential workers population to define the JFUA ring areas? Determining this ratio depends on each country's situation. For example, in the US and UK definitions, the cut-off point of commuting population into the core area has commonly been 15% of total residential employed population. However, the Japanese definitions set a lower ratio as its cut-off point. The REC and FUR definition were set at 5% and the SMEA defined it at 10%. Therefore, the ratio of

commuting population should be examined. The cut-off point was determined by the following procedure.

The first step is to calculate the main destination of all workers in all local authorities, excluding the 168 JFUA core candidates that were treated as cores. The main destination should be chosen as one of the 168 cities. The second step is to calculate the number of workers that commute to the 168 cities as a percentage of the total residential working population of the area of residence. These data are sorted by ratio from high to low. Figure 3-5 shows that it is impossible to find a clear cut-off point and recalculation is required. Local authorities are grouped for every 2.5%, and the number of every group is shown in Figure 3-6. From this figure, two candidates of the cut-off point are found: 17.5% or 7.5%. In the Japanese case, 7.5% seems more suitable for the cut-off point because commonly commuting time and distance in Japan tend to be longer than those of the US and UK.

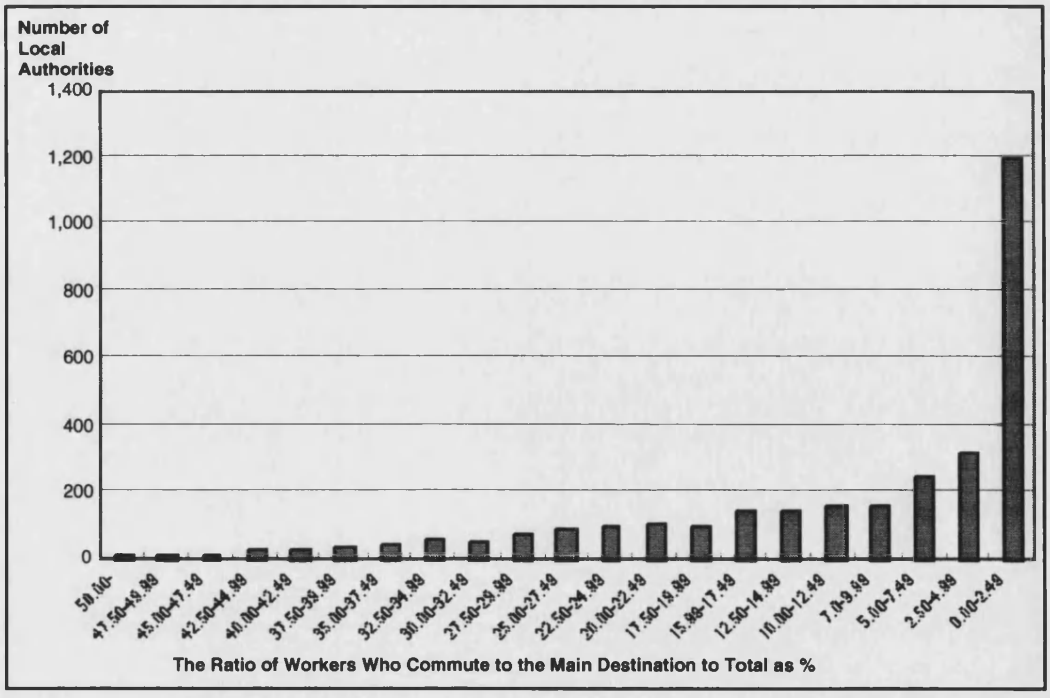
Although the basic criterion of the JFUA ring was defined, there were two points to be considered. The first is the treatment of isolated local authorities. It means that the authority meets the first criterion of the JFUA ring but is not contiguously located with the rest of the ring or JFUA core. According to the 1990 Population Census of Japan, there was only one authority in this category: Kushinotsu in Nagasaki (Kyushu-Okinawa region) for Ku-Areas of Tokyo-to. The distance of these two authorities is about 1000km. Therefore, Kushinotsu cannot be treated as a JFUA ring of Tokyo-to. It seemed appropriate, therefore, to apply the simple criterion that all areas within all the JFUA rings should be contiguously located to the JFUA core or ring.

Figure 3-5: Distribution of *shi-cho-son* by Out-commuting



Source: Author

Figure 3-6: Distribution of *shi-cho-son* by Out-commuting



Source: Author

The second problem is the treatment of local authorities that can be treated as the JFUA ring area for two or more JFUA cores. Most previous studies tried to avoid this problem. To avoid complication, only the largest number of workers commuting to the single JFUA core was paid attention to. As a result of this treatment, there is no JFUA ring that was counted for two or more JFUAs.

3.5.4. Modification for the JFUA Core

Although the basic idea of JFUA definition is outlined in section 3.5.2 and 3.5.3, there was an additional aspect to be considered determining the JFUAs. In section, 3.5.2, 168 *shi* areas were treated as the JFUA core candidates, however, there were 14 JFUA core candidates that did not have a JFUA ring. According to the core concept of the JFUA definition, each JFUA should have a ring area, therefore, these ringless 'cores' have to be excluded from the set of JFUA cores.

These 14 *shi* areas were examined to find out what relationship existed towards the other JFUA core candidates. From this, there were two findings: 13 *shi* areas met the criteria of the JFUA ring areas commuting to other JFUA cores. Therefore, these 13 areas were treated not as the JFUA core but as part of the JFUA ring of other JFUAs. It should be mentioned that one exception was found: Kosai in Shizuoka. This *shi* area could not be treated as a JFUA core because there was no proper ring area. On the other hand, Kosai could not be treated as JFUA ring because the area did not show a high ratio of commuting to any other JFUA core. Therefore, Kosai should be examined separately. Kosai contained only 43,781 residential population in 1990 – a number was smaller than the standard size of an administrative urban area (Chapter 2). Therefore, Kosai is excluded from the JFUA areas.

Thus, finally, the number of the JFUAs was fixed as 154 in 1990.

3.5.5. Definition of the JFUA

From previous sections, the JFUA was determined by the following criteria.

The first is that each JFUA should consist of a JFUA core and a ring area. The second is that the total of each JFUA should contain 50,000 or more residential population.

The JFUA core must satisfy the following two criteria:

(1) The first and essential criterion is that a JFUA core should be a single shi area, and should contain at least 30,000 workers based on work place in the 1990 Population Census of Japan.

(2) The number of workers commuting into the core must be greater than that of workers commuting out of the core.

There are three criteria for the JFUA ring to satisfy.

(1) The ring is composed of one or more administrative local authorities where 7.5% or more of the resident working population commute to the JFUA core.

(2) Each local authority of the JFUA ring should be contiguous with the JFUA core or another ring area of the same JFUA core.

(3) Each local authority can be classified in only one functional urban area: that which is the major destination of the commuters.

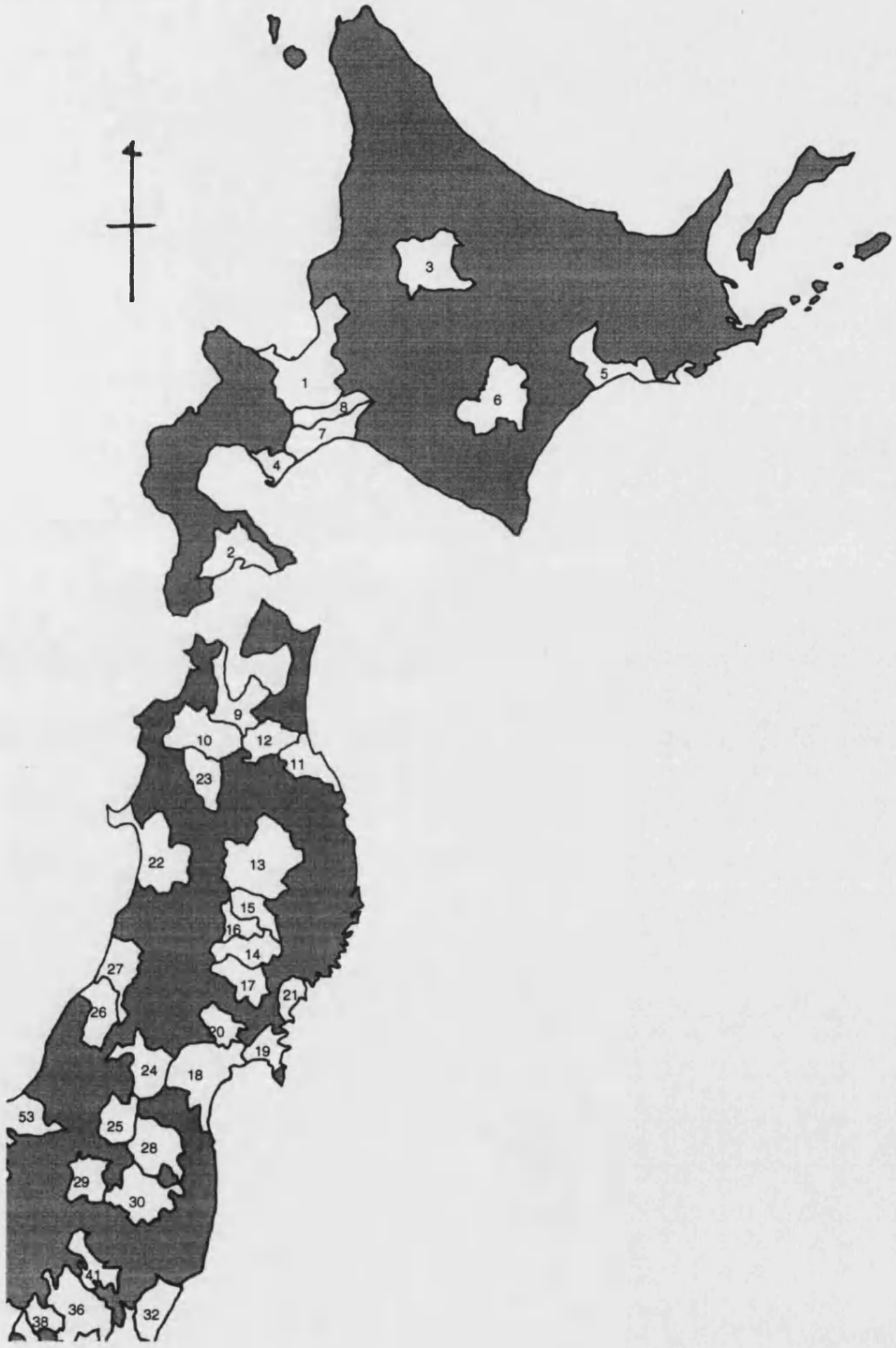
By the JFUA definition, there are 154 JFUAs in Japan and the population in the total JFUAs covered over 80% of the national population in 1990. The full resulting set of JFUAs is listed in Table 3-1 and mapped in Figures 3-7 to 3-9.

Table 3-1: 154 JFUAs List

JFUA Code	JFUA Name	JFUA Code	JFUA Name	JFUA Code	JFUA Name
1	Sapporo JFUA	56	Kashiwazaki JFUA	111	Tsuyama JFUA
2	Hakodate JFUA	57	Joetsu JFUA	112	Hiroshima JFUA
3	Asahikawa JFUA	58	Toyama JFUA	113	Kure JFUA
4	Muroran JFUA	59	Takaoka JFUA	114	Mihara JFUA
5	Kushiro JFUA	60	Kanazawa JFUA	115	Fukuyama JFUA
6	Obihiro JFUA	61	Komatsu JFUA	116	Higashihiroshima JFUA
7	Tomakomai JFUA	62	Fukui JFUA	117	Shimonoseki JFUA
8	Chitose JFUA	63	Tsuruga JFUA	118	Ube JFUA
9	Aomori JFUA	64	Takefu JFUA	119	Yamaguchi JFUA
10	Hirosaki JFUA	65	Sabae JFUA	120	Tokuyama JFUA
11	Hachinohe JFUA	66	Kofu JFUA	121	Iwakuni JFUA
12	Towada JFUA	67	Nagano JFUA	122	Tokushima JFUA
13	Morioka JFUA	68	Matsumoto JFUA	123	Takamatsu JFUA
14	Mizusawa JFUA	69	Ueda JFUA	124	Marugame JFUA
15	Hanamaki JFUA	70	Okaya JFUA	125	Sakaide JFUA
16	Kitakami JFUA	71	Iida JFUA	126	Matsuyama JFUA
17	Ichinoseki JFUA	72	Suwa JFUA	127	Imabari JFUA
18	Sendai JFUA	73	Ina JFUA	128	Uwajima JFUA
19	Ishimaki JFUA	74	Saku JFUA	129	Niihama JFUA
20	Furukawa JFUA	75	Gifu JFUA	130	Kochi JFUA
21	Kesennuma JFUA	76	Ogaki JFUA	131	Kitakyushu JFUA
22	Akita JFUA	77	Takayama JFUA	132	Fukuoka JFUA
23	Odate JFUA	78	Shizuoka JFUA	133	Omuta JFUA
24	Yamagata JFUA	79	Hamamatsu JFUA	134	Kurume JFUA
25	Yonezawa JFUA	80	Numazu JFUA	135	Iizuka JFUA
26	Tsuruoka JFUA	81	Fuji JFUA	136	Saga JFUA
27	Sakata JFUA	82	Iwata JFUA	137	Karatsu JFUA
28	Fukushima JFUA	83	Nagoya JFUA	138	Imari JFUA
29	Aizuwakamatsu JFUA	84	Handa JFUA	139	Nagasaki JFUA
30	Koriyama JFUA	85	Kariya JFUA	140	Sasebo JFUA
31	Mito JFUA	86	Toyota JFUA	141	Isahaya JFUA
32	Hitachi JFUA	87	Anjo JFUA	142	Kumamoto JFUA
33	Tsuchiura JFUA	88	Nishio JFUA	143	Yatsushiro JFUA
34	Shimodate JFUA	89	Tsu JFUA	144	Oita JFUA
35	Katsuta JFUA	90	Yokkaichi JFUA	145	Nakatsu JFUA
36	Utsunomiya JFUA	91	Ise JFUA	146	Hita JFUA
37	Sano JFUA	92	Matsusaka JFUA	147	Miyazaki JFUA
38	Kanuma JFUA	93	Ueno JFUA	148	Miyakonojo JFUA
39	Koyama JFUA	94	Hikone JFUA	149	Nobeoka JFUA
40	Mooka JFUA	95	Nagahama JFUA	150	Kagoshima JFUA
41	Otawara JFUA	96	Kyoto JFUA	151	Sendai JFUA
42	Maebashi JFUA	97	Fukuchiyama JFUA	152	Kanoya JFUA
43	Takasaki JFUA	98	Maizuru JFUA	153	Naha JFUA
44	Kiryu JFUA	99	Osaka JFUA	154	Okinawa JFUA
45	Isesaki JFUA	100	Kobe JFUA		
46	Ota JFUA	101	Himeji JFUA		
47	Kumagaya JFUA	102	Wakayama JFUA		
48	Mobara JFUA	103	Tanabe JFUA		
49	Narita JFUA	104	Tottori JFUA		
50	Kimizu JFUA	105	Yonago JFUA		
51	Ku-Areas of Tokyo-to JFUA	106	Kurayoshi JFUA		
52	Atsugi JFUA	107	Matsue JFUA		
53	Niigata JFUA	108	Izumo JFUA		
54	Nagaoka JFUA	109	Okayama JFUA		
55	Sanjo JFUA	110	Kurashiki JFUA		

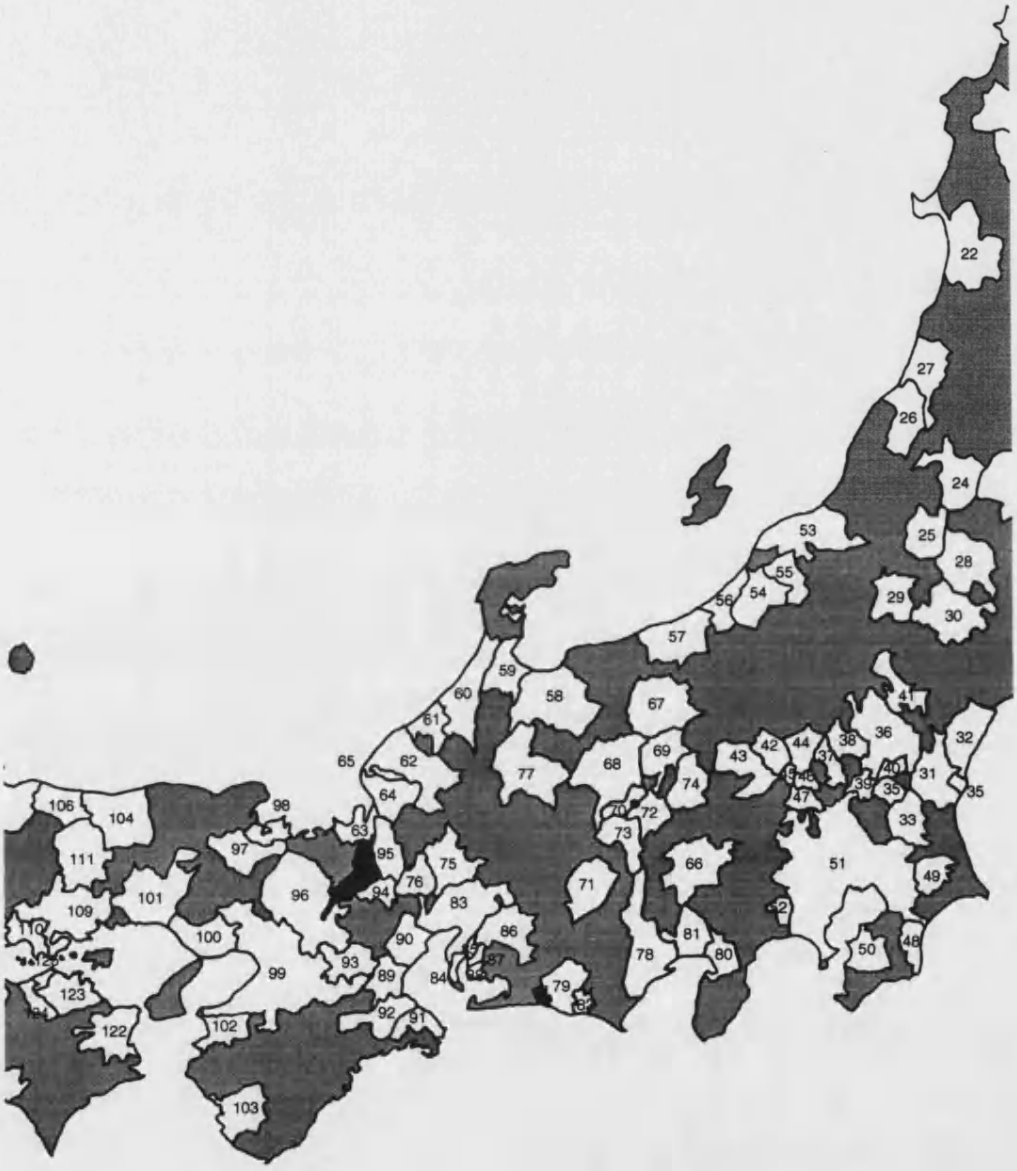
Source: Author

Figure 3-7: JFUAs in Northern Japan (Hokkaido and Tohoku)



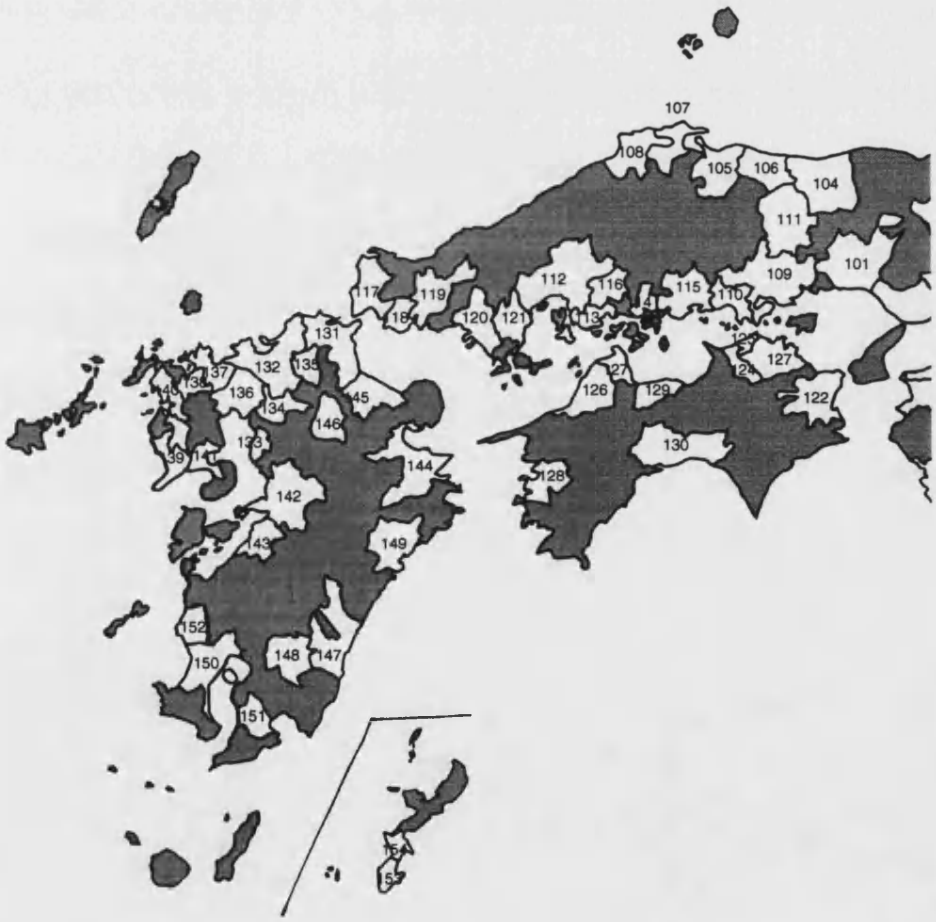
Source: Author

Figure 3-8: JFUAs in Central Japan (Kanto, Chubu and Kinki)



Source: Author

Figure 3-9: JFUAs in Southern Japan (Chugoku, Shikoku, and Kyushu-Okinawa)



Source: Author

3.6. Conclusion

Increasing distance between the work place and the place of residence has been caused by the development of transport, and the administrative boundaries are not a useful measure for urban analysis in this circumstance (Hall and Hay, 1980). Like other countries, a definition of a Japanese functional urban region is required. The main purpose of this chapter has been to find the Japanese functional urban region for this thesis and, in the process, to determine an original Japanese functional urban region. This spatial unit should be examined before starting to analyse the Japanese urban settlements.

To understand the concept of functional urban region and the development of the definition in other countries, development of the US, UK and European cases were examined in section 3.2. This helped to understand the basis of the functional urban region. In section 3.3, several definitions for the Japanese functional urban regions were introduced and investigated. These definitions can be classified into two approaches: 'Top-down' and 'Bottom-up'. The former pays attention to the core place. It requires the definition of a definite ring area. On the other hand, the 'Bottom-up' approach focuses on self-containment. From these differences of characteristics, the 'Top-down' approach seems more suitable for this project because the main purpose of this thesis is to examine the growth of the Japanese urban settlement.

Although various definitions of the functional urban region by the 'Top-down' approach are already established in Japan, e.g. FUR by Kawashima et al. (1993) and SMEA by Yamada (1983), there is no definition without modification for the analysis based on the 1990 Population Census of Japan. As a result of this, an original definition called the 'Japanese Functional Urban Area (JFUA)' was established for this thesis based on the 1990 administrative units and data. From

application of JFUA, 154 JFUAs were defined. These 154 JFUAs are treated as the basic urban settlements of Japan in the following chapters.

Chapter 4: General Demographic Trends of Japanese Urban Settlements Based on 154 JFUAs

4.1. Introduction

In Chapter 3, a new definition of functional urban regions applicable to the Japanese settlement system was developed, namely the Japanese Functional Urban Area (JFUA). In these terms, Japan consists of 154 urban areas. Although these 154 JFUAs covered only a third of Japan's land surface, they contained over 80% of its population in 1990. The largest JFUA is the Ku-Areas of Tokyo-to, which had more than 28,000,000 inhabitants in 1990. The smallest is the Sabae JFUA in the Fukui prefecture with just 71,000 inhabitants recorded for the same year.

To analyse the Japanese settlement system, it is first necessary to examine the general characteristics of the Japanese urban settlements. This is a basis for more detailed analyses. This chapter is organised as follows. The first section will review the previous studies of the settlement change in the context of the US and European countries. This section will help to clarify the characteristics of the Japanese settlement system based on the JFUA definition. The following two sections outline the basic characteristics of the JFUAs in the context of their spatial distribution and population change at a national level. The next two sections examine the characteristics based on two types of groups: JFUAs classified by population size and by regions. In section 4.7, individual characteristics of the JFUAs are examined. As one of the most important characteristics of the Japanese urban settlement system, the JFUAs with prefectural capital cities will be briefly

examined in section 4.8. Finally, the changing pattern of the Japanese settlement system in the 1970s and 1980s is outlined.

4.2. Population Change and the Settlement System in the US and European Countries

This section reviews the previous studies that briefly examined the settlement changes in the European countries, and the US. This is based on those studies of the settlement changes. This will be helpful to understand the population changes of the Japanese settlement system by comparing with the US, UK and European settlement systems.

4.2.1. Population Change in the Functional Urban Regions of European Countries

Hall and Hay (1980)[27] examined the urban settlement systems of European countries based on 539 metropolitan areas[28] between 1950 and 1975. They set several levels of European settlements. Firstly, European countries were examined, in full, to clarify the major tendency of the settlement system. Secondly, the whole of Europe was divided into five groups; Atlantic Europe (Great Britain and Ireland), Northern Europe (Sweden, Norway and Denmark), Western Europe (Netherlands, Belgium, with Luxembourg, and France), Southern Europe (Spain, Portugal and Italy) and Central Europe (Federal Republic of Germany, Switzerland and Austria).

This study exhibited the population growth pattern of the European settlements as follows. In the 1950s, the urban cores grew faster than the rings,

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[27] In Chapter 6, this study will be reviewed from the view point of the urban development stages.

[28] Each country has its own definition of functional urban regions. The UK definition was outlined in Chapter 3.

14.0% in the cores and 5.2% in the rings. In 1960s, the tendency changed. While the core areas grew 9.2%, the ring areas grew 10.9%, and non-metropolitan areas showed a small loss of population. Finally, in the early 1970s, the ring areas kept a similar rate of growth to that of the 1960s but the growth of the core areas nearly stopped and non-metropolitan areas suffered an accelerated population loss.

To focus on the five regions of the European countries described above, some regional characteristics were observed. Firstly, Atlantic Europe, including the UK, showed the highest degree of the urban population and this region showed an absolute decline in its urban cores. On the other hand, Southern European countries showed a rapid population growth in its urban areas. Other regions stayed in between above two regions. When the relationship between settlement size and population changed, it was observed that the medium-sized urban settlements were main growth centres in Atlantic Europe and Northern Europe, and that the larger settlements had a main role in the population change of the other three regions.

4.2.2. The Changing National Settlement System and 'Counterurbanisation'

The word 'counterurbanisation' was introduced by Berry (1976) to explain the changing US settlement system, where the population of metropolitan areas had started to decline in the early 1970s. According to Berry (1976), this phenomenon was defined as a process of population deconcentration; it implies a movement from a state of more concentration to a state of less concentration.

The US rural development in the early 1970s was first reported by Beale (1975), and the decline of the large metropolitan areas and the growth of the rural and small settlements in the US during the 1970s were confirmed (Berry, 1976; Frey and Speare, Jr, 1988; Frey, 1987, 1989). However, this change was not a long-

term trend, and the US settlement system showed a new tendency of change in the 1980s. It was called the 'urban renewal' because some large metropolitan areas showed a population growth in the 1980s (Frey, 1993).

In Europe, settlement change from the perspective of counterurbanisation has also been examined by several researchers. Fielding (1982) examined the word 'counterurbanisation' when he examined the European settlement system. According to Fielding, counterurbanisation was associated with the negative relationship between the rate of net-migration and settlement size, in contrast to the process of urbanisation in which larger areas recorded a higher rate of net-migration. Champion (1987, 1989) and Fielding (1986, 1989) confirmed the existence of this phenomenon in the UK and Western Europe. According to Champion's works in the late 1980s, the UK settlement system showed a negative relationship between growth and settlement size in the 1970s. As with the US, the UK settlement system showed a different characteristic in the 1980s. According to Champion (1992), the largest urban core showed a population gain in the 1980s. This was observed not only for redevelopment areas like the Docklands of London but also for central areas, that had suffered from population loss for a long time, and by the late 1980s were exhibiting a population increase (Champion et al., 1987).

In the Japanese case, there are two views about counterurbanisation. Tsuya and Kuroda (1989) examined the migration pattern and the population change based on the prefectures, and they concluded that Japan had experienced that phenomenon in the 1970s. On the other hand, Morikawa (1990) provided a different view. He argued that the Japanese settlement system was concentrating into larger settlements; he reached this conclusion by examining the population change based on the functional urban regions.

4.3. Spatial Distribution of the 154 JFUAs

Figure 4-1 shows the spatial distribution of the 154 JFUAs. From this figure, it is clear that many JFUAs are contiguously located between the Kanto Region and the northern part of Kyushu on the Pacific coast. This aggregation of JFUAs corresponds to 'the Pacific Coastal Belt Zone', the centre of the Japanese industrial zone highlighted in the National Income Doubling Plan in 1960.[29] This industrial zone contains eight JFUAs whose population exceeded one million in 1990: the Ku-Areas of Tokyo-to, Nagoya, Kyoto, Osaka, Kobe, Hiroshima, Kitakyushu and Fukuoka.

Other areas (Hokkaido, Tohoku, southern Shikoku, southern Kyushu, and the Japan Sea side of Honshu) do not show such an aggregation of JFUAs. The distance between Tokyo and Sapporo is approximately 1,000km. This is the same as the distance between Tokyo and Fukuoka. In contrast to the Pacific Coastal Belt Zone, between Tokyo and Sapporo, only Sendai JFUA contained over a million inhabitants in 1990. On the Japan Sea side of Honshu, Kanazawa is the largest JFUA, with a population of 720,000 in 1990. The southern Kyushu region has some large JFUAs, e.g. the Kumamoto and the Kagoshima JFUAs, but there is no aggregation of JFUAs as in the Pacific Coastal Belt Zone.

The prefectural capital cities tend to be the JFUA cores. As mentioned in Chapter 2, Japan has a three-tier system of administration: national, prefectural, and municipal. Each prefecture has its own prefectural government, and prefectural capital cities play an important role in local administration. Therefore, these cities tend to have a wide range of urban functions, including political functions, and this has an effect on the spatial distribution pattern of JFUAs. Although Japan has 47 prefectures, there are only 42 JFUAs whose core city is a prefectural capital city.

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[29] For detailed information, see Chapter 7.

Figure 4-1: Geographical Distribution of the 154 JFUAs

Source: Author

There are five prefectural capital cities that do not meet the criteria of JFUA cores. These five are Urawa in the Saitama Prefecture, Chiba in the Chiba Prefecture, Yokohama in the Kanagawa Prefecture, Ohtsu in the Shiga Prefecture, and Nara in the Nara Prefecture. All five are close to Japan's largest cities. These five prefectural capital cities lost more worker population than they gained via commuting. Therefore, prefectural capital cities in the Saitama, Chiba and Kanagawa are treated as the ring of the Ku-Areas of Tokyo-to JFUA, Ohtsu in the Shiga as the JFUA ring of the Kyoto JFUA, and Nara as the ring of the Osaka JFUA.

4.4. Changes in JFUA Population at National Level

In Chapter 2, the pattern of urbanisation in Japan was examined on the basis of two definitions of urban areas: administratively defined urban areas called *shi*, and Densely Inhabited Districts (DIDs). In this section, the JFUA will be used as the basic spatial unit to examine settlement change.

Table 4-1 shows the total JFUA population, the share of this within national population, growth in population in all JFUAs combined, and the percentage growth these represented between 1970 and 1990. The JFUA population has increased steadily since 1970. In 1970, the 154 JFUAs contained 82,666,374 inhabitants. This increased to 94,906,703 in 1980 and to 101,710,165 in 1990. In relative terms, the JFUA population grew by 14.8% in the 1970s and 7.2% in the 1980s. The national population was 104,665,171 in 1970, 116,989,033 in 1980, and 123,284,810 in 1990. The national population grew by 11.8% in the 1970s and by 5.4% in the 1980s. Thus the JFUA population grew faster than the national population as a whole, with the ratio of the former to the latter rising from 79.0% in 1970, to 81.1% in 1980, and to 82.5% in 1990.

Table 4-1: JFUA Population 1970-90

		JFUA Population				Population Growth	
		1970	1980	1990		1970s	1980s
JFUA	Pop. (000s)	82,666	94,907	101,710	Change (000s)	12,240	6,803
	Share (%)	79.0	81.1	82.5	Growth Rate (%)	14.8	7.2
JFUA Core	Pop. (000s)	43,612	46,979	48,650	Change (000s)	3,367	1,671
	Share (%)	41.7	40.2	39.5	Growth Rate (%)	7.7	3.6
JFUA Ring	Pop. (000s)	39,055	47,928	53,060	Change (000s)	8,873	5,132
	Share (%)	37.3	41.0	43.0	Growth Rate (%)	22.7	10.7
Non-JFUA	Pop. (000s)	21,999	22,082	21,575	Change (000s)	84	-508
	Share (%)	21.0	18.9	17.5	Growth Rate (%)	0.4	-2.3
Japan Total	Pop. (000s)	104,665	116,989	123,285	Change (000s)	12,324	6,296
	Share (%)	100.0	100.0	100.0	Growth Rate (%)	11.8	5.4

Source: Author

When population growth in the JFUA cores and rings is examined separately, the 1970s can be seen as the turning point in the balance between the populations in these two components. In 1970, 37.3% of the national population lived in the JFUA rings, i.e. 39,055,000. This number had increased to 47,928,000 by 1980. In other words, there was 22.7% growth in the 1970s. This was double the national average growth rate and meant that 60% of national population growth took place in the JFUA rings during this decade. The JFUA cores contained 43,612,000 inhabitants in 1970, 41.7% of the national population. In the 1970s, the JFUA cores grew by 7.7%, reaching a population of 46,979,000 in 1980. In 1980, the number of residents in the JFUA rings exceeded that in the cores. At that time, the ratio of the population in the cores to the national total decreased to 40.2%, whereas the ratio of population in the rings compared to the national total increased to 41.0%.

This tendency continued throughout the 1980s. The growth rate of the JFUA rings in this decade was 10.7%. The number of residents increased to 53,060,000 in 1990. In the same decade, the JFUA cores recorded just 3.6% growth. The number of the JFUA cores recorded 48,650,000 in 1990. In 1990, the population of the JFUA rings constituted 43.0% of the national total, while that of

the JFUA cores dropped to 39.5%. The gap between core and ring population has been widened.

Non-JFUA areas did not show a clear pattern of population growth. In the 1970s, although the population in the non-JFUAs grew in absolute terms, it declined relative to the national total. The number of residents in the non-JFUA areas increased slightly from 21,999,000 to 22,082,000 during this decade, while the proportion of the non-JFUA population to the national total decreased from 21.0% to 18.9%. In the 1980s, the non-JFUA population declined in both absolute and relative terms. In 1990, the figure was 21,575,000, constituting just 17.5% of the national population.

To sum up, it can be said that the Japanese settlement system has seen a concentration of population into the JFUAs, and that decentralisation has been observed at the national level. In contrast to the JFUAs, rural areas have declined. This pattern was particularly pronounced in the 1980s.

4.5. The 154 JFUAs Ranked by Size

Is there any relationship between population growth patterns and the size of settlements? This section examines the relationship between the size of JFUAs and population growth.

In order to establish the relationship between population growth and settlement size, it is first necessary to classify the 154 JFUAs into several groups according to their 1990 population size. This process will both assist in the statistical analysis, as well as help us to grasp the overall characteristics of the JFUAs. In this thesis, the 154 JFUAs are classified into four size groups with the classification determined as follows. In grouping the JFUAs, firstly, those with populations of over 1 million will be classed as the Largest JFUAs. 10 fall into this

category, and these 10 JFUAs include all 'Cities designated by Cabinet Order'.[30] The following groups will simply be split into separate groups as the population figures halve. Thus those settlements which are large but do not make it into the Largest JFUA category will fall into the Large JFUA section. This will include settlements with populations from one million (minus one) down to 500,000, of which there are 25.

Note that the combined 2 groups, shown above, only amount to 35 settlements. The Medium-sized JFUA category will include those with populations of just under 500,000 to 250,000, of which there are a further 35. The remaining 84 JFUAs with populations under 250,000 will be classed as Small JFUAs.

Figure 4-2 shows the population share of each group relative to total population of the 154 JFUAs in 1990. The largest JFUA accounted for 56.9% and the Large JFUA for 17.0%. However, the Medium-sized JFUA reached only 13.1%, while the share of the Small JFUAs was 13.0%. This result shows that the Japanese urban settlement system has a strong concentration of population in the largest urban settlements.

Table 4-2 shows the different pattern of change in the population share of each group of the 154 JFUAs in the 1970s and the 1980s. These four groups can be classified by their changing pattern. In the first place, only the Largest JFUAs increased their share from 54.7% in 1970 to 56.0% in 1980 and to 56.9% in 1990. On the other hand, all of the other groups showed a declining population share compared to the total JFUA population. The group of the small JFUAs is a good example. The proportion of the population in the small JFUAs compared to the 154 JFUAs recorded 14.3% in 1970. This had decreased to 13.0% by 1990.

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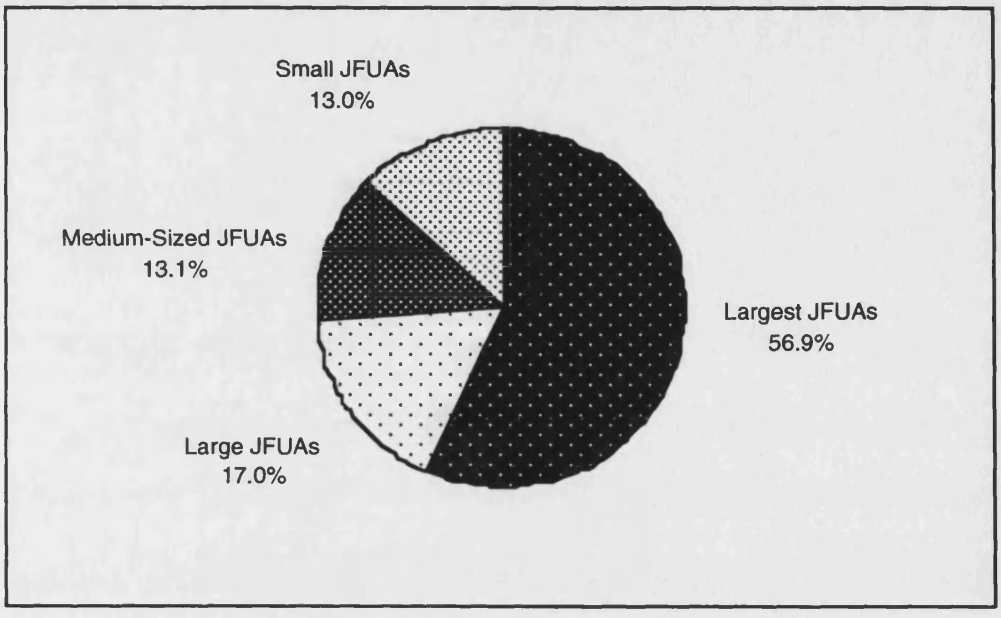
[30] See Chapter 3.

Figure 4-2: The Population Share of the Four JFUA Groups Arranged by Settlement Size (1990)



Source: Author

Table 4-2: The JFUA Population and Its Share to the 154 JFUAs Arranged by JFUA Size (000s and %)

		1970	1980	1990
Largest JFUAs	Pop. (000s)	45,257	53,132	57,925
	Share (%)	54.7	56.0	56.9
Large JFUAs	Pop. (000s)	14,211	16,276	17,249
	Share (%)	17.2	17.1	17.0
Medium-Sized JFUAs	Pop. (000s)	11,357	12,726	13,342
	Share (%)	13.7	13.4	13.1
Small JFUAs	Pop. (000s)	11,841	12,773	13,194
	Share (%)	14.3	13.5	13.0
154 JFUAs	Pop. (000s)	82,666	94,907	101,710
	Share (%)	100.0	100.0	100.0

Source: Author

This result offers a different perspective to that of Kuroda (1990) who classified all Japanese administratively defined urban areas into three categories (Large, Medium-sized and Small) by its population size.[31] He remarked that Japanese medium-sized cities had increased its population share to the whole urban population since 1950 and that Japanese large cities had not increased its population share very much (Chapter 2).

When the population growth rate of each group was examined, the following results emerged. (Table 4-3) The growth rate of the Largest JFUAs was 17.4% in the 1970s, mostly reflecting the rapid growth of the JFUA rings. In the 1970s, the JFUA rings of this group recorded a growth of 32.3%, meaning that the rings gained 7,488,000 inhabitants within a decade. During the same period, the JFUA cores of this group gained only 387,000 inhabitants, an increase of 1.8%. During the 1980s, this group grew by 9.0% in total. The growth rate of the ring areas dropped to 14.0%, but still experienced a higher growth. The JFUA cores grew by 2.2%, still low relative to the rings, but higher than in the 1970s.

In the 1970s, the growth rate of the Large JFUAs was 14.5%. Although lagging behind that of Largest JFUAs, this rate was higher than that of smaller settlement groups. In the 1970s, the JFUA cores grew faster than the rings, the cores growing by 15.6% and the rings by 13.1%. This pattern changed in the 1980s, with the growth rate of this group being just 6.0%, less than half of what it was in the previous decade. The rings grew faster in the 1980s, by 6.3% as opposed to 5.7% for the cores.

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[31] Large cities were those that contained a population of over 500,000. Medium-sized cities were those between 100,000 and 499,999, and small cities had a population of less than 99,999.

Table 4-3: Population Change Arranged by JFUA Size (000s and %)

Group		1970s			1980s		
		Total	Core	Ring	Total	Core	Ring
Largest JFUAs	Change (000s)	7,875	387	7,488	4,794	493	4,301
	Rate (%)	17.4	1.8	32.3	9.0	2.2	14.0
Large JFUAs	Change (000s)	2,065	1,268	796	973	538	436
	Rate (%)	14.5	15.6	13.1	6.0	5.7	6.3
Medium-Sized JFUAs	Change (000s)	1,369	932	437	615	323	292
	Rate (%)	12.1	14.2	9.1	4.8	4.3	5.6
Small JFUAs	Change (000s)	932	779	152	421	317	104
	Rate (%)	7.9	11.4	3.0	3.3	4.2	2.0
154 JFUAs	Change (000s)	12,240	3,367	8,873	6,803	1,671	5,132
	Rate (%)	14.8	7.7	22.7	7.2	3.6	10.7

Source: Author

The Medium-Sized JFUAs grew by 12.1% in the 1970s, with a rather rapid growth of 14.2% in comparison to the JFUA rings in this group which grew by just 9.1%. Like the Large JFUAs, the Medium-Sized JFUAs changed their growth pattern in the 1980s. During this decade, the growth speed of the rings exceeded that of the cores; the rings grew by 5.6% and the cores grew by 4.3%.

The Small JFUAs showed the lowest growth rate of the four groups in the two decades. Their growth rate was 7.9% in the 1970s and 3.3% in the 1980s. In these two decades, the JFUA cores of the group grew much faster than the JFUA rings. In the 1970s, the cores grew by 11.4% and the rings by 3.0%, in the 1980s, the cores grew by 4.2% and the rings by 2.0%.

Examining the relationship between size and population growth in the four groups, two things are striking. Firstly, in both decades, there was a positive relationship between the growth rate of the JFUA population and settlement size. In other words, the larger settlements grew faster than the smaller ones. This means that the Japanese settlement system has developed differently from those in the US and UK. Champion et al. (1987) examined the British settlement system with respect to population growth showing that there was a negative relationship between settlement size and population growth rate in the 1970s. In the US, the large cities

suffered population loss during the 1960s and the 1970s, although in the 1980s, some large urban settlements experienced renewal growth (Frey, 1993). By comparison, Japan has experienced a concentration of population into its large settlements in both of the decades in question.[32]

The conclusion of this analysis is at variance to that of previous studies such as the one carried out by Tsuya and Kuroda (1989). The explanation for this difference is the spatial unit for analysis. As mentioned before, the previous studies were based on the prefectural or regional basis. On the other hand, this study is based on the functional urban region called the JFUA. Prefectures are administratively defined areas and they are much larger than functional urban regions. In addition, the word 'metropolitan area' of Japan is different from the US and UK settlement studies. For example, the US definition of 'Metropolitan Area' relates to functionally defined urban regions (Chapter 3). In Japan, the official definition of 'Metropolitan Area' is to define the largest urban settlements only. In addition, when previous studies used metropolitan areas, the word is similar to 'regions that contains consolidated metropolitan area'.[33]

Secondly, there is a relationship between settlement size and the growth rate of the two components of a JFUA: core and ring. When the settlement size is larger, the ring areas show a higher growth rate than its core. In the two decades, the Largest JFUAs showed a rapid population growth in its ring areas, and Large JFUAs in the 1980s showed the same tendency. On the other hand, Small JFUAs showed a core area growth oriented pattern clearly.

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[32] However, this study cannot examine the internal migration pattern based on the JFUA definition because of data availability (Appendix 1.1.). In addition, the Japanese settlement recorded natural population growth over 10% in the 1970s. This circumstance is far from the 'zero growth' of population growth in the UK settlement system. Therefore, the relationship between settlement size and migration pattern cannot be examined in Japan.

[33] Therefore, some Japanese researchers misunderstand the meaning of 'metropolitan area', in the context of the international settlement studies, making direct comparisons invalid. Morikawa (1990) also confirmed that the Japanese urban system has continued concentration into larger settlements during last two decades.

4.6. Characteristics of the Eight Regions

This section focuses on the characteristics of the eight regions based on the JFUAs. The prefecture is not a suitable spatial unit of analysis for this thesis because some JFUAs cover local authorities crossing two or more prefectures. They are mostly the largest JFUAs, e.g. the Ku-Areas of Tokyo-to, Osaka, and Nagoya JFUAs. It is simpler to base analysis on regions than on prefectures. When the 154 JFUAs are classified by the regions set out in Chapter 2, the spatial distribution of the 154 JFUAs is as follows: 8 JFUAs are in Hokkaido, 22 JFUAs in Tohoku, 23 JFUAs in Kanto, 40 JFUAs in Chubu, 10 JFUAs in Kinki, 18 JFUAs in Chugoku, 9 JFUAs in Shikoku, and 24 JFUAs are in Kyushu-Okinawa region. This section examines two aspects of the JFUA population based on its eight regions: the ratio of the JFUA population to the regional total and the balance of population between the JFUA cores and rings.

4.6.1. The JFUA Population and the Regions

Table 4-4 shows the JFUA population arranged by eight regions at three dates, 1970, 1980 and 1990. From the table, it is clearly found that the JFUA population is concentrated into the Kanto, Chubu and Kinki regions. The sum of the population of these three regions in 1990 was 71,361,000 inhabitants. This means that these three regions contained 60% of the JFUA population.

Table 4-4 also shows the ratio of the JFUA population to the regional total. It can be said that the ratio shows the degree of regional urbanisation based on the JFUA definition. To focus on the pattern of the ratio, these eight regions can be classified into groups as follows.

Table 4-4: The JFUA Population and the Ratio of the JFUA Population of the Regional Total Arranged by Regions (000s and %)

Region		1970	1980	1990
Hokkaido	Pop. (000s)	2,887	3,553	3,837
	Share (%)	55.7	63.7	68.1
Tohoku	Pop. (000s)	5,524	6,145	6,427
	Share (%)	61.2	64.2	66.1
Kanto	Pop. (000s)	26,701	31,691	35,000
	Share (%)	88.2	88.9	89.2
Chubu	Pop. (000s)	14,901	16,750	17,738
	Share (%)	79.0	80.3	80.9
Kinki	Pop. (000s)	15,684	17,590	18,623
	Share (%)	90.1	90.2	91.6
Chugoku	Pop. (000s)	5,243	5,888	6,120
	Share (%)	74.9	77.6	79.1
Shikoku	Pop. (000s)	2,613	2,936	3,041
	Share (%)	66.9	70.6	72.6
Kyushu-Okinawa	Pop. (000s)	9,113	10,354	10,924
	Share (%)	70.0	73.6	75.4
All Regions	Pop. (000s)	82,666	94,907	101,710
	Share (%)	79.0	81.1	82.5

Source: Author

The Kanto and Kinki regions showed the highest ratio of the JFUA population to the regional total, exceeding the national average. In the Kanto region, the figure was 88.2% in 1970 rising to 89.2% in 1990. In the Kinki region, the figure was higher, 90.1% in 1970, and 90.2% in 1980, while in 1990 it was 91.6%.

The other six regions showed a lower level of the JFUA population. They can be classified into three types. The ratio of the JFUA population in the Chubu region was similar to the national average in the two decades. The JFUA population in this region was 79.0% in 1970, 80.3% in 1980 and 80.9% in 1990. This region lies between Kanto and Kinki, and contains the Nagoya metropolitan area, which accounts for the higher level of the JFUA population.

In other regions, the ratio of the JFUA population to the regional total was lower than the national average. The southern regions of Japan, i.e. Chugoku, Shikoku, and Kyushu-Okinawa, recorded relatively higher rates than the northern regions, Hokkaido and Tohoku. For the southern regions, the figure was over 70%

in 1990. For example, the Kyushu-Okinawa region recorded 75.4% in 1990. The Tohoku region showed a lower figure than other regions. In this region, the ratio of the JFUA population to the regional total did not achieve 70%.

It should also be mentioned that the JFUA population in the Hokkaido region over two decades grew rapidly, rising from 55.7% in 1970 to 63.7% in 1980 and finally reaching 68.1% in 1990. In the 1970s, the rate showed an 8.7% increase, which was the fastest of the nine regions. As a result of this rapid growth, the JFUA population in Hokkaido is higher than it is in Tohoku. In 1990, the ratio of the JFUA population in the Hokkaido region was 66.1%.

When the population of the JFUA core and the JFUA ring was compared, the eight regions are classified as follows (Table 4-5).

Table 4-5: The Ratio of the JFUA to the Regional Total by Regions (%)

	1970				1980				1990			
Region	JFUA Total	JFUA Core	JFUA Ring	Non-JFUA	JFUA Total	JFUA Core	JFUA Ring	Non-JFUA	JFUA Total	JFUA Core	JFUA Ring	Non-JFUA
Hokkaido	55.7	43.3	12.4	44.3	63.7	50.4	13.3	36.3	68.1	54.3	13.8	31.9
Tohoku	61.2	36.1	25.1	38.8	64.2	39.6	24.6	35.8	66.1	41.5	24.6	33.9
Kanto	88.2	38.4	49.9	11.8	88.9	32.6	56.3	11.1	89.2	29.8	59.4	10.8
Chubu	79.0	42.9	36.0	21.0	80.3	42.7	37.6	19.7	80.9	42.7	38.2	19.1
Kinki	90.1	44.2	45.9	9.9	90.2	39.0	51.2	9.8	91.6	37.7	53.9	8.4
Chugoku	74.9	50.3	24.7	25.1	77.6	53.5	24.1	22.4	79.1	55.3	23.8	20.9
Shikoku	66.9	38.4	28.5	33.1	70.6	41.6	29.0	29.4	72.6	43.2	29.5	27.4
Kyushu-Okinawa	70.0	43.7	26.3	30.0	73.6	45.9	27.7	26.4	75.4	46.6	28.8	24.6
Total	79.0	41.7	37.3	21.0	81.1	40.2	41.0	18.9	82.5	39.5	43.0	17.5

Source: Author

The first group is that of the Kanto and Kinki regions. In these two regions, the population ratio of the JFUA rings exceeds that of the JFUA cores and the gap between the cores and rings has increased over the two decades in question. In 1970, 38.4% of the total population in the Kanto region lived in the JFUA cores, and this dropped to 32.6% in 1980 and eventually to 29.8% in 1990.

On the other hand, 49.9% of the total population lived in the JFUA ring in 1970, and this rose to 56.3% in 1980 and to 59.4% in 1990. A similar pattern is found for the Kinki region, where the percentage of population living in the JFUA core to the total has decreased from 44.2% in 1970 to 37.7% in 1990. Meanwhile, the percentage of population in the JFUA ring has increased from 45.9% in 1970 to 53.9% in 1990. This characteristic of the Kanto and Kinki regions is confirmed by the comparison with the population growth rate of the JFUA cores and rings.

In the other seven regions, population in the JFUA core was greater than that in the JFUA ring and these regions show their own pattern of population change of the JFUA core and ring. The Chubu region, containing the Nagoya metropolitan area, showed an original pattern. Although the JFUA core population was larger than the JFUA ring population, the gap between core and ring was of a similar level. The populations of the core and ring were respectively 42.9% and 36.0% in 1970, and 42.7% and 38.2% in 1990. In addition, the ratio of the JFUA core gradually decreased over the two decades, while that of the JFUA ring gradually increased.

The Hokkaido, Tohoku, Chugoku, Shikoku, and Kyushu-Okinawa regions showed a similar pattern of the JFUA cores and rings. In these regions, it is clearly seen that the population of the JFUA cores was greater than that of the JFUA rings. The Hokkaido region showed a outstanding pattern of this population pattern. In the Hokkaido region, the population in the JFUA cores was four times larger than that in the JFUA rings.

4.6.2. The Regional Characteristics of the Population Growth Pattern

When the JFUA population growth rates for the eight regions were examined, the following findings were observed (Table 4-6). Firstly, it was clearly

found that the Kanto region, containing Tokyo metropolitan area, showed a high degree of population growth. In the 1970s, this region showed an 18.7% growth rate and 10.4% in the 1980s. On the other hand, the Kinki region, containing Kansai metropolitan area, did not record a fast growth. The growth rate in this region was 12.1% in the 1970s and 5.9% in the 1980s. These rates were lower than that of the 154 JFUAs. Another characteristic was the rapid growth in the Hokkaido region in the 1970s. In this decade, the Hokkaido region showed the highest growth rate, i.e. 23.1%. In the 1980s, the growth rate of this region dropped to 8.0%, this is not as outstandingly fast as that the 1970s but was still faster than that of all the 154 JFUAs combined.

Table 4-6: Population Change Arranged by Regions (000s and %)

Region		1970s			1980s		
		JFUA Total	Core	Ring	JFUA Total	Core	Ring
Hokkaido	Change (000s)	666	567	99	284	250	34
	Rate (%)	23.1	25.3	15.4	8.0	8.9	4.6
Tohoku	Change (000s)	622	535	86	281	242	39
	Rate (%)	11.3	16.4	3.8	4.6	6.4	1.7
Kanto	Change (000s)	4,989	7	4,982	3,309	89	3,220
	Rate (%)	18.7	0.2	33.0	10.4	1.2	15.9
Chubu	Change (000s)	1,848	812	1,036	989	444	544
	Rate (%)	12.4	10.0	15.2	5.9	5.0	7.0
Kinki	Change (000s)	1,906	-87	1,993	1,033	55	978
	Rate (%)	12.1	-1.1	24.9	5.8	0.7	9.8
Chugoku	Change (000s)	644	540	104	233	217	16
	Rate (%)	12.3	15.4	6.0	4.0	5.3	0.9
Shikoku	Change (000s)	324	231	93	105	76	29
	Rate (%)	12.4	15.4	8.3	3.6	4.4	2.4
Kyushu-Okinawa	Change (000s)	1,241	760	481	570	298	272
	Rate (%)	13.6	13.4	14.1	5.5	4.6	7.0
Total	Change (000s)	12,240	3,367	8,873	6,803	1,671	5,132
	Rate (%)	14.8	7.8	22.7	7.2	3.7	10.6

Source: Author

When the growth pattern of each component of the JFUAs was examined, its nine regions were divided into two groups. Kanto, Chubu, Kinki and Kyushu-Okinawa regions formed the first group. In these regions, the JFUA rings grew faster than the JFUA cores. This tendency is clearly observed in the Kinki region. In the 1970s, the JFUA cores decreased by –1.1% while the JFUA rings grew by 24.9 % in Kinki. In the 1980s, the JFUA cores of the region showed a small but positive growth rate of 0.7%, while the JFUA rings recorded a 9.8% growth. The Kanto region never recorded an actual decrease in the JFUA core, but demonstrated the same general tendency as Kinki, with a higher JFUA core growth within the 1980s than that of the 1970s.

The other four regions showed an opposite pattern from the first group. These regions showed a higher population growth rate in the JFUA cores than the rings. The Chugoku region provides a good example. In the 1970s, the JUFA cores in this region recorded 15.4 % growth and the rings grew by 6.0%. In the 1980s, this tendency was accelerated; the cores grew by 5.3% and the rings grew by only 0.9%.

4.6.3. Comments

The changing JFUA population was examined with respect to the eight regions in section 4.5. The Kanto and Kinki regions showed a different population growth pattern from other regions. The Kanto and Kinki regions had the highest ratio of the JFUA population to the regional total population and a faster growth in the JFUA rings than in the cores. As is well known, Kanto and Kinki are Japan's two metropolitan regions, the former containing the Tokyo metropolitan area and the latter containing the Kansai metropolitan area. However, Kanto did not show a decrease in the JFUA cores. On the other hand, Kinki showed a population decline in its JFUA cores.

The Chubu region, which contains the Nagoya metropolitan area, had a lower ratio of the JFUA population than Kanto and Kinki, although this region showed a higher ratio than the other regions.

Although there was some variation in certain aspects, it is generally clear that the regions outside the three metropolitan areas showed a uniform pattern. It is clear too that the northern regions had a lower JFUA population. The Tohoku region showed stagnation in its JFUAs, but the Hokkaido region showed a rapid growth of the JFUA population.

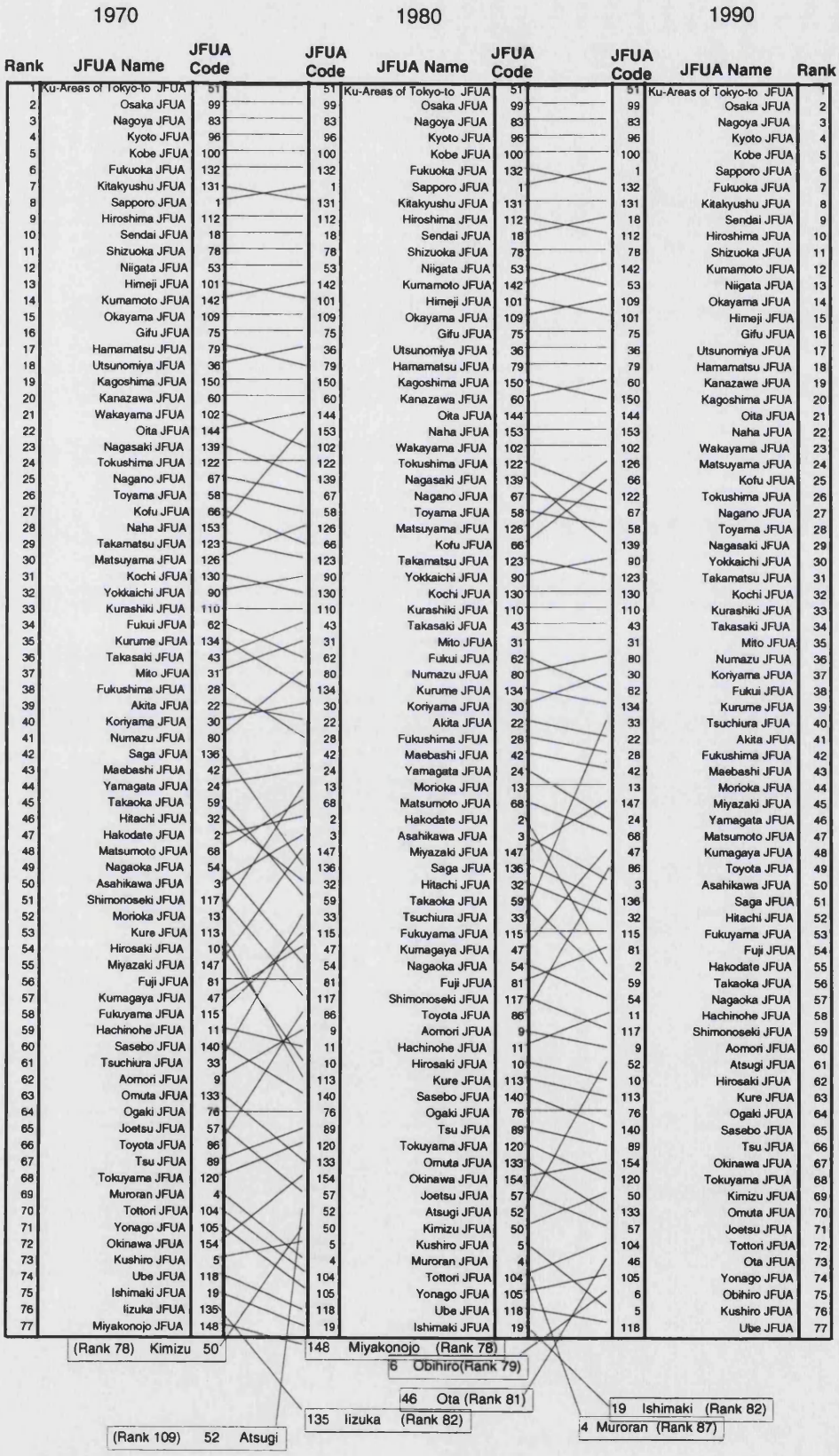
4.7. The Characteristics of 154 JFUAs

In the previous section, various aspects of JFUA population were examined on the basis of the different groupings of the JFUAs by settlement size and regions. This section examines the characteristics of individual JFUAs.

4.7.1. Changes in the Rankings 1970-1990

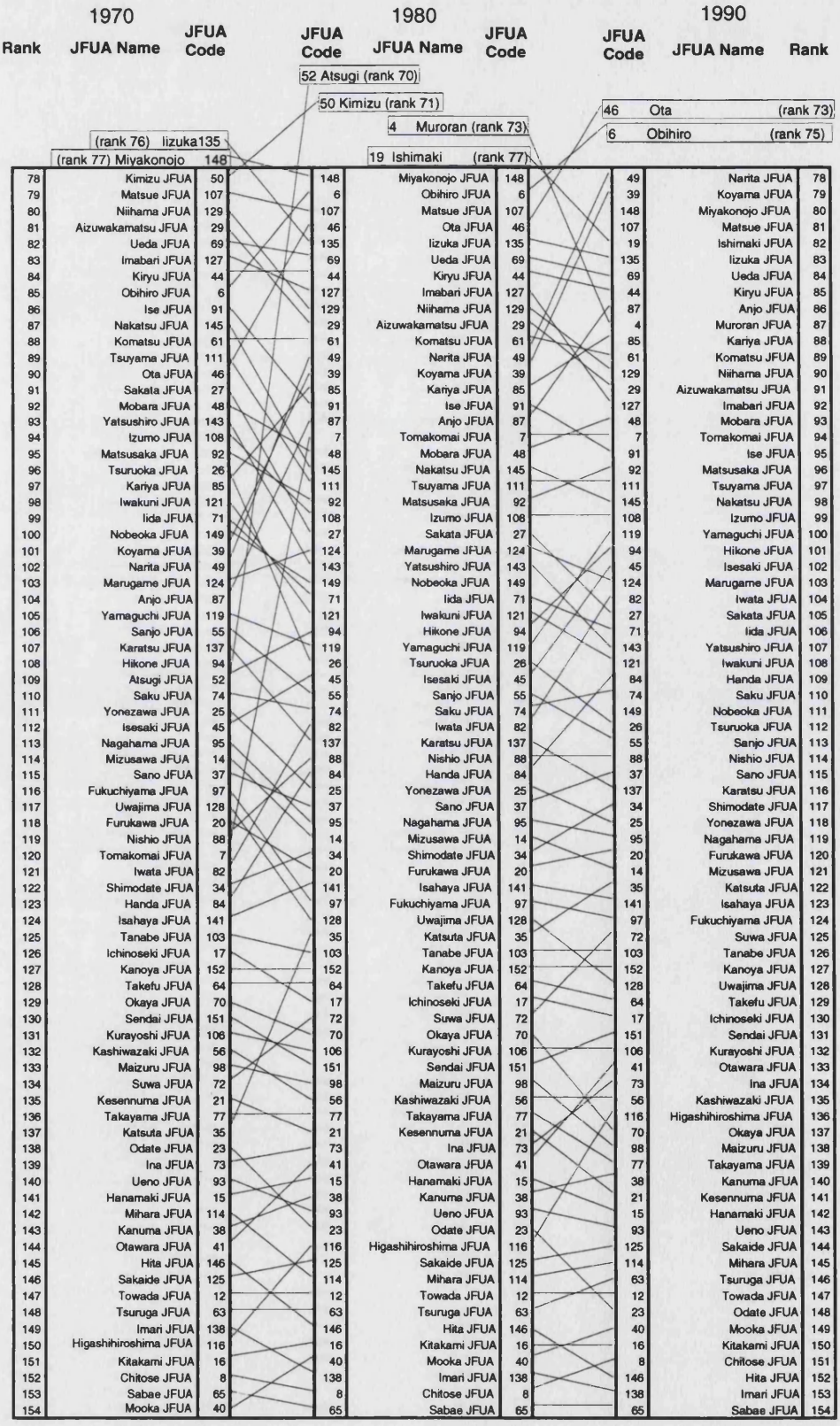
Figures 4-3 illustrates the changing ranking of the 154 JFUAs in terms of population size for the periods, 1970, 1980, and 1990. As Figure 4-3 shows, the 1970s saw more drastic changes than the 1980s, and this took place among the JFUAs ranked lower than 20. In the 1970s, a number of JFUAs made a big leap up. The Atsugi and Tomakomai JFUAs showed a rapid movement up the ranks. The Atsugi JFUA rose its rank from 109 in 1970 to 70 by 1980 and the Tomakomai JFUA rose its rank from 120 in 1970 to 90 in 1980.

Figure 4-3: Changes in JFUA Population Ranking, 1970, 1980, and 1990



Source: Author

Figure 4-3: Changes in JFUA Population Ranking, 1970, 1980, and 1990 (Continued)



Source: Author

The JFUAs that rose in the 1970s can be classified into two types. The first type is associated with the regional distribution. Most JFUAs in this category are located in Kanto or Chubu regions. Atsugi, Tsuchiura and Toyota JFUAs are good examples. Another type is that some JFUAs with prefectural capital cities moved up the hierarchy. The Naha and Morioka JFUAs are good examples.

In the 1980s, JFUAs with prefectural capital cities did not show the relative increase in size of the 1970s. As a result, only JFUAs near Kanto and Chubu regions showed a rapid movement up the ranks. To clarify this characteristic, comparing the Tomakomai JFUA and Atsugi is useful. These two JFUAs showed a rapid increase in relative size in the 1970s. However, these JFUAs showed a different pattern in the 1980s. Tomakomai JFUA, which moved very little during the 1980s, is located in the Hokkaido region. On the other hand, the Atsugi JFUA, which moved up the ranks in both the 1970s and 1980s, is in the Kanto region.

To focus on the JFUAs that fell down the size rankings in the 1970s and 1980s, there are several comments that can be made. In the two decades, the characteristics are the same. Mainly, JFUAs in Tohoku and Kyushu-Okinawa regions showed a decline in their rank. Not only small JFUAs, but also medium-sized JFUAs showed a decline. They are known as the old industrial centres of steel and shipbuilding such as Muroran JFUA and Kure JFUA. Kure JFUA slipped from 53 to 63 in the 1970s and Muroran JFUA from 73 to 87 in the 1980s.

4.7.2. The Characteristics of JFUAs with a High Degree of Population Growth

Table 4-7 shows the 15 JFUAs with the largest gains in population. In the 1970s, all of these were JFUAs with prefectural capital cities. In addition, nine JFUAs out of the top 15 JFUAs were those categorised as Largest JFUAs in

section 4.4 above[34] including the Ku-Areas of Tokyo-to JFUA which gained over 4 million inhabitants in the 1970s, and a further 2 million in the 1980s. This is consistent with the more general finding described above that larger settlements showed greater population gains, in contrast to the situation in the US and UK in the 1970s.

Table 4-7: The Fastest Growing JFUAs in Absolute Terms

4-7A: 1970s

Rank	Number of Pop.Change	JFUA Name	JFUA Code	Region	Size	1970 Rank	1980 Rank	1990 Rank
1	4,115,864	Ku-Areas of Tokyo-to JFUA	51	Kanto	Largest	1	1	1
2	1,167,914	Osaka JFUA	99	Kinki	Largest	2	2	2
3	566,383	Nagoya JFUA	83	Chubu	Largest	3	3	3
4	453,987	Sapporo JFUA	1	Hokkaido	Largest	8	7	6
5	444,719	Fukuoka JFUA	132	Kyushu-Okinawa	Largest	6	6	7
6	331,102	Kyoto JFUA	96	Kinki	Largest	4	4	4
7	243,835	Sendai JFUA	18	Tohoku	Largest	10	10	9
8	241,229	Kobe JFUA	100	Kinki	Largest	5	5	5
9	229,693	Hiroshima JFUA	112	Chugoku	Largest	9	9	10
10	125,918	Naha JFUA	153	Kyushu-Okinawa	Large	28	22	22
11	118,408	Utsunomiya JFUA	36	Kanto	Large	18	17	17
12	117,252	Okayama JFUA	109	Chugoku	Large	15	15	14
13	114,779	Kumamoto JFUA	142	Kyushu-Okinawa	Large	14	13	12
14	114,738	Gifu JFUA	75	Chubu	Large	16	16	16
15	109,596	Kagoshima JFUA	150	Kyushu-Okinawa	Large	19	19	20

4-7B: 1980s

Rank	Number of Pop.Change	JFUA Name	JFUA Code	Region	Size	1970 Rank	1980 Rank	1990 Rank
1	2,638,123	Ku-Areas of Tokyo-to JFUA	51	Kanto	Largest	1	1	1
2	704,826	Osaka JFUA	99	Kinki	Largest	2	2	2
3	304,625	Nagoya JFUA	83	Chubu	Largest	3	3	3
4	297,071	Sapporo JFUA	1	Hokkaido	Largest	8	7	6
5	243,231	Fukuoka JFUA	132	Kyushu-Okinawa	Largest	6	6	7
6	178,556	Sendai JFUA	18	Tohoku	Largest	10	10	9
7	158,800	Kobe JFUA	100	Kinki	Largest	5	5	5
8	132,198	Kyoto JFUA	96	Kinki	Largest	4	4	4
9	117,895	Hiroshima JFUA	112	Chugoku	Largest	9	9	10
10	86,154	Tsuchiura JFUA	33	Kanto	Medium-Sized	61	52	40
11	85,731	Kumamoto JFUA	142	Kyushu-Okinawa	Large	14	13	12
12	81,410	Atsugi JFUA	52	Kanto	Medium-Sized	109	70	61
13	79,845	Utsunomiya JFUA	36	Kanto	Large	18	17	17
14	64,359	Hamamatsu JFUA	79	Chubu	Large	17	18	18
15	64,175	Naha JFUA	153	Kyushu-Okinawa	Large	28	22	22

Source: Author

[34] However, Kitakyushu JFUA, one of the largest JFUAs, did not rank in this group. This JFUA is the only one largest JFUA that does not have a prefectural capital city.

A new tendency was observed in the 1980s when three JFUAs without prefectural capital cities entered the top 15, the Atsugi, Narita and Hamamatsu JFUAs. These three JFUAs have two characteristics. Firstly, Tsuchiura and Atsugi JFUAs are the Medium-Sized JFUA, and are smaller JFUAs than other JFUAs in the top15. This means that these JFUAs recorded outstandingly fast growth. Secondly, these three JFUAs without prefectural capital cities have a geographical characteristic. They are closely located to the metropolitan areas. The Tsuchiura and Atsugi JFUAs are located in the Kanto region, adjacent to the largest JFUA called the Ku-Areas of Tokyo-to JFUA. Hamamatsu JFUA is located between Tokyo and Nagoya and this area is the centre of the exporting industries, and machine manufacturing.

Table 4-8 shows the 15 JFUAs with the fastest growth in percentage terms. The first finding is a regional disparity with JFUAs in the Kanto region having the highest growth rates. In the 1970s, 6 JFUAs out of this top 15 were located in this region, this number increased to seven in the 1980s. In addition, in the 1980s, the top four fastest growing JFUAs were in the Kanto region. The second finding is that JFUAs with prefectural capital cities had a relevant importance within this group. In the 1970s, five JFUAs in the top 15 were JFUAs with prefectural capital cities, the number decreased to three in the 1980s. These three JFUAs are treated as the centres of their region, Sapporo, Sendai and Fukuoka. The third finding, related to the first, is that the fast-growing JFUAs in this group located near the largest JFUAs showed a faster growth. These JFUAs in the Kanto region and are located near the Ku-Areas of Tokyo-to or Nagoya JFUAs. The Atsugi JFUA grew rapidly in the 1970s and the 1980s, by 68% growth and 35% respectively.

Table 4-8: The Fastest Growing JFUAs in % Terms

4-8A: 1970s

Rank	Growth Rate (%)	JFUA Name	JFUA Code	Region	Size	1970 Rank	1980 Rank	1990 Rank
1	68.2	Atsugi JFUA	52	Kanto	Medium-Sized	109	70	61
2	42.3	Tomakomai JFUA	7	Hokkaido	Small	120	94	94
3	35.6	Toyota JFUA	86	Chubu	Medium-Sized	66	58	49
4	33.6	Sapporo JFUA	1	Hokkaido	Largest	8	7	6
5	32.2	Higashihiroshima JFUA	116	Chugoku	Small	150	144	136
6	31.9	Fukuoka JFUA	132	Kyushu-Okinawa	Largest	6	6	7
7	26.4	Katsuta JFUA	35	Kanto	Small	137	125	122
8	25.8	Narita JFUA	49	Kanto	Small	102	89	78
9	25.7	Naha JFUA	153	Kyushu-Okinawa	Large	28	22	22
10	25.1	Mooka JFUA	40	Kanto	Small	154	151	149
11	24.71	Sendai JFUA	18	Tohoku	Largest	10	10	9
12	24.66	Tsuchiura JFUA	33	Kanto	Medium-Sized	61	52	40
13	24.5	Ota JFUA	46	Kanto	Small	90	81	73
14	23.0	Miyazaki JFUA	147	Kyushu-Okinawa	Medium-Sized	55	48	45
15	22.9	Anjo JFUA	87	Chubu	Small	104	93	86

4-8B: 1980s

Rank	Growth Rate (%)	JFUA Name	JFUA Code	Region	Size	1970 Rank	1980 Rank	1990 Rank
1	32.7	Atsugi JFUA	52	Kanto	Medium-Sized	109	70	61
2	22.6	Tsuchiura JFUA	33	Kanto	Medium-Sized	61	52	40
3	20.7	Narita JFUA	49	Kanto	Small	102	89	78
4	19.5	Koyama JFUA	39	Kanto	Small	101	90	79
5	18.5	Higashihiroshima JFUA	116	Chugoku	Small	150	144	136
6	16.9	Toyota JFUA	86	Chubu	Medium-Sized	66	58	49
7	16.5	Sapporo JFUA	1	Hokkaido	Largest	8	7	6
8	15.4	Chitose JFUA	8	Hokkaido	Small	152	153	151
9	15.0	Mooka JFUA	40	Kanto	Small	154	151	149
10	14.6	Ota JFUA	46	Kanto	Small	90	81	73
11	14.5	Sendai JFUA	18	Tohoku	Largest	10	10	9
12	13.5	Iwata JFUA	82	Chubu	Small	121	112	104
13	13.2	Fukuoka JFUA	132	Kyushu-Okinawa	Largest	6	6	7
14	12.8	Katsuta JFUA	35	Kanto	Small	137	125	122
15	12.6	Handa JFUA	84	Chubu	Small	123	115	109

Source: Author

On the other hand, no JFUA in Shikoku and Kinki regions entered in this group in the two decades. In addition, JFUAs without a prefectural capital city of this group were polarised because they are located in only four regions; Hokkaido, Kanto, Chubu and Kyushu-Okinawa regions.

4.7.3. The Characteristics of JFUAs with a Low Degree of Population Growth

Table 4-9 shows the 15 JFUAs that recorded the lowest population growth in the 1970s and 1980s. At this other end of the scale, the 15 JFUAs that recorded the smallest population gains showed rather different characteristics. In contrast to the JFUAs that recorded massive population growth in absolute terms, no JFUA which was a prefectural capital city appeared in the bottom 15 in the two decades in question.

Table 4-9: The Slowest Growing JFUAs in Absolute Terms

4-9A: 1970s

Rank	Number of Pop.Change	JFUA Name	JFUA Code	Region	Size	1970 Rank	1980 Rank	1990 Rank
1	-6,083	Omuta JFUA	133	Kyushu-Okinawa	Medium-Sized	63	67	70
2	-3,151	Joetsu JFUA	57	Chubu	Small	65	69	71
3	-2,335	Odate JFUA	23	Tohoku	Small	138	143	148
4	-1,933	Hita JFUA	146	Kyushu-Okinawa	Small	145	149	152
5	-1,902	Imari JFUA	138	Kyushu-Okinawa	Small	149	152	153
6	-1,783	Uwajima JFUA	128	Shikoku	Small	117	124	128
7	-1,607	Yonezawa JFUA	25	Tohoku	Small	111	116	118
8	-303	Kashiwazaki JFUA	56	Chubu	Small	132	135	135
9	-228	Tsuruoka JFUA	26	Tohoku	Small	96	108	112
10	1,048	Karatsu JFUA	137	Kyushu-Okinawa	Small	107	113	116
11	1,222	Ichinoseki JFUA	17	Tohoku	Small	126	129	130
12	1,482	Yatsushiro JFUA	143	Kyushu-Okinawa	Small	93	102	107
13	1,518	Mihara JFUA	114	Chugoku	Small	142	146	145
14	1,984	Fukuchiyama JFUA	97	Kinki	Small	116	123	124
15	2,044	Sendai JFUA	151	Kyushu-Okinawa	Small	130	133	131

4-9B: 1980s

Rank	Number of Pop.Change	JFUA Name	JFUA Code	Region	Size	1970 Rank	1980 Rank	1990 Rank
1	-33,686	Muroran JFUA	4	Hokkaido	Small	69	73	87
2	-17,481	Kure JFUA	113	Chugoku	Medium-Sized	53	62	63
3	-14,813	Omuta JFUA	133	Kyushu-Okinawa	Medium-Sized	63	67	70
4	-12,052	Hakodate JFUA	2	Hokkaido	Medium-Sized	47	46	55
5	-10,826	Shimonoseki JFUA	117	Chugoku	Medium-Sized	51	57	59
6	-8,765	Hirosaki JFUA	10	Tohoku	Medium-Sized	54	61	62
7	-7,603	Uwajima JFUA	128	Shikoku	Small	117	124	128
8	-7,182	Nobeoka JFUA	149	Kyushu-Okinawa	Small	100	103	111
9	-6,824	Sasebo JFUA	140	Kyushu-Okinawa	Medium-Sized	60	63	65
10	-5,452	Odate JFUA	23	Tohoku	Small	138	143	148
11	-5,185	Tokuyama JFUA	120	Chugoku	Medium-Sized	68	66	68
12	-4,986	Iwakuni JFUA	121	Chugoku	Small	98	104	108
13	-4,906	Joetsu JFUA	57	Chubu	Small	65	69	71
14	-4,848	Yatsushiro JFUA	143	Kyushu-Okinawa	Small	93	102	107
15	-4,797	Kesennuma JFUA	21	Tohoku	Small	135	137	141

Source: Author

In the 1970s, only nine JFUAs recorded a population loss in absolute terms. There were two features of the fifteen JFUAs in the slowest growing group. Firstly, except Omuta JFUA, 14 out of the 15 JFUAs were categorised as 'Small JFUAs'. Secondly, looking at the regional distribution of the JFUAs, it turned out that 9 of them were located in the Kyushu-Okinawa region and another 4 were in the Tohoku region.

Table 4-10: The Slowest Growing JFUAs in % Terms

4-10A: 1970s

Rank	Growth Rate (%)	JFUA Name	JFUA Code	Region	Size	1970 Rank	1980 Rank	1990 Rank
1	-2.5	Imari JFUA	138	Kyushu-Okinawa	Small	149	152	153
2	-2.4	Odate JFUA	23	Tohoku	Small	138	143	148
3	-2.3	Hita JFUA	146	Kyushu-Okinawa	Small	145	149	152
4	-2.2	Omuta JFUA	133	Kyushu-Okinawa	Medium-Sized	63	67	70
5	-1.4	Uwajima JFUA	128	Shikoku	Small	117	124	128
6	-1.2	Joetsu JFUA	57	Chubu	Small	65	69	71
7	-1.1	Yonezawa JFUA	25	Tohoku	Small	111	116	118
8	-0.3	Kashiwazaki JFUA	56	Chubu	Small	132	135	135
9	-0.1	Tsuruoka JFUA	26	Tohoku	Small	96	108	112
10	0.7	Karatsu JFUA	137	Kyushu-Okinawa	Small	107	113	116
11	0.89	Yatsushiro JFUA	143	Kyushu-Okinawa	Small	93	102	107
12	0.90	Kure JFUA	113	Chugoku	Medium-Sized	53	62	63
13	1.06	Ichinoseki JFUA	17	Tohoku	Small	126	129	130
14	1.12	Sasebo JFUA	140	Kyushu-Okinawa	Medium-Sized	60	63	65
15	1.4	Muroran JFUA	4	Hokkaido	Small	69	73	87

4-10B: 1980s

Rank	Growth Rate (%)	JFUA Name	JFUA Code	Region	Size	1970 Rank	1980 Rank	1990 Rank
1	-14.0	Muroran JFUA	4	Hokkaido	Small	69	73	87
2	-5.9	Uwajima JFUA	128	Shikoku	Small	117	124	128
3	-5.7	Odate JFUA	23	Tohoku	Small	138	143	148
4	-5.5	Omuta JFUA	133	Kyushu-Okinawa	Medium-Sized	63	67	70
5	-5.2	Kure JFUA	113	Chugoku	Medium-Sized	53	62	63
6	-4.5	Kesennuma JFUA	21	Tohoku	Small	135	137	141
7	-4.3	Nobeoka JFUA	149	Kyushu-Okinawa	Small	100	103	111
8	-3.1	Shimonoseki JFUA	117	Chugoku	Medium-Sized	51	57	59
9	-3.05	Hakodate JFUA	2	Hokkaido	Medium-Sized	47	46	55
10	-3.03	Okaya JFUA	70	Chubu	Small	129	131	137
11	-2.97	Iwakuni JFUA	121	Chugoku	Small	98	104	108
12	-2.88	Yatsushiro JFUA	143	Kyushu-Okinawa	Small	93	102	107
13	-2.63	Sakata JFUA	27	Tohoku	Small	91	100	105
14	-2.59	Hirosaki JFUA	10	Tohoku	Medium-Sized	54	61	62
15	-2.57	Hita JFUA	146	Kyushu-Okinawa	Small	145	149	152

Source: Author

In the 1980s, more JFUAs experienced population loss than in the 1970s. Five JFUAs each lost over 10,000 inhabitants in the 1980s. To compare this situation with the 1970s, 7 Medium-Sized JFUAs entered this group, for example Kure JFUA and Hakodate JFUA. All large JFUAs were categorised as old industrial centres, and the tendency towards decline was observed in these places.

Table 4-10 showed the 15 JFUAs that recorded the lowest population growth in percentage terms. In the 1970s, some Large JFUAs had already appeared in the lowest population growth group, Kure and Muroran being good examples. In the 1980s, though the ranking was slightly different, the characteristics of the group as a whole did not change. There was also no JFUA with a prefectural capital city in this group.

4.7.4. Comments

Some regional JFUAs went up in rank. These were mostly those close to the Largest JFUAs. The Atsugi, Tsuchiura, and Narita JFUAs are located near to the Ku-Areas of Tokyo-to JFUA and the Toyota and Anjo JFUAs are close to the Nagoya JFUA. Another characteristic is that the prefectural capitals showed high growth, especially those which were also the regional centres, e.g. Sapporo, Sendai and Fukuoka. They grew fast in both absolute and relative terms. The largest JFUA recorded massive population growth in absolute terms; the Ku-Areas of Tokyo-to JFUA increased by over six million in the two decades.

On the other hand, some JFUAs showed less growth or even a decline in the two decades, and most of these were local JFUAs without a prefectural capital city. In the 1980s, the old industrial centres showed a decline in absolute terms. The Kure and Muroran JFUAs are good example. In relative terms, a decline of the old industrial centres was clearly observed in the 1970s and 1980s.

4.8. JFUAs with Prefectural Capital Cities

From previous sections 4.6 and 4.7, it was found that some JFUAs with prefectural capital cities showed higher level of population growth. The prefectural capital cities are the political centre of each prefecture, therefore, these cities have an important regional role. To understand this role of JFUAs with prefectural capital cities compared to the regions or prefectures, the characteristics of the JFUAs with prefectural capital cities are shown in this section.

As the first point, it should be mentioned that most JFUAs with prefectural capital cities are the largest JFUAs in their prefecture except two JFUAs with a prefectural capital city; Mie and Yamaguchi. In the Mie prefecture, the Tsu JFUA which contains the prefectural capital city is smaller than the Yokkaichi JFUA. Yokkaichi is one of the major centres of the petrochemical industry in Japan. Another exception is the Yamaguchi prefecture, in which the Shimonoseki JFUA is larger than the Yamaguchi JFUA although the latter contains the prefectural capital city. Shimonoseki is on the border between Kyushu and Honshu and acts as the transport hub for the region.

Table 4-11 shows what the percentage of the JFUA population with prefectural capital cities is of the total prefectural population in each decade. This table also shows other characteristics of the JFUAs with a prefectural capital city.[35]

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[35] In Table 4-11, four JFUAs with prefectural capital cities were excluded because they contain local authorities that overlap the prefectural border. The four JFUAs are as follows; the Ku-Areas of Tokyo-to (Saitama, Chiba, Tokyo, and Kanagawa), the Nagoya (Aichi, Gifu and Mie), the Kyoto (Shiga and Kyoto), and the Osaka (Kyoto, Osaka, Hyogo, Nara and Wakayama) JFUAs.

Table 4-11: The Ratio of the JFUAs with a Prefectural Capital City Compared to the Prefectural Population Total (%)

Name	1970 JFUA/Pre	1980 JFUA/Pre	1990 JFUA/Pre	1970s Change	1980s Change
Sapporo JFUA	26.0	32.4	37.3	6.3	4.9
Aomori JFUA	20.7	22.4	22.7	1.7	0.3
Morioka JFUA	24.6	28.3	30.9	3.6	2.6
Sendai JFUA	54.2	59.1	62.9	4.9	3.7
Akita JFUA	32.3	35.4	37.1	3.1	1.7
Yamagata JFUA	29.8	32.5	33.7	2.7	1.2
Fukushima JFUA	20.7	21.5	21.5	0.8	-0.1
Mito JFUA	19.2	18.4	17.7	-0.7	-0.7
Utsunomiya JFUA	39.0	41.0	42.1	2.0	1.1
Maebashi JFUA	22.2	22.3	22.6	0.1	0.3
Niigata JFUA	34.5	37.3	38.9	2.8	1.6
Toyama JFUA	48.6	50.2	51.2	1.6	1.0
Kanazawa JFUA	55.9	59.6	62.2	3.7	2.6
Fukui JFUA	57.2	57.8	57.8	0.6	0.0
Kofu JFUA	65.1	67.5	68.7	2.5	1.2
Nagano JFUA	25.8	26.7	26.9	0.8	0.2
Gifu JFUA	41.0	42.6	42.9	1.7	0.2
Shizuoka JFUA	27.0	27.0	26.4	0.0	-0.6
Tsu JFUA	16.2	16.6	16.7	0.4	0.1
Kobe JFUA	37.0	38.4	39.5	1.3	1.2
Wakayama JFUA	53.5	55.4	56.1	2.0	0.7
Tottori JFUA	40.1	39.7	40.4	-0.4	0.7
Matsue JFUA	25.8	27.8	28.9	2.0	1.2
Okayama JFUA	43.5	46.0	47.4	2.5	1.4
Hiroshima JFUA	43.2	46.8	49.2	3.6	2.4
Yamaguchi JFUA	10.0	10.3	11.4	0.4	1.0
Tokushima JFUA	64.0	68.0	70.4	4.0	2.4
Takamatsu JFUA	49.9	51.9	53.1	2.0	1.2
Matsuyama JFUA	31.9	36.4	39.3	4.5	2.9
Kochi JFUA	57.1	61.4	64.2	4.3	2.7
Fukuoka JFUA	34.7	40.5	43.5	5.8	3.0
Saga JFUA	44.0	44.5	45.0	0.5	0.5
Nagasaki JFUA	32.6	35.0	36.3	2.4	1.3
Kumamoto JFUA	45.0	49.1	52.5	4.2	3.4
Oita JFUA	46.8	52.8	55.3	6.0	2.6
Miyazaki JFUA	30.3	34.0	36.6	3.7	2.5
Kagoshima JFUA	33.0	38.1	40.0	5.1	1.9
Naha JFUA	51.9	55.7	56.0	3.9	0.3

Source: Author

The first characteristic of this group is that JFUAs including a prefectural capital city showed a concentration of population compared to the total prefectural population. Only six JFUAs with prefectural capital cities contained less than 25% of the prefectural total in 1990. The smallest proportion was observed in the Yamaguchi prefecture. Although the Yamaguchi JFUA contains a prefectural capital city, it had only 11.4% of the prefectural population in 1990. On the other hand, 21 JFUAs had over 40% of the total prefectural population in this year. The highest concentration was recorded in the Tokushima prefecture, of which the Tokushima JFUA contains 70.4% of the total prefectural population.

The second is that most of these 38 JFUAs showed a tendency towards concentration of population in the two decades. In each decade there were only three JFUAs of this group which decreased their proportion. In the 1970s, Mito in Ibaraki prefecture, Shizuoka in Shizuoka prefecture and Tottori in Tottori prefecture did not show an increasing concentration. In the 1980s, Fukushima in Fukushima prefecture, Mito in Ibaraki prefecture and Shizuoka in Shizuoka prefecture recorded a declining share.

4.9. The Japanese Urban Settlement System 1970-1990

In the previous sections, the basic characteristics of the Japanese urban settlements were examined. To make them clear, this section tries to summarise the changing pattern of the Japanese settlement system in the two decades.

4.9.1. Changes in the 1970s

The largest JFUAs comprising the three metropolitan areas recorded massive population gains. The three metropolitan areas of Japan recorded population growth, although the core cities of the metropolitan areas, i.e. the Ku-Areas of Tokyo-to and Osaka, recorded a decline in their residential population. Additionally, some small JFUAs recorded rapid growth in this decade. Most of these were located near the Largest JFUAs. The Atsugi JFUA, which showed the highest population growth rate in the 1970s, is neighbouring the Ku-Areas of Tokyo-to JFUA. The JFUAs that surrounded Nagoya JFUA showed a similar pattern.

In this decade, the Largest JFUAs outside the three metropolitan areas grew faster than the largest JFUAs that comprised these areas. These JFUAs were Sapporo, Sendai, Hiroshima and Fukuoka, which in this study are treated not only as JFUAs with prefectural capital cities but also as the centre of their regions. Sapporo is the centre of Hokkaido, and Sendai of Tohoku. In southern Japan, Hiroshima is the centre of the Chugoku and Shikoku region, and Fukuoka is the regional core of the Kyushu-Okinawa region.

To focus on the change at the prefectural level, settlement change was observed as follows. JFUAs with prefectural capital cities showed a population growth. In addition, most JFUAs with a prefectural capital cities increased their proportion of the total prefectural population. Some JFUAs with prefectural capital cities showed a rapid upward movement in the overall ranking of JFUAs by size in this decade. In this sense, this was the process of concentration into prefectural centres.

On the other hand, JFUAs without a prefectural capital city and remote to the three metropolitan areas showed a relative stagnation in terms of population growth. In addition, it has to be mentioned that old regional manufacturing centres

featured strongly in this group of declining JFUAs. Most of these JFUAs were dependent on traditional industries such as shipbuilding and steel. In the 1970s, there were nine JFUAs that showed population loss. Most of these were smaller settlements and none contained prefectural capital cities.

4.9.2. Changes in the 1980s

In the 1980s, the Japanese settlement system underwent a transformation with clear regional differences in pattern. In this decade, most JFUAs that showed a population growth pattern were located in the Kanto region. These JFUAs surrounding the Ku-Areas of Tokyo-to JFUA grew rapidly. The Ku-Areas of Tokyo-to JFUA, the largest JFUA, showed a massive population gain in the 1980s. On the other hand, Osaka and Nagoya JFUAs, the second and third largest respectively, did not grow as fast as the Tokyo area. This shows that there was 'Unipolar Concentration into the Tokyo Area'.

Except for the expansion of the Tokyo area, the general tendencies of the growth pattern had not changed since the 1970s. The first such tendency was that concentration continued into the JFUAs with the regional centres, e.g. Sapporo, Sendai, Hiroshima and Fukuoka. These JFUAs showed a faster growth in absolute and relative terms. The second point is that most JFUAs with prefectural capital cities did not suffer population loss, except for the Aomori JFUA.[36] However, most JFUAs with prefectural capital cities showed positive growth, and they contained the biggest proportion of their prefecture's total population. The third point is that regional JFUAs without prefectural capital cities did not grow so fast. Some of such JFUAs suffered a population loss. The number of the JFUAs in the population decline group increased from 9 in the 1970s to 38 in the 1980s.

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[36] Aomori JFUA grew in the core and overall in the 1970s, however, Aomori, the prefectural capital city, suffered population loss in the 1980s.

4.10. Conclusion

This chapter investigates the general aspects of population change based on the JFUA definition. From this, it is clear that the changing pattern of the Japanese urban settlement in the 1970s and 1980s was quite distinct from the US and UK settlement systems that were observed over the same period.

Firstly, overall the 154 JFUAs showed population increase during the two decades. While the overall growth and the balance of that growth between the larger and medium to smaller urban regions was different, the changing balance between cores and rings was more similar to the US and UK. The population in the JFUA rings has exceeded that in the JFUA cores since 1980, a phenomenon which was observed in the 1970s in the UK (Hall and Hay, 1980; van den Berg et al., 1982).

Secondly, a positive relationship between settlement size and growth rate was observed when the 154 JFUAs were classified into four groups by settlement size. In this respect it can be said that the Japanese settlement system showed a different pattern of settlement change from the US and UK settlement systems in the 1970s. In the US and UK, the largest settlements in the 1970s suffered a population loss and the smaller settlements (or non-metropolitan area) recorded higher population gain. According to Fielding (1982) and Champion (1989), the counterurbanisaton shows a negative relationship between settlement size and the population gains by internal migration. It is difficult to apply precisely the same definition to the Japanese urban settlement system because data for the internal migration pattern are not available.

Thirdly, the characteristics of the 154 JFUA population in terms of geographical context were also examined. From the examination, the Kanto and Kinki regions, showed a high degree of JFUA population growth. In these regions, the JFUA populations constituted a high proportion of the total regions and the JFUA rings were more populous than the JFUA cores. On the other hand, the

Tohoku and Hokkaido regions showed a different pattern. Here, the JFUA cores still enjoyed a higher growth than the rings, and the ratio of JFUA population compared to its total regional value was relatively low.

This chapter also examined the specific characteristics of the fastest and slowest growing JFUAs. The JFUAs in the fastest growth group could be classified into two types. The first type was the JFUAs located near the largest JFUAs, especially the Ku-Areas of Tokyo-to JFUA. The Atsugi and Tsuchiura JFUAs are good examples. The second type was JFUAs with prefectural capital cities. Not all such JFUAs showed rapid growth in absolute terms, but most grew in relation to their prefecture. On the other hand, regional JFUAs stagnated in the 1980s, and some actually suffered population loss. Some JFUAs traditionally known as industrial centres also faced stagnation, a good example being Muroran. This area is well known as a steel production centre, and the decline of this industry may have influenced the growth pattern. As a result, this JFUA had suffered a population loss for the last two decades.

Chapter 5: The City Size Distribution and Japanese Urban Settlements

5.1. Introduction

In Chapter 3, several definitions of the Japanese urban areas were examined and an original definition of the Japanese functional urban regions, i.e. the Japanese Functional Urban Area (JFUA), was established. This definition is designed to handle the Japanese urban settlement system and it will be used as the basic statistical unit for the Japanese urban settlement analysis.

As a tool for analysing the pattern of the national settlement system, it is useful to examine the city size distribution. Although its origin can be found in Auerbach (1913), they are more commonly attributed to the work of Zipf (1949). He mentioned that the settlement distribution pattern showed a special relationship between settlement size and rank, which he called the 'urban rank-size rule.' Much of the subsequent researches into this rule have gone into the discussion involving the establishment of criteria by which to judge the applicability of the 'urban rank-size rule'. Other researches have applied the city size distribution to settlement systems for international comparative studies. Therefore, it is interesting to examine the city size distribution of the Japanese settlement system.

The main purpose of this chapter is to explain the Japanese settlement system by means of the city size distribution, and to test the sensitivity of the results in order to compare them to alternative definitions of urban areas and different thresholds of population size. There are several problems when this rule is applied to the Japanese settlement system. Some of the problems are caused by specific

Japanese circumstances, and others are methodological. The former problems are mainly from data availability, and the latter are due to the actual empirical analysis.

There are three parts to this chapter. The first part outlines the development of the 'urban rank-size rule'. This section deals with three topics; the basic concept of the city size distribution and the 'urban rank-size rule', the development of theories, and an examination of some studies that applied this rule to settlement systems. In addition, previous studies on the Japanese settlement system will be investigated and discussed in this section. The second section examines the methodology and involves modification and finding problems with the various methods of sample taking for the urban system, used by previous researchers, for application to the Japanese settlement system. In this part, various types of sensitivity test for the city size distribution will be examined. The third part analyses the changes in the city size distribution in the Japanese settlement system between 1970 and 1990.

5.2. The Development of the City Size Distribution

This section examines the development of the city size distribution and the 'urban rank-size rule'. In section 5.2.1, the concept of the city size distribution and the 'urban rank-size rule' will be introduced. The subsequent three sections will review various relevant studies.

5.2.1. The City Size Distribution and the 'Urban Rank-Size Rule'

The city size distribution, which focuses on the relationship between urban settlement size and its rank within the hierarchy of the urbanisation, is widely used by urban economists and geographers. A paper on this topic written by Auerbach in 1913, examining the size distribution of the German settlement system, was probably the first study of this type.

Singer (1936) showed that the city size distribution could be expressed as a Pareto distribution. The equation of a Pareto distribution is as follows;

$$y = Ax^{-\alpha} \qquad \text{--- (1)}$$

or

$$\log y = \log A - \alpha \log x \qquad \text{--- (1')}$$

x: Population of city

y: Number of cities with population greater than x

α: Pareto exponent

A: Constant

Zipf (1949) developed the application of the Pareto distribution of city sizes further. He concluded that the distribution of city sizes took a special form of the Pareto distribution, which meets the following two criteria simultaneously. The first is that the Pareto exponent equals 1, and the other criterion is that the constant A equals the population of the largest city. This case has become well known as the 'urban rank-size rule'.

After Zipf (1949), many researchers developed this approach and applied this method to a wide range of settlement systems. For example, Madden (1956) showed the changing US city size distribution from 1790 to 1950. In a European study, Hall and Hay (1980) showed the urban rank size distribution for 15 European countries although they did not analyse this aspect of the European settlement system in any detail.

5.2.2. Economic Development and the City Size Distribution

The city size distribution is widely used for international comparative studies of population distribution in the urban settlement system. Berry (1961) examined the settlement distribution pattern of 37 countries. On the basis of this analysis, he classified these countries into three groups. The first group satisfies the 'urban rank-size rule'. Thirteen countries were identified in this group and they showed a 'lognormal' distribution pattern. Fifteen countries were treated as the second group that displayed a 'primate' urban hierarchy. A 'primate' pattern was defined as one in which the largest cities dominated the country's urban settlement pattern. This pattern can be observed particularly in developing countries. The third group was placed between the two groups, and was called an 'intermediate' pattern. Berry argued that there was a relationship between different distribution patterns and the level of economic development in each country but could not find any clear relationship between the distribution pattern and their economic development.

The city size distribution has also been used to investigate the dynamics of settlement patterns in different periods. Parr (1985) examined the change of the Pareto exponent in twelve countries over a period of seventy years. He demonstrated a relationship between the city size distribution and the level of economic development, and then classified them into three patterns from the change

in the Pareto exponent. The first pattern is observed in developing countries. In these countries, the exponent had decreased for all periods, indicating a continuing process of concentration. The second pattern was identified in countries where the exponent had shown falling values initially, and then had changed to a slight increase. This suggested that the level of concentration was gradually declining. The last pattern exhibited a clear U-shape: that is the exponent declined in the early years, and later had clearly increased. These countries were the developed European countries and the US. This U-shaped change of the Pareto exponent over a number of years was also examined by Alperovich (1992).

5.2.3. Validity of the 'Urban Rank-Size Rule'

Dziewonski (1972) asserted that the city distribution was 'a very useful tool for the analysis of settlements systems', and the city size distribution has been widely used and the urban rank-size rule widely accepted. Some researchers, however, have examined whether the 'urban rank-size rule' is appropriate or not.

Rosen and Resnick (1980) examined the city size distribution of the 50 largest urban areas in 44 countries. This study covered a wide range of relevant topics. They estimated a range of values of the Pareto exponent, from Morocco (0.809) to Australia (1.963). The simple mean of the exponent was 1.14 and in 32 countries out of 44 exceeded unity. The value of the Pareto exponent would be 1 under the 'urban rank-size rule'. From the results, these 32 countries can be treated as more equally distributed nations in the terms of population distribution, and validity of the 'urban rank-size rule' appears to be open to question.[37]

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[37] Rosen and Resnick also studied the development of the form of the city size distribution.

Alperovich investigated the validity of the rule by using several tests (1984, 1988, 1989). He selected 15 countries and examined the validity of the rank size rule for all cities having over 100,000 inhabitants (1984). The urban rank size rule is valid only when the Pareto exponent equals 1 and the constant A equals the population of the largest city. From statistical tests, he concluded that the distribution of most countries did not support the rank size rule. According to his later paper, written in 1988, he examined the validity of the rank size rule for 17 countries. From this examination, he found that, from a statistical point of view, the 'urban rank-size rule' could not be rejected only in the US and Poland. In 1989, he examined the sensitivity of the Pareto exponent for the US settlement system based on the Metropolitan Statistical Area (MSA), i.e. the functional urban regions for the US settlement, in 1970 and 1980.

Hsing (1990) examined the city size distribution for the US settlement system based on 318 US SMSAs in 1980. He suggested that the simple log linear Pareto distribution does not provide a good fit for the settlement distribution.[38]

5.2.4. Settlements for the Analysis of City Size Distribution

Dziewonski (1972) noted that the form of settlement distribution was affected by the sample of the settlement system to which the distribution was applied. In other words, the settlement distribution patterns estimated on the basis of only large settlements might be different from that based on a large number of settlements including smaller settlements. The estimates of the coefficient of the Pareto distribution are sensitive to the cut-off point applied to settlement size.

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[38] Therefore, he suggested that the functional form, first developed by Box and Cox (1964), was more suitable than the simple log linear Pareto distribution. The development of the Pareto distribution form is also discussed in Cameron (1990).

Rosen and Resnick (1980) systematically examined the sensitivity of the city size distribution comparing it to the definition of the settlement system. They looked at two tests for data definition for the distribution. The first test was to compare the Pareto exponent based on administratively defined urban areas, with the exponent based on functional urban areas. They compared this test for six countries out of 44 countries where data for both definitions of a city were available. The result was that the exponent values estimated on the basis of data for functional urban areas showed smaller values than the exponent based on administratively defined urban areas. The mean of the Pareto exponent for six countries from the functionally defined metropolitan areas was 0.995 while that of the exponent values based on 'city proper' data was 1.181. The difference of these two values was 0.186, and this indicates 15% difference in relative terms. The second finding was that the Pareto exponent based on the functional definitions was much closer to 1. In other words when defined using functional criteria, the city size distribution conforms more closely to the value of the Pareto exponent of the 'urban rank-size rule'. Although the result demonstrated the disadvantage of administratively defined 'city proper' data, they used the 'city proper' data because of its availability.

The second test of Rosen and Resnick was about the different ways of sampling the settlement system. They examined the effects of varying size of the sample of settlements. On the assumption that administrative boundaries appropriately defined the urban system, they compared two criteria, a fixed number of cities and a threshold population, for choosing the sample to which to fit the city size distribution. They compared the Pareto exponent of the 50 largest cities with the exponent of all cities having 100,000 or more inhabitants. This test was examined for six countries and showed a variety of differences between the two criteria. In USSR, the Pareto exponent estimated on the basis of only the 50 largest urban settlements showed a 19.6% lower value than that estimated on the basis of

all urban settlements exceeding 100,000 inhabitants. On the other hand, in Japan, the exponent of the 50 largest cities was 8.9% higher than that of cities with 100,000 or more inhabitants. These results point out the importance of the right choice of sample size.

Malecki (1980) also analysed the relationship between the choice of sample and estimated value of the Pareto exponent for the city size distribution in another study of the US settlement system. He examined the American Midwest settlement system from 1940 to 1970. Using 1970 data, he showed the changing rank size parameters for different threshold populations. He showed how threshold size has effects on the city size distribution, and how attempts to fit an 'urban rank-size rule' to a small set of large cities would result in a notably different characterisation of an urban system than would result from an analysis on a larger set that included smaller places.

Guérin-Pace (1995) investigated how the estimated coefficients for the Pareto distribution varied with sample size, using six thresholds between 2,000 and 100,000 in the context of the French settlement system between 1831 and 1982. This study showed the different aspects of development of the French settlement system. In the case of smaller thresholds, i.e. less than 20,000, the slope parameter ($=1/\alpha$) increased continuously between four censuses, 1831, 1881, 1931 and 1982. This result would indicate that the French settlement system had been in a progressive concentration of the population towards the largest cities. On the other hand, the estimated slope parameter with thresholds over 50,000 had been decreasing in each of the same four censuses since 1831. This would indicate a reduction of the concentration of population in the largest cities. From these conflicting results, it was concluded that researchers should consider more carefully the use of the city size distribution and especially the sensitivity of results to the choice of an appropriate cut-off settlement size.

Ehrlich and Gyourko (2000) examined the US settlement system between 1910 and 1995. They investigated the changing pattern of the 10 largest urban settlements comparing various definitions of the metropolitan areas. From the investigation, it was found that the largest settlement had increased its population share compared to the national total before WWII and that the largest settlements had reduced their share compared to the national total after WWII. However, this relative decline of the largest settlements was replaced by the next largest group of settlements.

5.2.5. Previous Studies of City Size Distribution of Japan

Some international comparative works discussed in section 5.2.4 examined the city size distribution of the Japanese settlement system (Rosen and Resnick, 1980; Parr, 1985). The following three papers, however, focused only on the city size distribution of the Japanese settlement system.

Takahashi (1982) used the city size distribution to explain the Japanese urban settlement system based on administratively defined urban areas. He examined the Japanese urban settlement system from 1875 to 1980, and focused on the changing rank of the larger Japanese cities. It emerged that Japan has had a dual structure in its settlement system since the 19th century; it was divided into six large cities, i.e. Tokyo, Osaka, Kyoto, Nagoya, Yokohama, and Kobe, and other small cities. After WWII, cities between the seventh and fourteenth largest grew up rapidly to 'fill up the gap' between smaller cities and the six largest.

Glickman (1979) examined the city size distribution of the Japanese settlements between 1950 and 1975. This analysis was based on the Regional Economic Cluster (REC), i.e. his original definition of Japanese functional urban regions. He found that the slope parameter for the Japanese settlement system of 80 RECs had changed from -0.816, in 1950, to -0.956, in 1975. From the change of

slope parameter, he expressed the two following points. The first is that the settlement pattern in Japan had undergone a phase of centralisation for twenty-five years. The second is that the speed of centralisation had slowed down.

Yamada and Tokuoka (1991) examined the changing city size distribution for the Japanese urban settlement system with their original definition of Japanese functional urban regions, i.e. the Standard Metropolitan Employment Area (SMEA)[39]. They examined the city size distribution for 82 SMEAs for three different periods, 1965, 1975 and 1985. The Pareto exponent had increased in the first decade. On the other hand, the exponent had decreased between 1975 and 1985. Yamada and Tokuoka focused on the relationship of the growth rate of the medium sized SMEAs and that of the largest SMEAs. In the two decades, medium sized SMEA had grown to a higher rate, while larger SMEAs had slowed down their growth rate.

5.3. Examination of the City Size Distribution for the Japanese Settlement System

In this section, various analysis of the city size distribution will be applied to the Japanese settlement system. This section contains three types of tests; (1) sensitivity tests for distribution, (2) an examination of the validity of the application of the Pareto distribution to the Japanese settlement system, and (3) long term changes in the Pareto exponent. In addition, a note on the definitions of the Japanese settlement system will be added before starting the various tests to explain the modifications for this chapter.

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[39] For further information, see Chapter 3.

5.3.1. A Note on the Definitions of the Japanese Settlement System

As noted in section 5.2, many researchers have investigated the definition of urban areas and the impact this may have on estimated values of the size distribution parameter (Rosen and Resnick, 1980; Parr, 1985). Although Rosen and Resnick agreed that data based on functional urban regions seem better than that based on political boundaries, in their survey, they used data based on political boundaries because of the availability of such data for the 44 countries. This chapter will compare the results of the analysis based on the different definitions for the Japanese settlement system, administrative boundaries and functional urban regions. In comparing these different definitions, there is an important modification worth noting.

As defined in Chapter 3, the JFUA definition is determined by the 1990 census data, and the JFUAs are fixed for target periods, 1970, 1980 and 1990. This is similar to the approach adopted in previous studies for the European countries (Hall and Hay, 1980; van den Berg et al., 1982; Cheshire and Hay, 1989; Champion, 1992; Cheshire, 1995). On the other hand, administrative boundaries are changeable. Therefore, there are some differences on the boundaries between 1970 and 1990.[40] This situation is not convenient for comparison with the analysis based on the JFUA definition. To make the results, between two definitions in these periods, comparable, administrative boundaries need to be fixed at their 1990 limits.[41] As a result, the total number of administrative units is 3,246 and the total number of JFUAs is 154.

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[40] To understand the examples of the change, see Chapter 2.

[41] The dataset collected was based on boundaries that depended on various census dates. At that time, some data of previous censuses was modified on the basis of newer boundaries. However, some data was not transferred to the new boundaries. The ratio of urbanisation in Chapter 2 is based on the previous censuses containing old data and boundaries.

5.3.2. Sensitivity Tests for the City Size Distribution

5.3.2.1. Two Definitions of Urban Area

As was noted in the previous section, administratively defined urban areas have been most commonly used for previous studies of the city size distribution. For example, Takahashi (1982) used administrative boundaries for his study on Japanese settlements. In the context of international comparative study, Rosen and Resnick (1980) and Parr (1985) also used this type of data. On the other hand, some researchers have used functional urban regions as the basic unit for analysis of the national settlement system. When Glickman (1979) analysed the city size distribution of Japan, he used RECs, his original definition of Japanese functional urban regions.

As noted in section 5.2.4, Rosen and Resnick (1980) compared the estimated value of the Pareto exponent based on functional urban areas with that estimated on the basis of the administrative boundaries for six countries. They stated that the Pareto exponent, estimated as the basis of the FUR definition, showed a lower value - closer to 1 - than that estimated on the basis of administrative boundaries. They did not have enough data to include Japan in this comparison. The first step is therefore to test whether the finding of Rosen and Resnick for six countries would also fit the case of Japan.

Table 5-1 shows the result for the estimates of the Pareto exponents fitted to the settlement system based on the administrative boundaries and on the JFUA definition. For this test, only the 50 largest areas were treated as the Japanese settlement system since this criterion is directly comparable with that used by Rosen and Resnick (1980). The test focuses on the Japanese settlements in 1970, 1980 and 1990. In 1990, the Pareto exponent for the 50 largest JFUAs was 1.018. In the same period, the exponent for the 50 largest administrative cities was 1.298.

This result supports Rosen and Resnick (1980). The exponent based on the JFUAs dropped by 21.6% when it was compared with the exponent based on administratively defined urban areas in 1990.

Table 5-1: Pareto Exponents (Two Definitions)

	JFUAs		Administraitve Areas			
Year	α1	SE	α2	SE	Difference (%)	T
1970	1.042	0.03956	1.189	0.02608	-12.4	5.6450
1980	1.028	0.03571	1.280	0.03374	-19.7	7.4909
1990	1.018	0.03517	1.298	0.03295	-21.6	8.5122

Source: Author

To examine the statistical significance of differences between these two values, a hypothesis that the Pareto exponent based on the administrative definition of cities data equals the exponent based on JFUA data was tested. From Student's T-test for the hypothesis, it is clearly found that the hypothesis was rejected at a 5% level of significance in each one of the three periods. Therefore, it can be said that the definition of urban areas has significant effects on the estimated Pareto exponent for the Japanese settlement system.

As Rosen and Resnick mentioned, functional definition causes a greater change for large cities. The largest administrative area, Ku-Areas of Tokyo-to, contained 8 million residents in 1990. On the other hand, the largest JFUA, Ku-Areas of Tokyo-to JFUA, contained 28 million residents in the same period. The explanation of this gap was the change of definition for some urban places. A good example is Yokohama in Kanagawa prefecture. Yokohama itself contained more than three million people in 1990 and was the second largest city of Japan in the context of administrative definitions. On the other hand, the JFUA definition

identifies Yokohama as a component of the ring area of Ku-Areas of Tokyo-to JFUA.

The advantage of the data based on administrative boundaries is that of data availability, as Parr (1985), and Rosen and Resnick (1980) have noted. It is extremely difficult to analyse the city size distribution based on functional urban regions in the context of international comparative studies, and the analysis based on administrative boundaries are more widely used in this field. On the other hand, JFUA is based on patterns of socio-economic behaviour and this means that this definition reflects the real changes of urban settlement. Therefore, it can be said that the analysis based on JFUAs reflects the 'real' city size distribution.

5.3.2.2. Two Ways of Sample Taking

If the real city size distribution matched the 'urban rank-size rule' perfectly, then the number of urban areas in the sample size would not be important. However, the real settlement system does not fit in with the Pareto distribution, so it is important to choose the sample of settlements. Dziewonski (1972) noted the possibility of different shapes of the city size distribution emerging with different samples of settlements from the whole settlement system.

In previous studies, there were two major methods of sample taking for analysing city size distribution. The first is to use a fixed number of settlements. For example, Rosen and Resnick (1980) used the 50 largest settlements and Parr (1985) used the 30 largest settlements of the Japanese settlement system. The other way of sampling settlement systems is by determining a fixed population threshold. A good example is Guérin-Pace (1995) who tested several population thresholds to examine the difference this made to the estimation of the French settlement system's size distribution via the Pareto exponent.

In this section, comparison between these two ways of measuring data will be examined for the Japanese settlement system for three periods, 1970, 1980 and 1990. Table 5-2 shows the Pareto exponent for the 50 largest places and the exponent for all places with a population of 100,000 or more inhabitants. From this table, one can note several findings.

Table 5-2: Pareto Exponents (Two Different Ways of Sample Taking)

	No.	α1	SE of α1	α2	SE of α	Difference (%)	T
1970 (Adm.)	152	1.313	0.01494	1.189	0.02608	-9.4	4.7467
1980 (Adm.)	194	1.310	0.01239	1.280	0.03374	-2.2	0.8655
1990 (Adm.)	210	1.319	0.01107	1.298	0.03295	-1.6	0.6281
1970 (JFUAs)	136	1.086	0.01684	1.042	0.03956	-4.0	1.1106
1980 (JFUAs)	139	1.050	0.01531	1.028	0.03571	-2.1	0.6241
1990 (JFUAs)	141	1.021	0.01432	1.018	0.03517	-0.3	0.0964

No.= Number of areas whose poulation is 100,000 or more inhabitants
α1= Pareto exponent for areas where contain 100,000 or more residents
α2= Pareto exponent for the 50 largest areas

Source: Author

In 1970, the Pareto exponent for all administrative units that contained 100,000 or more inhabitants was 1.313 and this showed a 9.4% difference from the exponent for the 50 largest administrative urban areas.[42] The gap between the two Pareto exponents estimated for different sample criteria narrowed, although the number of sample settlements determined by population thresholds had increased from 152 in 1970 to 210 in 1990. Within two decades, the gap between the Pareto exponents fell from 9.4% to 1.6%. When the Pareto exponents, based on two different ways of sample taking, were examined using the JFUA definition, it was

[42] This number has a higher value than that found in the research carried out by Rosen and Resnick (1980). This difference is due to the fact that their study was based on the 1970 Population Census of Japan and it had different boundaries from the 1990 Population Census of Japan that is examined in this chapter.

noted that the gap between the two was relatively smaller but showed the same declining tendency. That is the difference between 1990 and 1970 was a decrease from 4.0% to 0.3%.

To examine the significance of the gap in terms of its statistical significance, a hypothesis that the Pareto exponent for the 50 largest urban areas equals the exponent for all urban areas with 100,000 or more inhabitants was examined for six cases (Table 5-2: Column 'T'). It is found that the hypothesis was rejected only for the exponent based on the boundaries of administrative units in 1970 at a 5% level of significance. For other five cases, the hypothesis could not be rejected.

5.3.2.3. Various Thresholds by Fixed Number of Settlement

Table 5-3 shows the Pareto exponent estimated on the basis of six different thresholds; the largest 30, 50, 100, 150, 200, and 300 for 1990 data using the administrative boundaries. From the table, it is clearly found that the estimation of the Pareto exponent was affected by the change of threshold. When the Pareto exponent was estimated for the 100 largest administrative units, the exponent showed the highest value of 1.420. On the other hand, the lowest exponent was 1.169 for the 30 largest units.

Table 5-3: Sensitivity Test: Various Thresholds of Fixed Sample Number (1990)

	All Administrative Areas			154 JFUAs		
Threshold	α	SE of α	T	α	SE of α	T
None	1.169	0.02853	4.5386	0.901	0.03744	3.1264
50	1.298	0.03295	-	1.018	0.03517	-
100	1.420	0.02217	5.4981	1.070	0.01949	2.6553
150	1.370	0.01509	4.7457	0.998	0.01427	1.3795
200	1.326	0.01174	2.3966			
300	1.260	0.00871	4.4431			

Source: Author

For the Japanese settlement system based on JFUA definition in 1990, the Pareto exponent was examined for four different thresholds. From the table, it is clearly found that the Pareto exponent based on JFUA definition was also affected by different number of sampled settlements. The exponent for the 30 largest JFUAs showed the lowest value, i.e. 0.901. On the other hand, the highest Pareto exponent was 1.070 when 100 was applied as the threshold number.

The hypothesis that the Pareto exponent equals that for the 50 largest areas was tested. Except the case of 150 settlements based on the JFUA definition, the hypothesis was rejected in most cases at a 5% level of significance. From these results, it can be said that the sample procedure for selecting the number of settlements has significant effects on the estimation of the Pareto exponent.

5.3.2.4. Various Thresholds by Settlement Size

As Dziewonski (1972) has mentioned, the choice of the sample of settlements to which to apply the analysis has effects on the distribution pattern of settlement, and this opinion was supported by tests in the above section. In this section, we will further investigate the thresholds of the settlement system. For this investigation, two different Japanese definitions are used for comparison.

Malecki (1980) applied a sensitivity test for the US Midwest settlement in 1970, examining eleven threshold points which were between 100 and 100,000. Moreover, Guérin-Pace (1995) carried out similar tests for French settlements using six thresholds between 2,000 and 100,000. Both authors noted the thresholds effect on the value of the estimated Pareto exponent. They mentioned that the urban analysis based on large cities shows a different pattern from that based on the entire settlement system.

For the Japanese settlement system based on the administrative boundaries, twelve thresholds of populations between 2,500 and 300,000 were used for the 1990

census data. From table 5-4, it can be said that population thresholds have very considerable effects on the estimation of the Pareto exponent. In 1990, the largest value of the Pareto exponent was 1.419 when threshold population size was 200,000. As the threshold size decreases, the Pareto exponent decreased to the lowest value, i.e. 0.770, without any thresholds.

Table 5-4: Sensitivity Test: Various Population Thresholds (1990)

	Administrative Areas				154 JFUAs			
Threshold	No. of Area	α	SE of α	T	No. of Area	α	SE of α	T
None	3,246	0.770	0.00409	134.2031	154	0.984	0.01453	2.5378
2,500	3,041	0.866	0.00287	157.6420				
5,000	2,617	0.929	0.00242	160.8794				
7,500	2,121	0.970	0.00255	136.6741				
10,000	1,719	1.000	0.00290	110.0766				
25,000	809	1.119	0.00430	46.5220				
50,000	435	1.206	0.00642	17.5914				
75,000	279	1.270	0.00894	5.4962	152	0.992	0.01432	2.0184
100,000	210	1.319	0.01107	-	141	1.021	0.01432	-
150,000	135	1.389	0.01647	4.2612	114	1.061	0.01693	2.3222
200,000	104	1.419	0.02124	4.7277	92	1.071	0.02142	2.3075
250,000	83	1.404	0.02613	3.2624	70	1.075	0.02902	1.8519
300,000	64	1.355	0.03033	1.1743	65	1.072	0.03133	1.6056

Source: Author

In the examination of the Japanese settlement based on the JFUA definition, six population thresholds between 75,000 and 300,000 were applied to the Japanese settlement in 1990. Table 4-2 indicates the Pareto exponent of JFUA with six thresholds. In 1990, the highest Pareto exponent was 1.075 when threshold size was 250,000. When whole JFUAs were examined, the exponent showed the lowest value, i.e. 0.984.

To investigate the statistical significance of the gap, the exponent was examined with the hypothesis that the Pareto exponent for each case is equal to the value of all the settlements with 100,000 or more inhabitants. According to estimated Pareto exponent based on administrative areas, the hypothesis could not

be rejected at the 5% of statistical significance only for 300,000 as threshold size. When the hypothesis was examined for the exponent based on the JFUA definition, it could not be rejected for two cases, that cut-off point was 250,000 or 300,000.

5.3.3. The 'Urban Rank-Size Rule' and the Japanese Settlement System

The arguments advanced by Alperovich (1984), with respect to the validity of the 'urban rank-size rule' can be applied to the case of the Japanese settlement system. To satisfy Alperovich's criteria, the following conditions should be satisfied simultaneously. The first is that the Pareto exponent equals 1, and the second is that the constant A equals the population of the largest urban area or the average magnitude of the product of a city size and its rank.

Therefore, the three hypotheses should be tested to examine the 'urban rank-size rule.' Table 5-5 shows the results. Column T (α=1) shows the results of the Student's T-test for the first hypothesis where the Pareto exponent equals 1. Column T1 (Pmax) shows the result of the T-test for the second hypothesis where constant A equals the population of the largest settlement. The third Column T2 (Mag) shows the result of the T-test for the third hypothesis where constant A equals the average magnitude of the product of a city size and its rank.

Table 5-5: T-Test for an Investigation of the 'Urban Rank-Size Rule'

Table 5-5A: Administrative Areas (1970)

Threshold	No. of Area	LogA	SE	T1 (Pmax)	T2 (Mag)	α	SE of α	T (α=1)
None	3,246	15.4917	0.04040	12.4558	26.5391	0.890	0.00425	25.9743
2,500	3,123	16.3229	0.02634	12.4531	10.1211	0.973	0.00275	9.7653
5,000	2,796	16.9540	0.01684	56.9422	19.6604	1.035	0.00173	19.9844
7,500	2,227	17.2945	0.01686	77.0924	39.0374	1.067	0.00169	39.4303
10,000	1,719	17.4777	0.02123	69.8354	39.7886	1.084	0.00208	40.1891
25,000	698	18.4949	0.04098	61.0118	46.1468	1.172	0.00370	46.5554
50,000	340	18.9434	0.08566	34.4201	28.3196	1.209	0.00733	28.5830
75,000	214	19.5533	0.13531	26.2990	22.8212	1.258	0.01120	23.0370
100,000	152	20.2581	0.18476	23.0748	20.7478	1.313	0.01494	20.9446
150,000	111	20.6707	0.25418	18.3957	16.9307	1.345	0.02016	17.0948
200,000	78	19.9639	0.32911	12.0597	11.2821	1.292	0.02563	11.3948
250,000	53	18.7366	0.34515	7.9436	7.6169	1.203	0.02638	7.6875
300,000	36	17.6609	0.36924	4.5121	4.5111	1.126	0.02767	4.5523

Table 5-5B: Administrative Areas (1980)

Threshold	No. of Area	LogA	SE	T1 (Pmax)	T2 (Mag)	α	SE of α	T (α=1)
None	3,246	14.7657	0.03937	29.7280	46.5139	0.811	0.00413	45.6999
2,500	3,072	15.6930	0.02673	9.0930	35.2219	0.904	0.00277	34.7972
5,000	2,699	16.3145	0.02106	17.9696	17.3771	0.963	0.00214	17.1549
7,500	2,160	16.7327	0.02240	35.5557	0.7537	1.002	0.00222	0.9613
10,000	1,736	16.9898	0.02665	39.5347	5.8736	1.025	0.00259	9.8480
25,000	774	18.2258	0.04621	49.5481	31.6788	1.133	0.00415	31.9817
50,000	405	19.1183	0.07938	40.0869	30.1948	1.206	0.00677	30.4696
75,000	253	19.8478	0.12269	31.8821	25.8745	1.264	0.01012	26.1120
100,000	194	20.4304	0.15306	29.3636	24.7506	1.310	0.01239	24.9760
150,000	127	21.4808	0.22000	25.2035	22.2788	1.390	0.01734	22.4805
200,000	97	21.6711	0.29741	19.2830	17.3386	1.404	0.02309	17.4997
250,000	74	21.0903	0.36444	14.1427	12.8232	1.361	0.02793	12.9438
300,000	54	20.1963	0.43225	9.8557	9.0129	1.297	0.03264	9.0977

Table 5-5C: Administrative Areas (1990)

Threshold	No. of Area	LogA	SE	T1 (Pmax)	T2 (Mag)	α	SE of α	T (α=1)
None	3,246	14.3669	0.03902	39.4732	57.3372	0.770	0.00409	56.2510
2,500	3,041	15.3372	0.02779	20.5147	47.2425	0.866	0.00287	46.6538
5,000	2,617	16.0024	0.02394	3.9725	28.3272	0.929	0.00242	29.1784
7,500	2,121	16.4472	0.02584	20.8959	11.7969	0.970	0.00255	11.5839
10,000	1,719	16.7742	0.03005	28.8505	0.2137	1.000	0.00290	0.0076
25,000	809	18.1462	0.04801	46.6324	27.3351	1.119	0.00430	27.6077
50,000	435	19.2065	0.07534	43.7910	31.8134	1.206	0.00642	32.1017
75,000	279	20.0107	0.10842	37.8492	29.9094	1.270	0.00894	30.1759
100,000	210	20.6475	0.13947	33.9872	28.0774	1.319	0.01107	28.8044
150,000	135	21.5691	0.20938	27.0412	23.4920	1.389	0.01647	23.6321
200,000	104	21.9729	0.27420	22.1212	19.5906	1.419	0.02124	19.7428
250,000	83	21.7647	0.34104	17.1754	15.3496	1.404	0.02613	15.4721
300,000	64	21.0792	0.40062	12.9098	11.5852	1.355	0.03033	11.6931

Table 5-5: T-Test for an Investigation of the 'Urban Rank-Size Rule' (Continued)

Table 5-5D: JFUAs (1970)

Threshold	No. of Area	LogA	SE	T1 (Pmax)	T2 (Mag)	α	SE of α	T (α=1)
None	154	16.8259	0.21136	0.2709	1.5930	1.028	0.01698	1.6766
75,000	149	17.1562	0.20289	1.3458	3.2339	1.054	0.01625	3.3155
100,000	136	17.5764	0.21205	3.2691	5.0114	1.086	0.01684	5.0937
150,000	105	17.8942	0.28258	3.5778	4.8995	1.110	0.02202	4.9768
200,000	78	17.9466	0.40039	2.6560	3.6408	1.113	0.03058	3.7095
250,000	67	17.8493	0.47433	2.0367	2.9025	1.106	0.03588	2.9666
300,000	60	17.5637	0.51545	1.3202	2.1650	1.086	0.03876	2.2243

Table 5-5E: JFUAs (1980)

Threshold	No. of Area	LogA	SE	T1 (Pmax)	T2 (Mag)	α	SE of α	T (α=1)
None	154	16.6296	0.19527	2.1959	0.2063	1.004	0.01556	0.2836
75,000	150	16.8566	0.19012	1.0617	1.3603	1.022	0.01511	1.4348
100,000	139	17.2310	0.19404	0.8896	3.1862	1.050	0.01531	3.2596
150,000	112	17.7028	0.23917	2.6944	4.5093	1.085	0.01856	4.5817
200,000	86	17.8107	0.32601	2.3075	3.6740	1.093	0.02483	3.7401
250,000	69	17.7679	0.42040	1.6876	2.7854	1.090	0.03156	2.8460
300,000	64	17.6863	0.45525	1.3792	2.4121	1.084	0.03402	2.4707

Table 5-5F: JFUAs (1990)

Threshold	No. of Area	LogA	SE	T1 (Pmax)	T2 (Mag)	α	SE of α	T (α=1)
None	154	16.4310	0.18308	3.9625	1.1476	0.984	0.01453	1.0754
75,000	152	16.5362	0.18066	3.4334	0.6054	0.992	0.01432	0.5345
100,000	141	16.9209	0.18205	1.2937	1.4163	1.021	0.01432	1.4832
150,000	114	17.4514	0.21891	1.3471	3.5115	1.061	0.01693	3.5773
200,000	92	17.5908	0.28137	1.5437	3.2366	1.071	0.02142	3.2991
250,000	70	17.6512	0.38834	1.2739	2.5268	1.075	0.02902	2.5840
300,000	65	17.6024	0.42131	1.0584	2.2281	1.072	0.03133	2.2836

Source: Author

Table 5-5A, 5-5B and 5-5C show the results of the various T-tests for estimated values based on administrative areas with various population thresholds in the three different periods. From these tables, it can be concluded that, in most cases, the 'urban rank-size rule' is not confirmed by the data based on administrative areas. Only two cases, i.e. 7,500 threshold in 1980 and at 10,000 threshold in 1990, could not be rejected at 5% of statistical significance for the two hypotheses. There was no case that could not be rejected by the three hypotheses at the same time.

Table 5-5D, 5-5E and 5-5E indicate results of the various T-tests for estimated value based on JFUAs with various population thresholds in the three different periods. From the results, there are several findings. The first point is that the first hypothesis was not rejected in six cases. These six cases are all JFUAs in 1970, 1980 and 1990, JFUAs over 75,000 in 1980 and 1990, and JFUAs with 100,000 or more inhabitants in 1990. The hypothesis that constant A equals the average magnitude of the product of a city size and its rank could not rejected for six cases. All of these six cases could not be rejected the hypothesis that the Pareto exponent equals 1. On the other hand, the test for the hypothesis that constant A equals the population of the largest JFUA shows different results. In many cases, the hypothesis could not be rejected but these results were different from the other hypothesis. From these three hypotheses, only three cases could not be rejected for all three hypotheses. These three cases are 154 JFUAs in 1970, JFUAs with 75,000 or more inhabitants in 1980, and JFUAs with 100,000 or more inhabitants in 1990.

5.3.4. Change of the Pareto Exponent in the Long Term

It is useful to investigate the change of the Pareto exponent in the different periods, and some researchers have mentioned the change of distribution pattern in the long term (Glickman, 1979; Parr, 1985; Yamada and Tokuoka, 1991; Guérin-Pace, 1995). Table 5-6 shows the changing pattern of the Pareto exponent with different thresholds for twenty years.

For the Japanese settlement system based on administrative areas, Table 5-6A indicated four different aspects of the settlement system. If the threshold applied was less than 50,000, the estimated Pareto exponent decreased for the two decades. This would imply that Japan had been in the process of concentration into larger settlements. When the threshold was 75,000, or thresholds larger than 200,000, the estimated value of the exponent increased for the twenty year period. This means that Japan had been in the process of deconcentration from larger settlements. When 100,000 was applied as the threshold, a third pattern of change was indicated that the value decreased in the 1970s but increased in the 1980s. The fourth pattern was the opposite of the third pattern. In this case, the value increased for the first decade and decreased in the 1980s.

These four different patterns show that the results obtained are highly sensitive to the threshold used. Therefore, the administrative area should not be used to compare changes due to the unreliability of its results. In other words, when the entire settlement system is examined, it can be noted that inequality in city size has been accelerating over the past two decades. On the other hand, when only the larger settlements are considered, the city size inequality of the Japanese settlement has been reduced. These dual aspects of the Pareto exponent changes are similar to those of the French settlement examined by Guérin-Pace (1995).

Table 5-6: Changing Pareto Exponents

Table 5-6A: Administrative Areas

Threshold (Size)	1970	1980	1990	1970s	1980s
None	0.890	0.811	0.770	-	-
2,500	0.973	0.904	0.866	-	-
5,000	1.035	0.963	0.929	-	-
7,500	1.067	1.002	0.970	-	-
10,000	1.084	1.025	1.000	-	-
25,000	1.172	1.133	1.119	-	-
50,000	1.209	1.206	1.206	-	-
75,000	1.258	1.264	1.270	+	+
100,000	1.313	1.310	1.319	-	+
150,000	1.345	1.390	1.389	+	-
200,000	1.292	1.404	1.419	+	+
250,000	1.203	1.361	1.404	+	+
300,000	1.126	1.297	1.355	+	+
Threshold (No.)	1970	1980	1990	1970s	1980s
30	1.092	1.153	1.169	+	+
50	1.189	1.280	1.298	+	+
100	1.332	1.405	1.420	+	+
150	1.315	1.357	1.370	+	+
200	1.266	1.305	1.326	+	+
300	1.218	1.234	1.260	+	+
None	0.890	0.811	0.770	-	-

Table 5-6B: JFUAs

Threshold (Size)	1970	1980	1990	1970s	1980s
None	1.028	1.004	0.984	-	-
75,000	1.054	1.022	0.992	-	-
100,000	1.086	1.050	1.021	-	-
150,000	1.110	1.085	1.061	-	-
200,000	1.113	1.093	1.071	-	-
250,000	1.106	1.090	1.075	-	-
300,000	1.086	1.084	1.072	-	-
Threshold (No.)	1970	1980	1990	1970s	1980s
30	0.914	0.910	0.901	-	-
50	1.042	1.028	1.018	-	-
100	1.107	1.085	1.070	-	-
150	1.050	1.022	0.998	-	-
None	1.028	1.004	0.984	-	-

Source: Author

On the other hand, the Pareto exponent of each decade based on JFUAs does not result in such a disparate set of patterns that were observed in the case of administrative areas. Therefore, the JFUA definition is preferred to the administrative area because the Pareto exponent decreases constantly. The estimated Pareto exponent decreased for twenty years at any threshold. This would imply that the Japanese settlement system had been in a process of concentration into larger settlements.

5.3.5. Comments for Various Tests for the Distribution

In this section, various tests that relate to the city size distribution were tried. The following findings were observed.

From four sensitivity tests for the Japanese settlement system, there are two main findings for estimation of the Pareto exponent. From section 5.3.2, it is clearly found that the distribution on the basis of functional urban regions is closer to 1, the theoretical Pareto exponent of the 'urban rank-size rule'. From various tests of thresholds, it is clearly found that different ways of sample taking have effects on the estimation of the Pareto exponents. This result appears in the data for both definitions of 'city' in Japan. However, estimates based on functional urban regions are relatively less affected by different sampling criteria. From the last two sections, sensitivity of various thresholds was further examined. These results demonstrated the effects of different samples used to estimate the exponent. Therefore, it is quite important to consider carefully the sampling criterion.

In section 5.3.3, the validity of the 'urban rank-size rule' for the Japanese settlement system was examined. Although the city size distribution based on the JFUAs approximates much more closely to the 'urban rank-size rule', it was found that the Japanese settlement system did not fit completely to the 'urban rank-size

rule'. On the other hand, analysis based on the administrative areas seldom – or if the strictest criterion was used, never - fitted the rule.

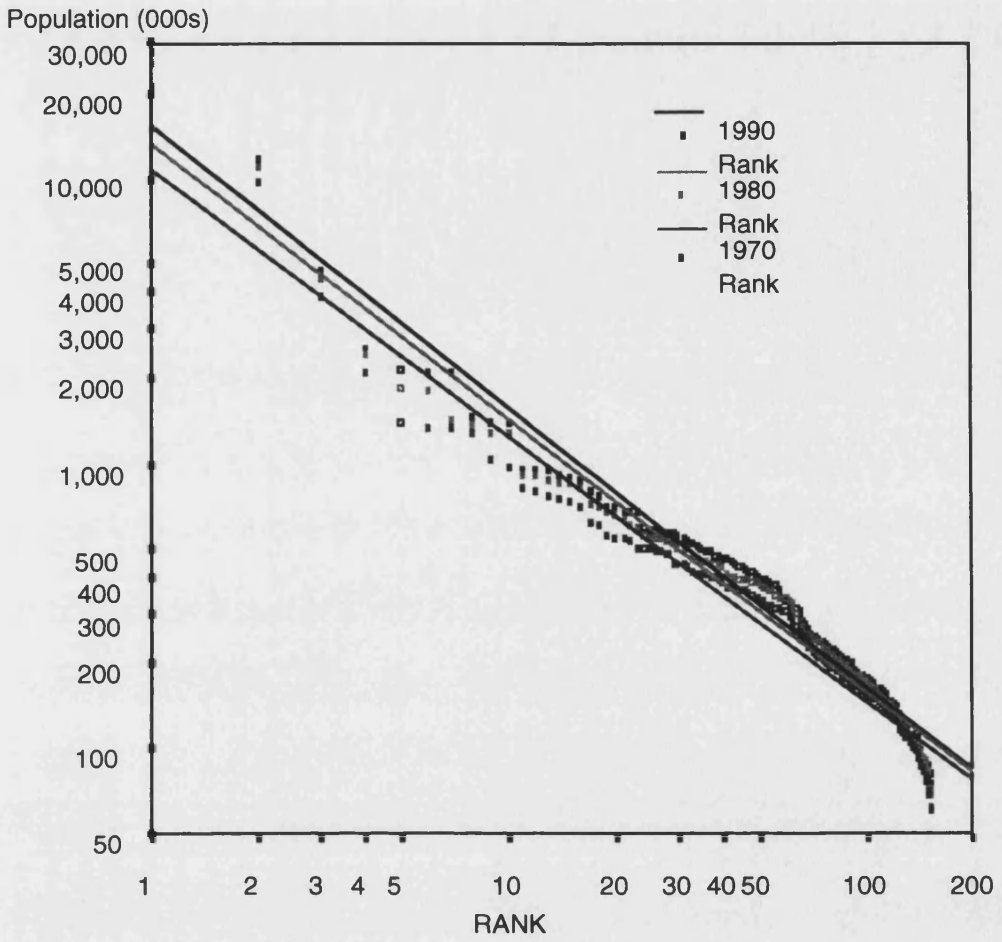
The definition of the settlement system and the number of settlements have effects on the changing pattern of the Pareto exponent in the long term. Analysis based on the JFUAs showed a clear concentration pattern within the Japanese urban settlement system by showing the decrease of the Pareto exponent. On the other hand, it is more difficult to find this tendency from analysis based on administrative areas. Using this definition, four patterns of change were observed. From the patterns, it can be said that Japan has ended the stage of the concentration into large settlements. However, Japan has been in the concentration phase at a national level, based on the JFUAs. The difference is mainly caused by the definition of the urban areas.

As mentioned in section 5.3.2, data based on functional urban regions should reflect any real changes in settlement systems better than any results based on administrative areas. Therefore, conclusions regarding changes in the Japanese urban settlement systems are based on the data analysis on the basis of the JFUAs.

5.4. The City Size Distribution and Japanese Settlements 1970-90

According to Berry (1961), the distribution pattern of the Japanese settlement system was classified as 'primate'. According to him, the 'primate' pattern is that in which one or more larger cities are dominant. Figure 5-1 illustrates the city size distribution of the Japanese settlements with all JFUAs in 1970, 1980, and 1990. As explained in section 5.3, it was clearly found that the Japanese settlement system has gone into a concentration pattern.

Figure 5-1: City Size Distribution (154 JFUAs, 1970, 1980, 1990)



Source: Author

When Parr (1985) examined the change of the estimated Pareto exponents for the Japanese settlement system for seventy years, he noted that the Pareto exponents showed the early stage of a U-shape pattern. The U-shape pattern represents an increase of the Pareto exponent after a decrease occurred over a long term, and, according to Parr (1985), the pattern is related to the degree of economic development. According to his analysis, Japan had shown a concentrated pattern until 1970 and then started to demonstrate a decrease in concentration. Parr's observation does not match the result based on the JFUA definition.

The reason appears to be the data used for the analysis. There are two important differences. The first point is the sample number of settlements. When Parr examined the Japanese settlement system, he focused only on the 30 largest administratively defined urban areas. This means that his analysis is for changes affecting only larger settlements. This result was reflected in the sensitivity of the city size distribution (Malecki, 1980; Rosen and Resnick, 1980; Parr, 1985). The other point is the definition of urban area. Parr used administrative boundaries as urban settlements. When the Pareto exponents for the 30 largest administrative areas between 1970 and 1990 were examined, the exponent showed a continuous increase (Tables 5-6A and 5-6B). This result is consistent with his claim that Japan has been in an early stage of the U-shape of the distribution curve but the result is valid only if the analysis is conducted on administratively defined settlements.

Yamada and Tokuoka (1991) also concluded that Japan had entered a new phase of population distribution pattern, i.e. decentralisation to smaller cities. They used SMEAs for their analysis. They found a decrease in the slope parameter between 1975 and 1985. Why do we have different results? This again is due to the different definition of areas. According to the SMEA definition, the ratio of commuters to core area should be greater than 10%, whereas 7.5% was the threshold for the JFUA ring area. In addition, Yamada and Tokuoka's SMEAs were defined for each period, 1965, 1975, and 1985. From these criteria, it can be said that their SMEA has a tighter definition of ring areas, and therefore, the population of the largest SMEAs should be smaller than that of the largest JFUAs. This test made it easy to 'find' the growth of medium sized areas. Another possibility is the use of different periods; Yamada and Tokuoka (1991) examined from 1965-1975 and 1975-1985. During the period between 1975 and 1985, the Japanese economy was in transformation and the largest urban areas suffered in the period.

When Ades and Glaeser (1995) investigated the degree of concentration of national populations into the large cities in each country, Tokyo, the largest Japanese city represented 15.76% of the total population of Japan.[43] The JFUA definition showed a much higher degree of concentration than that seen in their study. The share of the largest JFUA in 1970 was 23.3% of the national population, 24.9% in 1980, and 25.1% in 1990. On this measure, therefore, the Japanese urban settlement system has tended to concentrate.[44]

5.5. Conclusion

The city size distribution is widely used for explaining the population distribution of a national settlement system and its long history has allowed the development of a methodology with many empirical studies analysing national settlement systems.

From previous studies, there are three criteria to be taken into account when examining the city size distribution of national settlements. The first is about the choice of settlement. The second is about the changing pattern and time scale of changes in the city size distribution. The last point is whether the rule is appropriate or not.

There are various sensitivity tests for the city size distribution. The definition of 'urban area' is a basic but crucial point to note for analysis. In this chapter, the estimated Pareto exponent based on the JFUAs is compared with the exponent based on the administrative areas. From this comparison, the result

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[43] According to Ades and Glaeser (1995), Tokyo's population in 1985 was 19,037,361 and 15.76% was calculated from this number. However, this number is larger than Tokyo's prefectural population but smaller than that of the Keihin Major Metropolitan Area.

[44] Ades and Glaeser (1995) examined the relationship between the degree of concentration into largest cities and various factors such as the economic or political structure. This topic will be discussed in Chapters 6 and 7.

supported Rosen and Resnick (1980). They found that estimated values based on functional definitions of the urban area showed a value closer to 1 than that based on 'city proper' data. In addition to the definition of settlement, the choice of settlement size cut-off point is important for urban settlement analysis. Therefore, the change of the estimated value of the Pareto exponent was investigated using several sensitivity tests. From these tests, it is found that different sampling criteria have significant effects on the estimated city size distribution, and that sample taking for settlement distribution should be done with appropriate care.

In addition, the validity of the 'urban rank-size rule' was examined. Although the Japanese settlement system based on both definitions of the urban areas did not completely fit the rule, the Japanese settlement system based on JFUAs was much closer to the rule.

Furthermore, the changing pattern of the Pareto exponent in the long term was examined for the Japanese settlements. From examination of this change, it was found that the definition of the settlements and the thresholds had effects on the changing pattern of the Pareto exponent.

From various tests of the city size distribution to the Japanese settlement system, it was confirmed that a functional definition of urban area seems more suitable for urban settlement analysis, because functional urban regions reflect real settlement change. In the last section, the Japanese settlement system was examined with the JFUA definition. From the results, it can be stated that the Japanese settlement system had been in a phase of the concentration towards the largest settlements.

Chapter 6: The Growth and the Decline of JFUAs

6.1. Introduction

When one pays attention to the changing pattern of each functional urban region, what are the observed characteristics? When we draw our attention to the previous studies of the European urban systems, it will be found that some of them examined the development of each functional urban region. Hall and Hay (1980) examined European urban settlements based on functional urban regions, and they used the concept of the urban development stages to analyse their changes between 1950 and 1975. A similar approach was used by van den Berg et al. (1982) and these studies showed that European urban settlements entered a new phase during the 1960s.

The main aim of this chapter is to examine the pattern of the Japanese settlement change in terms of its stages of urban development. In Chapters 4 and 5, in which the Japanese settlement system was examined on the basis of the JFUA definition the structural change inside each JFUA was not paid attention to. This chapter will examine the characteristics of the development pattern within each JFUA. This will be carried out in three parts. In the first part, previous studies on urban development stages will be reviewed. The second part will consist of a hypothesis explaining the Japanese settlement system. The last part will be the analysis of the Japanese urban settlement change between 1970 and 1990. In this section, the characteristics of the urban stages of the 154 JFUAs will be examined.

6.2. Previous Studies about Urban Development Stages

As a first step in this chapter, various previous studies of urban development will be reviewed. Most of the studies have been focused on the European and the US urban settlements but a few studies are focused on the Japanese urban settlement system.

6.2.1. The Six Stages of the European Urban Settlements

Hall and Hay (1980) examined the degree of urban development of European countries within an international context. They examined the urban settlement systems, based on functional urban regions (FURs), of fifteen European countries between 1950 and 1975. Each functional urban region contains a core area and a ring area; from the relationship of population change of the FUR core, ring, and total, six stages of urban development, in terms of centralisation or decentralisation, were established (Table 6-1). The description of the six stages is as follows.

Table 6-1: Six Stages of Urban Growth (Hall and Hay, 1980)

Stage 1	LC	Centralisation during regional decline in population
Stage 2	AC	Absolute Centralisation
Stage 3	RC	Relative Centralisation
Stage 4	RD	Relative Decentralisation
Stage 5	AD	Absolute Decentralisation
Stage 6	LD	Decentralisation during regional decline in population

Source: Modified from Hall and Hay (1980) by the Author

The first stage was called 'Centralisation during regional decline in population (LC).' In this stage, while total population is declining, the population of the core area shows a higher rate of growth than that of the ring area. The next stage is 'Absolute Centralisation (AC)' where the population of the FUR and that of the core area increase while that of the ring area decreases. The third stage is 'Relative Centralisation (RC)'. FUR, core and ring areas gain residential population, and the rate of core growth is greater than that of the ring area.

After these three centralisation stages, three decentralisation stages follow. The first stage of decentralisation is 'Relative Decentralisation (RD)'. In this stage, FUR, core and ring areas show a population growth, as in the last centralisation stage ('Relative Centralisation'). But in stage 4 (RD), the growth rate of the ring area exceeds that of the core area. The 'Absolute Decentralisation (AD)' stage occurs when the ring area and the total FUR show a population growth but the FUR core shows a decline. The sixth stage, 'Decentralisation during regional decline in population (LD)' happens as a result of the FUR, core and ring total population showing a decline but the population change of the ring areas shows a growth relative to that of the core.

Although there are some exceptions, a high total proportion of metropolitan regions in Europe conformed to the sequential stage-by-stage progress of urban stages between 1950 and 1975.[45] In southern European countries and France, the majority of the metropolitan regions were in one of the centralisation stages, even though, in this period, some metropolitan regions entered their decentralisation stages. In Northern, Western (except France), and Central European countries, the majority of the metropolitan regions moved from centralisation stages to decentralisation stages. Great Britain showed a higher proportion of metropolitan regions in the stages of decentralisation during the period than most other countries. This pattern is a similar to the US. Furthermore, in other countries, some

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[45] The data between 1950 and 1975 could not be collected in some countries.

metropolitan regions outside Great Britain that had been in the decentralisation stages, during the period in question, were observed. All of them were old industrial areas.

6.2.2. The Urban Life Cycle Hypothesis and the European Urban Settlement

Another famous comparative study of the European urban settlement system was conducted by van den Berg et al. (1982). In this study, the core and ring areas of the European urban settlements and their own settlement growth rates have been compared and divided into four groups. The development pattern of urban settlements was classified into four stages: (1) urbanisation, (2) suburbanisation, (3) disurbanisation, and (4) reurbanisation, each of which must be further subdivided into two substages (Table 6-2).[46]

Table 6-2: Stages of Development in a Functional Urban Region (FUR)

Stage of Development	Classification Type	Population Change Characteristics		
		Core	Ring	FUR
I Urbanisation	1 Absolute centralisation	++	+	+
	2 Relative centralisation	++	+	+++
II Suburbanisation	3 Relative decentralisation	+	++	+++
	4 Absolute decentralisation	-	++	+
III Disurbanisation	5 Absolute decentralisation	--	+	-
	6 Relative decentralisation	--	-	---
IV Reurbanisation	7 Relative centralisation	-	--	---
	8 Absolute centralisation	+	--	-

Source: Modified from van den Berg et al. (1982) by the Author

[46] Klaassen and Scimemi (1981) expressed the four stages as (1) urbanisation, (2) suburbanisation, (3) disurbanisation, and (4) reurbanisation. To express these four stages, van den Berg et al. (1982) used (1) urbanization, (2) suburbanization, (3) desurbanization, and (4) reurbanization. In this review, the technical vocabulary will follow that used by Klaassen and Scimemi (1981).

The first stage of urban development is urbanisation, a process where there is population growth in the core area and the whole area. In the earlier stage, only the core area shows a population growth, and residential population of the ring area declines. This is classified as absolute centralisation in the urbanisation stage. In the latter part of this stage, called relative centralisation in urbanisation, cities start to expand. In this stage, the ring area gains population at a lower rate than that of the core area.

When the growth rate of the ring area becomes higher than that of the core area, urban settlement enters the second stage, and this is called suburbanisation. In the earlier stage of suburbanisation, the core area still shows a population growth. While this process continues, the core areas will show a decline although the ring area and the whole area keep on gaining population. This is the fourth substage, i.e. absolute decentralisation of suburbanisation.

When population losses in the core exceed population gains in the ring, so that the agglomeration's population goes down, the area goes to a new stage called 'disurbanisation'. In the earlier stage, the growth of the ring area shows a positive figure. However, eventually the population growth of the ring area begins to slow, until it records population decline. When the ring area goes into decline, the settlement enters into the late stage of disurbanisation, absolute disurbanisation.

The fourth stage of urban development is 'reurbanisation', a process where the effects of population loss are less serious in the core than in the ring. In the earlier stage, relative reurbanisation, population loss in the core area is less serious than that in the ring area. In the absolute centralisation of reurbanisation, the core even grows while the ring declines, although growth in the core is inadequate to make the whole functional urban region show an increase. Although this stage was not observed in the European settlement system before 1975, it was introduced to cover future possibilities.

According to urban settlement analysis with the urban life cycle hypothesis, the proportion of FURs changed as follows. The FURs in the urbanisation stage had dropped from 47% to 18% between 1950 and 1975. In the same period, the percentage of FURs in suburbanisation increased from 50%, in 1950, to 73%, in 1970. In 1975, the ratio dropped to 63%. FURs in the disurbanisation stage increased from 3%, in 1950, to 19%, in 1975.

When the relationship between urban stages and each functional urban region in European countries was paid attention to between 1950 and 1975, the results can be summarised as follows. The urbanisation stage was dominated by FURs of eastern European countries. The latest stages of urban development were dominated by FURs founded during the Industrial Revolution, e.g. Liverpool, Glasgow and Manchester. Also capital cities and larger industrial cities were in a later stage of development than lower-order centres within the same national urban system. In addition, the main regional centres in Western Europe were predominantly in the suburbanisation stage.

6.2.3. The Eight Stages of the Urban Development and the European Urban Settlement in the 1980s

Cheshire and Hay (1986) modified the six stages of urban development that were introduced by Hall and Hay (1980). They added two stages by dividing the LC and LD stages into two further stages (Table 6-3). These new eight stages of development have been used for the analysis of the European urban system between 1951 and 1981. This concept was also used to examine the impact on cities of de-industrialisation in the 1970s (Cheshire and Hay, 1989).

The eight stages of urban development were also used to examine the change of European urban settlements during the 1980s (Cheshire, 1995). This held well in that European urban settlements had shifted from centralisation to

decentralisation between 1950 and 1980, and it was clear that the tendency to shift to decentralisation was broken up in the 1980s. Almost half of all core cities in northern Europe recorded population gains. On the other hand, some cities continued with their decentralisation trend. From these varieties of urban settlement change, it can be said that the European urban system began to show a new pattern of development.

Table 6-3: Stages of Urban Growth: Population Change

		Core (C)	Hinterland (H)	Region (=C+ H)	
Stage 1	LC-A	-	-	-	-ΔC<-ΔH
Stage 2	LC-B	+	-	-	
Stage 3	AC	+	-	+	
Stage 4	RC	+	+	+	ΔC>ΔH
Stage 5	RD	+	+	+	ΔH>ΔC
Stage 6	AD	-	+	+	
Stage 7	LD-A	-	+	-	
Stage 8	LD-B	-	-	-	-ΔC>-ΔH

Source: Modified from Cheshire (1986) by the Author

6.2.4. Urban Development Stages and the Japanese Settlement

Glickman (1979) examined the population changes of the Japanese urban settlement system using his original Japanese functional urban region, i.e. Regional Economic Cluster (REC), between 1950 and 1975. From the population changes in both relative and absolute terms, he concluded that Japan had been undergoing a rapid urbanisation from 1950 through to 1970.[47] However he focused only on the population growth of the ring and core areas and he did not concentrate on the urban development stages.

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[47] For detailed information, see Chapter 3.

Yamada and Tokuoka (1991) examined the Japanese urban settlement system using the original definition of Japanese functional urban region, Standard Metropolitan Employment Area (SMEA), between 1965 and 1985.[48] The analysis used the eight urban development stages that were used in van den Berg et al. (1982). The first finding was that only a few SMEAs were in disurbanisation during this period. Only one SMEA was in disurbanisation between 1965 and 1985, with one more SMEA entering a period of disurbanisation from 1975. Secondly, most of the largest SMEAs had been in the later stage of suburbanisation, except one SMEA that was in the later stage of urbanisation. This trend was also observed by Kawashima (1987), who examined the 30 largest functional urban regions.[49]

Kawashima et al. (1993) investigated the changing tendencies of the Japanese urban settlement for 88 FURs.[50] He also applied the eight stages of urban development as defined by van den Berg et al. (1982) to Japanese settlement. He estimated the 1995 population with its migration tendency, and 88 FURs were examined with the concept of the eight stages of urban development. Two methods of investigation were used on the 88 FURs.

The first was to examine the relationship between the population size of FURs and urban development stages. This found that all FURs with a population over 5,000,000 were at the later stage of suburbanisation. Most FURs with a population between 1,000,000 and 4,999,999 were in the early stage of suburbanisation. Most FURs with population between 500,000 and 999,999 stayed in the stages of urbanisation or suburbanisation. The majority of FURs with a population between 300,000 and 499,999 were broadly distributed over various

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[48] For detailed information, see Chapter 3.

[49] These 30 settlements are based on Kawashima's definition.

[50] FUR is Kawashima's original definition of functional urban region for the Japanese settlement system (Chapter 3).

stages. Finally, FURs with a population below 300,000 tended to be in the stages of disurbanisation or reurbanisation.

The other investigation was to examine the geographical characteristics of the urban development stages. He found that most FURs in the Kanto, Chubu and Kinki regions were in the urbanisation and suburbanisation stages. These three regions contain the three metropolitan areas, Tokyo, Kansai, and Nagoya. On the other hand, most FURs in the Hokkaido region were in the disurbanisation and reurbanisation.

6.2.5. Short Comments about the Urban Stages

In looking at development stages of cities, one can see two general approaches. One is that used by van den Berg et al. (1982), i.e. analysis based on the urban life cycle hypothesis, and the other is the approach taken by Hall and Hay (1980), later modified by Cheshire (the Hall/Cheshire/Hay sequence).

The main differences is between the view that regards the 'stages' as a description of the life cycle of cities and that which sees them just as useful classificatory devices to establish patterns of change. Cheshire (1995) noted the difference between the Hall/Cheshire/Hay sequence and urban life cycle hypothesis, as used in van den Berg et al. (1982) (Table 6-4). As a basis for classifying stages of centralisation/decentralisation, the Hall/Cheshire/Hay sequence and urban life cycle hypothesis have both differences and similarities. The difference is in that the first two stages of centralisation of the Hall/Cheshire/Hay sequence are located as reurbanisation stages in the urban life cycle hypothesis. The other six stages are in the same order.

Table 6-4: Comparison of the Various Urban Development Stages

Stages		
Hall & Hay	Cheshire	Van den Berg et al
LC	LC-A	7
	LC-B	8
AC	AC	1
RC	RC	2
RD	RD	3
AD	AD	4
LD	LD-A	5
	LD-B	6

Source: Author

In the following sections, the Hall/Cheshire/Hay model is used for the urban settlement analysis because this model is more suitable for the main purpose of this thesis. We will examine the characteristics and industrial structure of the JFUA cores to investigate the relationship between the urban functions of the core cities and the growth pattern of each urban settlement. For this, the Hall/Cheshire/Hay sequence has an advantage in that it falls symmetrically into two equal centralising and decentralising halves (Cheshire, 1995). This however, as was made clear in Cheshire (1995) is not taken to 'indicate a specific sequence of stages with a given city moving through them as in the life-cycle 'model'. It is rather used as a classificatory device to help organise the facts or reveal any patterns of change which need to be explained.[51] On the other hand, the arrangement based on the urban life cycle hypothesis is complicated in the context of centralisation or decentralisation of urban centres.

[51] Tokuoka (1995) mentioned that 'the urban life cycle hypothesis is extremely simple and that it contains many problems in explaining the process of urban development. However, this model is a useful device for classifying various patterns of urbanisation (Tokuoka, 1995)'. Although he applied eight stages based on the urban life cycle hypothesis for the Japanese urban settlement, his concept is similar to Cheshire's comment, that is 'the stages are seen as providing a helpful classificatory and heuristic device (Cheshire, 1995)'.

6.3. Background of the Japanese Urban Settlement 1970-1990

In this section, after revisiting the changes as found in Chapter 4, we shall look at the possible factors causing these changes. We shall first examine the general characteristics of the Japanese urban settlement between 1970 and 1990. This part is partly repeating from Chapter 4. In the second part of the section, various factors underlying urban change are examined.

6.3.1. Changes of the Japanese Urban Settlements

In the 1970s, the changes in the Japanese settlement system were focused on the growth of the largest JFUAs outside the three metropolitan areas. These largest JFUAs, i.e. Sapporo, Sendai, Hiroshima and Fukuoka, are not only all prefectural capital cities but also regional centres. The JFUA core of the Ku-Areas of Tokyo-to JFUA showed a decline in its residential population between 1970 and 1990, and the core of the Osaka JFUA also followed this trend towards population loss. However, these two JFUAs, as regions, did record population growth: growth in their hinterlands more than offset loss from their cores. Although most JFUAs displayed a population increase, there were two types of JFUAs that recorded faster growth; (1) JFUAs closely located to the largest JFUAs and (2) JFUAs with a prefectural capital city. An example of the former is Atsugi, and for the latter, Sapporo, Sendai, or Fukuoka.

In the 1980s, the Japanese settlement system showed a different pattern to that of the 1970s. In particular, the late 1980s can be treated as a period of 'Unipolar Concentration into the Tokyo area'. This phrase indicates excessive concentration of urban functions into only the Tokyo metropolitan area and the relative decline of urban functions for the national settlement systems of Kansai and Nagoya metropolitan areas. This functional concentration towards the Tokyo area

occurred under a situation where residential population in central Tokyo had declined but the surrounding areas had shown a rapid growth. Furthermore, it may be noted that regional centres, like Sapporo, also saw high rates of growth in each prefecture.

Although already in existence in the 1970s, a characteristic that became even more obvious was the tendency of declining areas. The vast majority of the JFUAs within this group were industrial cities, and although in the 1970s these tended to be relatively small JFUAs, the 1980s saw larger JFUAs showing population decline. Kure and Muroran JFUAs are good examples of this (Chapter 4).

6.3.2. Changes as a Result of Developments in Industrial Structure

Japan experienced a rapid economic growth from the late 1950s to the early 1970s. The main industry of the Japanese economy in this period was based on the resource oriented industries, e.g. steel and shipbuilding. These industries required natural resources and cheap labour. Since Japan has poor natural resources, the economic structure of the country relies on imported natural resources. Therefore, cities with ports had a strong role as manufacturing centres during this period. With the change of the industrial structure, these industries inevitably came to lose their importance.

The first oil crisis of 1973 ended the period of rapid economic growth in Japan and promoted the idea of moving away from an industrial structure that was dependent on the resource oriented industries. It may be noted that this applied not only to Japan but also to other countries such as the US (Frey, 1993).

The rise in production costs that came with the rapid economic growth is a result of two events. The first is the absolute rise in wages. Another reason for the rise in costs is due to movements of the exchange rate. Before 1973, 1 US dollar equalled 360 Japanese yen. With the growth of the Japanese economy, the yen

became stronger compared to other currencies. Since the late 1980s, the exchange rate of the yen to US dollar rose up to 150 yen through currency realignment. This change in the rate of exchange made production costs rise from a foreign perspective and the Japanese competitive advantage in the view of product cost decreased in the international market.

As a result of international circumstances, the main industry of Japan transformed to knowledge intensive manufacturing, e.g. high-tech product. Knowledge intensive industries have two great advantages. The first is that this type of industries requires fewer resources. In other words, knowledge intensive industries are less affected by natural resources than old style manufacturing. This is favourable for Japan that depends on imported materials. The second point is that the products of knowledge intensive industry have a high value added in addition to being competitively advantageous. This is important in Japan's industrial ability to compete with other Asian countries.

From these circumstances, the Japanese economy required industrial restructuring towards knowledge intensive industry (MITI, 1980). Due to these changes, the areas that were depending on declining industries had difficulties in altering their economic structure and, consequently, they have had less influence on their surrounding areas, further moving towards decline.

The change in the industrial structure has had effects on the Japanese settlement system. Knowledge intensive industries do not require any presence of natural resources or specific location. The majority of research and development centres crucial to knowledge intensive industry were located near the largest cities, towards the Kanto region (Takahashi and Sugiura, 1992).

Furthermore, the Japanese industrial structure shifted towards a service sector oriented pattern. There are two characteristics of the service sector: the sector is footloose in comparison to manufacturing (Cheshire, 1995) and also has higher profit rates. According to the 1990 Population Census of Japan, the industrial

structure of employment changed as follows. Between 1970 and 1990, employment in the primary sector dropped from 19.3% to 7.1% of the total. In the secondary sector the percentage stayed almost static, moving only from 34.0% to 33.3%. The tertiary sector employment, however, rose from 46.6% to 59.0%. This structural change has had effects on the patterns of urban growth. The settlements where the service sector had a more important role tended to experience a faster population growth than the old manufacturing centres (Cheshire, 1995). Prefectural capital cities tended to develop stronger service sectors, at least these cities had a political function for their regions and showed a relatively high growth rates of population.

The development of transport systems can be said to have a large effect on urban development (Anas and Moses, 1978; van den Berg et al., 1982; Cheshire and Hay, 1989). In terms of its impact upon the changes in the Japanese settlement system at the national level, the development of the transport system set up linkages between cities, with high-speed railway systems, and a highway road system built for inter-city links (Ohta, 1989). With the Shinkansen express, the bullet train, it takes only three hours between Tokyo and Osaka, and two hours to get between Tokyo and Nagoya. This caused a centralisation of capital functions rather than decentralisation due to the increased interconnection between cities (Abe, 1989). It also increased the importance of the JFUAs with prefectural capital cities.

The development of the transport system has also had effects on the ring areas of each functional urban region. Japanese land prices showed hyperinflation for many years, and people have tended to move to suburban areas in order to seek houses with cheaper land (Miyao, 1985). In addition, public transport systems are heavily subsidised in Japan thus lowering costs of commuting (Mills and Ohta, 1976). From an internal perspective of a settlement, the development of the transport system resulted in the expansion of commuting hinterland (Mills and Ohta, 1976; Anas and Moses 1978; van den Berg et al., 1982).

Between 1970 and 1990, the JFUAs in the Kanto region showed a rapid population growth although central Tokyo has been declining since the 1960s. The centralisation of the Kanto region was supported by newly growing industries, e.g. research and development centre. On the other hand, regions outside the Tokaido area dependent on manufacturing tended not to grow. From a prefectural view, JFUAs with prefectural capital cities showed a centralisation pattern in the last two decades (Takahashi and Sugiura, 1992; Yada, 1994). Prefectural capital cities already have a specialisation in administrative functions, with the result that they were hit by de-industrialisation.

To sum up the change of Japanese urban settlements, the pattern of urban development can be outlined as follows. After WWII, Japanese old industrial centres were located in cities near large ports for importing natural resources. These cities depended on the resource oriented industries and the decline of this type of industry affected its ability to generate jobs. As a result, old industrial cities showed decentralisation and decline. On the other hand, transformation from economic restructuring caused a change in industrial location. New types of industry, e.g. research and development centres, tended to be located in the Kanto region. In addition, prefectural capital cities showed population gain because these cities have many workers in the service sector, the growth sector of the Japanese economy.

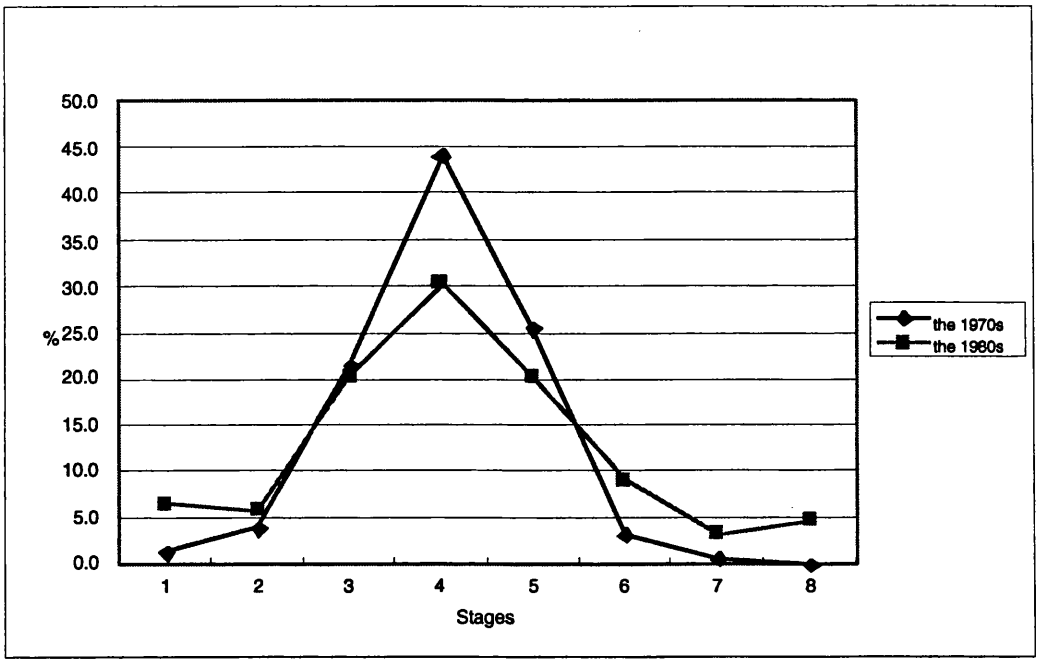
6.4. Urban Development Stages and JFUAs

In this section, Japanese urban development will be examined using urban development stages. This section consists of four parts. The first section outlines the general characteristics of the 154 JFUAs and their urban stages. The second one examines the relationship between the population size of JFUAs and the development stages of places along the lines of Kawashima et al. (1993). The third section examines regional disparities of urban stages. These first three sections make the distribution pattern of urban stages of development clear. As mentioned in section 6.3, the urban functions may be associated with the pattern of urban development. In the Japanese settlement system, prefectural capital cities would show a clear pattern. Therefore, in the final section, JFUAs with prefectural capital cities will be compared to those without.

6.4.1. Urban Development Stages and the 154 JFUAs

Figure 6-1 represents the frequency distribution of Japanese urban development in the 1970s and 1980s. From this, it is possible to deduce that Japan in the 1970s witnessed a concentration in stages 3, 4, and 5. With 33 JFUAs in stage 3 (21.4%), 68 in stage 4 (44.2%), and 39 in stage 5 (25.3%), we find that approximately 90% of JFUAs fall into these categories. On the other hand, the 1980s witnessed a slight shift towards decentralisation. As before, the share of JFUAs in stage 4 tends to be large with 47 JFUAs (30.5%) falling within this category, although this is less than in the previous decade. There was little change in the number of JFUAs in stage 3, with the number totalling 31 (30.1%). Those in stage 5 declined to 31 (20.1%). The JFUAs that shifted out of these three categories were distributed relatively evenly into the other five remaining stages.

Figure 6-1: 154 JFUAs: Frequency Distribution of Urban Stages



Source: Author

Table 6-5: 154 JFUAs: Population Sequential Shifts 1970-1990

		1980-1990								
	Urban Stages	1	2	3	4	5	6	7	8	No. of JFUAs
	1						1		1	2
	2	2	2	2						6
1970	3	4	5	17	5			1	1	33
-	4	4	2	12	37	8	2		3	68
1980	5				5	23	8	3		39
	6						3	1	1	5
	7								1	1
	8									0
	No. of JFUAs	10	9	31	47	31	14	5	7	154

Source: Author

Table 6-5 charts the changes that occurred between 1970 and 1990. The vertical axis represents the number of JFUAs in each stage in the 1970s whilst the number of JFUAs in each stage in the 1980s is plotted on the horizontal axis. From this, we see that the two JFUAs which were in stage 1 in the 1970s moved on to decentralisation stages.

Except stage 1, all of the other stages, i.e. 2 to 8, of JFUAs showed a sequential shift to the right, between the 1970s and the 1980s. For example, 66.7% of JFUAs (22 JFUAs) in stage 3 during the 1970s either remained in that category or sequentially moved on to the next stage. Furthermore, of those that were in stage 4, i.e. 66.2% (45 JFUAs) either remained to this stage or sequentially shifted to stage 5, and of those that were in stage 5 in the 1970s 79.5% or 31 JFUAs have either stayed in that category or sequentially moved on to the next stage.

Of the three stages just examined, it would be possible to note the following characteristics. Firstly, compared to the European stages as examined by Hall and Hay (1980), there is a greater share of JFUAs that remained in the same stage over the twenty year period. Indeed, for stage 3, stage 4, and stage 5, there were 17, 37, and 23 JFUAs that would fall within this category respectively.

Also, if we view stages 1 to 4 as centralisation stages and 5 to 8 as decentralisation stages, the ratio of centralisation to decentralisation was 109 to 45 in the 1970s, and 97 to 57 in the 1980s. This amounts to a change of 8%, and would not qualify as a particularly large shift. Both the mode and the median of the urban stages of the 154 JFUAs remained as stage 4 and did not witness any change.

On the other hand, JFUAs in stages 3 and 4 experience various patterns of dispersion towards other stages. However, from this overall picture, it is not possible to tell the specifics stages. Thus from the next section, it is necessary to form groups and see if any characteristics can be gleaned from the analysis.

6.4.2. Relationship between the JFUA Size and the Urban Stages

The first step in capturing the characteristics of changes requires an analysis of whether there is any relationship between JFUA size and development stages. As already noted in Chapter 4, one of the characteristics of JFUAs is that there are still relatively large ones that continue to grow in size. Thus, we shall use the four groups as defined in Chapter 4 and follow the changes that occurred in these groups, via their development stages.

The groupings outlined in Chapter 4 are as follows.

Population	Group	Number of JFUAs
0 – 249,999	Small JFUAs	84
250,000 – 499,999	Medium-Sized JFUAs	35
500,000 – 999,999	Large JFUAs	25
1,000,000 -	Largest JFUAs	10

The characteristics of these groups are as follows.

Largest JFUAs (Table 6-6A): There are only 10 of this particular type of JFUA, and during the 1970s, these were primarily centred around stage 5. However, in the 1980s changes occurred within stage 5 with a strong tendency towards centralisation for Fukuoka which shifted to stage 4, whereas Kyoto and Kitakyushu moved towards stage 6 together with decline in the population of the JFUA cores. As a result, the frequency distribution shows a shift from a single peak configuration, centred around stages 4 and 5, towards a twin peaked distribution.

Table 6-6A: Largest JFUAs: Population Sequential Shifts 1970-1990

1970 - 1980 \ 1980-1990 Urban Stages	1	2	3	4	5	6	7	8	No. of JFUAs
1									0
2									0
3									0
4				3					3
5				1	2	2			5
6						2			2
7									0
8									0
No. of JFUAs	0	0	0	4	2	4	0	0	10

Source: Author

Large JFUAs (Table 6-6B): The following can be said about the changes within this group over the twenty years period. Firstly, in the 1970s Large JFUAs only existed in stages 4 or 5. Some movement towards other stages can be seen in the 1980s with one JFUA migrating to stage 3 and several others towards decentralisation stages. However, the general picture for this group seems to be one of little change in the 1980s. Out of 15 JFUAs in stage 4, 11 remained there and 8 out of 10 have stayed in stage 5. Overall, it seems that there is a slight relative sequential movement to the right.

Table 6-6B: Large JFUAs: Population Sequential Shifts 1970-1990

1970 - 1980 \ 1980-1990 Urban Stages	1	2	3	4	5	6	7	8	No. of JFUAs
1									0
2									0
3									0
4			1	11	2	1			15
5					8	2			10
6									0
7									0
8									0
No. of JFUAs	0	0	1	11	10	3	0	0	25

Source: Author

Medium-Sized JFUAs (Table 6-6C): Centred around stage 4, the distribution pattern of this groups ranged from stages 3 to 5 in the 1970s. However, in the 1980s it spread across the whole development stage spectrum from stages 1 to 8, with the most outstanding point (that can be deduced from the graph) being the changes within stage 4. To the extent that stage 4 is also the focal point of change in the 1980s, it could be said that there is little change in the overall dynamics of the group. Of the distinguishing features of Medium-Sized JFUAs that cannot be found in the two previous groups, we find that although the 1970s did not witness any stages indicating population decline (1,2,7,8), the 1980s saw 7 JFUAs shifting towards this trend.

Small JFUAs (Table 6-6D): Unlike the previous three groups, this group shows a reasonable degree of change over the twenty year period examined. Firstly, the peak which was centred around stage 4 in the 1970s shifted to the left to stage 3. Secondly, the profile of JFUA distribution became flatter (Figure A1-4). If we examine the changes between the two decades, it is possible to find some characteristics in relation to stages 1 to 4 that are unique to this group. There are more JFUAs within this group, that move towards the left, than any other group as is especially the case with stages 3 and 4. In addition, in tandem with the tendency of stage 4 JFUAs to move left, it is also possible to witness the shift of the peak within the graph. Furthermore, the stages 1, 2, 7 and 8, represent an overall picture of the population decline which is commonly seen in all groups with the exception of small JFUAs. In the 1970s, 9 JFUAs fell within these stages whilst in the 1980s, the number increased to 24.

Table 6-6C: Medium-Sized JFUAs: Population Sequential Shifts 1970-1990

1980-1990

1970 - 1980	Urban Stages	1	2	3	4	5	6	7	8	No. of JFUAs
	1									0
	2									0
	3	2		4	1					7
	4	2	1	1	10	2			1	17
	5				1	6	1	1		9
	6							1		1
	7								1	1
	8									0
	No. of JFUAs	4	1	5	12	8	1	2	2	35

Source: Author

Table 6-6D: Small JFUAs: Population Sequential Shifts 1970-1990

1980-1990

Shift 1970 - 1980	Urban Stages	1	2	3	4	5	6	7	8	No. of JFUAs
	1						1		1	2
	2	2	2	2						6
	3	2	5	13	4			1	1	26
	4	2	1	10	14	4	1		2	34
	5				2	7	3	2		14
	6						1		1	2
	7									0
	8									0
	No. of JFUAs	6	8	25	20	11	6	3	5	84

Source: Author

From the above, we can draw the following provisional conclusions. The larger the JFUA population, the more the JFUAs show a sequential movement in terms of development stages. This trend is particularly pronounced in the case of Large JFUAs and the Largest JFUAs. In addition, the larger JFUAs have not witnessed a shift large enough to amount to a change in the development stage over the twenty years period.

On the other hand, it is clear that there have been some changes in the smaller JFUAs, particularly in the 1980s. Those that showed a concentration in stages 3 and 4 in the 1970s saw various patterns of decentralisation in the 1980s.

Further, in terms of changes in JFUAs, it is worth noting that those showing population decline were either Medium-sized or, in particular, Small JFUAs. In future, it is worth paying attention to whether these will show an overall decline in population.

From these points, we end up with the question of why this particular relation between JFUA size and development stage arises. Three possible factors can be attributed to this. Firstly, in comparison to the US and Europe, the Japanese urbanisation has had a considerably later start and has a fundamentally different development pattern. This can be seen from the fact that the population of the FUR rings in Japan outnumbered that of the cores since the 1970s (Yamada, 1986). In addition, at the same time, changes in the economic and industrial structures started prior to the decline of large cities, thus altering the structure of large cities while they continuined to grow. On the other hand, there were not many small JFUAs that were equipped with urban functions, which were thus vulnerable to direct effects of fluctuations in economic activity. For these JFUAs, the shift towards the service sector in the 1970s and the change in the main industrial activities were highly damaging. In this regard, there seems to be a parallel between the patterns witnessed in Europe as argued by Cheshire (1995).

In this section, the relationship between JFUA size and development stages was examined without addressing the issue of spatial distribution. This will be looked at in the next section where we shall be looking at the actual relation between development stages and spatial distribution.

6.4.3. The Relationship between the Regions and the Urban Stages

Would it be possible to witness any regional patterns in the Japanese urban development? In Chapter 4, it was found that in relation to the characteristics of

population growth, the Kanto region saw a significant increase. In comparison, the Kinki and Chubu regions did not witness the same level of growth. However, rapid population growth was concentrated in JFUAs within the Kanto and Chubu regions. In this section, we shall attempt to discover regional relationships through the examination of each region.

Hokkaido (Table 6-7A): It is possible to see that this region experiences a sequential shift in the overall development stages. The main change that has happened since the 1970s was that Tomakomai, which had been in stage 4, shifted to stage 3 in the 1980s. However, perhaps as a result, it has not had a rate of growth that was high enough to encourage the enlargement of the ring area. On the other hand, JFUAs such as Kushiro, Hakodate and Muroran experienced a rapid dispersion in their development stages towards population decline.

Tohoku (Table 6-7B): The Tohoku region originally was centred around stage 3. In the 1970s, there were 13 JFUAs (59.1%) within that group. However, there was a considerable change within this group in the 1980s. Beginning with Aomori and Hirosaki, such JFUAs showed a pattern of population decline whilst maintaining centralisation towards the core i.e. a shift towards stages representing decline. As a result of this, the 1980s saw an overall shift of development stages, formerly concentrated in a peak at stage 3, where they were dispersed from stages 1 to 4. Some have even shifted to stage 8.

Kanto (Table 6-7C): From what can be deduced from the graph, there seems to have been little change in the distribution of the FURs of this region between stages over the twenty years period. Both the mode and the median of the distribution have remained in stage 4. This can also be inferred from the matrix. However, it may be noted that this is due to the even balance of JFUAs migrating from stage 4 to 5 and vice versa although the number in the latter group is smaller than that of the former group.

Table 6-7A: Hokkaido: Population Sequential Shifts 1970--1990

1980-1990

1970 - 1980 Urban Stages	1	2	3	4	5	6	7	8	No. of JFUAs
1									0
2									0
3			2						2
4			1	2					3
5							2		2
6								1	1
7									0
8									0
No. of JFUAs	0	0	3	2	0	0	2	1	8

Source: Author

Table 6-7B: Tohoku: Population Sequential Shifts 1970—1990

1980-1990

1970 - 1980 Urban Stages	1	2	3	4	5	6	7	8	No. of JFUAs
1								1	1
2		1	1						2
3	3	2	5	2				1	13
4			1	4					5
5						1			1
6									0
7									0
8									0
No. of JFUAs	3	3	7	6	0	1	0	2	22

Source: Author

Table 6-7C: Kanto: Population Sequential Shifts 1970—1990

1980-1990

1970 - 1980 Urban Stages	1	2	3	4	5	6	7	8	No. of JFUAs
1									0
2									0
3				1					1
4			1	9	3				13
5				2	4	1			7
6						2			2
7									0
8									0
No. of JFUAs	0	0	1	12	7	3	0	0	23

Source: Author

Chubu (Table 6-7D): The median of the distribution remained in stage 4 for this region but the mode has been in stage 5 throughout the period. In addition, the JFUAs that have moved from stage 4 to stage 8, such as Okaya, and from stage 3 to 7, such as Ueno, where both small with no prefectural capital city.

Kinki (Table 6-7E): The Kinki region contains 3 of the Largest JFUAs, and apart from small JFUAs such as Fukuchiyama JFUA in Kyoto, and Tanabe JFUA in Wakayama, that moved towards the stages of centralisation, the peak has generally shifted towards centralisation. In comparison to the Kanto and Chubu regions, the shift towards the right is very clear. If we chart this movement, the peak in stages 4 and 5 in the 1970s has moved to stages 5 and 6 in the 1980s.

Chugoku (Table 6-7F): The Chugoku region is unique in its pattern of change in comparison to the previous regions. In the 1970s, most JFUAs were in centralisation stages with 11 JFUAs (61.1%) in stage 4. However, in the 1980s the peak shifted to stage 3, with JFUAs dispersing to stages from 1 through to 7, and the number in stage 4 declining to 5 (27.7%). When individual changes in the table are investigated, it was found that JFUAs in this region did not confirm to the stages of development sequence. For example, JFUAs that were in stage 4 in the 1970s have moved to stage 1 or 3 in the 1980s. Thus, overall it could be said that this region has gone through a considerable change.

Shikoku (Table 6-7G): JFUAs in this region were concentrated in stage 4 in the 1970s. Indeed stage 4 accounted for two-thirds of all JFUAs. There has been some movement towards other stages in the 1980s and this has meant that the concentration is now not as pronounced.

Table 6-7D: Chubu: Population Sequential Shifts 1970—1990

1970 - 1980 \ 1980-1990	1	2	3	4	5	6	7	8	No. of JFUAs
1									0
2		1	1						2
3			3				1		4
4		1	3	11	1			1	17
5				2	13	2			17
6									0
7									0
8									0
No. of JFUAs	0	2	7	13	14	2	1	1	40

Source: Author

Table 6-7E: Kinki: Population Sequential Shifts 1970—1990

1970 - 1980 \ 1980-1990	1	2	3	4	5	6	7	8	No. of JFUAs
1									0
2									0
3		1							1
4		1		1	1	1			4
5					2	1	1		4
6						1			1
7									0
8									0
No. of JFUAs	0	2	0	1	3	3	1	0	10

Source: Author

Table 6-7F: Chugoku: Population Sequential Shifts 1970—1990

1970 - 1980 \ 1980-1990	1	2	3	4	5	6	7	8	No. of JFUAs
1									0
2									0
3			4	1					5
4	3		3	4		1			11
5					1				1
6							1		1
7									0
8									0
No. of JFUAs	3	0	7	5	1	1	1	0	18

Source: Author

Table 6-7G: Shikoku: Population Sequential Shifts 1970—1990

1970 - 1980 \ 1980-1990	1	2	3	4	5	6	7	8	No. of JFUAs
1									0
2	1								1
3									0
4	1		1	3	1				6
5						2			2
6									0
7									0
8									0
No. of JFUAs	2	0	1	3	1	2	0	0	9

Source: Author

Table 6-7H: Kyushu-Okinawa: Population Sequential Shifts 1970—1990

1970 - 1980 \ 1980-1990	1	2	3	4	5	6	7	8	No. of JFUAs
1						1			1
2	1								1
3	1	2	3	1					7
4			2	3	2			2	9
5				1	2	2			5
6									0
7								1	1
8									0
No. of JFUAs	2	2	5	5	4	3	0	3	24

Source: Author

Kyushu-Okinawa (Table 6-7H): This region has experienced a reasonable degree of change. Concentration was biased towards stages 3, 4 and 5 in the 1970s but the graph shows that this spread across the whole spectrum in the 1980s. If we look in further detail, the table reveals that JFUAs in stages 1 to 4 did not show the sequential shift. These JFUAs have spread both to early centralisation stages and late decentralisation stages. Furthermore, in comparison to other regions, Kyushu-Okinawa region has experienced a relatively strong tendency towards decentralisation stages. If we view stages 1 to 4 as centralisation and 5 to 8 as decentralisation, the latter has increased from 6 JFUAs (25%) to 10 (41.7%). This ratio represents the highest value for all of the eight regions.

We have thus examined the regional characteristics of Japan by dividing the country into eight regions, and it has been possible to find the following.

If the distributional peaks in the 1970s are examined, Tohoku has the heaviest concentration in stage 3, whereas for the southern regions, the heaviest concentration is in stage 4. In the 1980s, almost all regions witnessed some form of change with a relatively fixed pattern of developmental stages of the 1970s, spreading out in the 1980s. This is the combined result of JFUAs moving both sequentially and non-sequentially. The changes in regions outside the three metropolitan areas are especially pronounced, for example in the case of JFUAs in stage 4 in the Chugoku region.

Within this trend, the Kanto, Chubu and Kinki regions, which have metropolitan areas, show relatively clear changes. From the figure, the Kanto region has exhibited a very stable distribution, where as the Chubu region has a slight shift towards the right, i.e. decentralisation. The Kinki region, partly as a result of the small number of JFUAs it contains, large JFUAs in this region shows a clearer move towards the right.

On the other hand, regions located outside the three metropolitan areas showed a non-sequential movement of urban development stages during the 1980s. From the combined results of the regional characteristics and the results from section 6.4.2, it can be said that small JFUAs in these regions without metropolitan areas showed highly irregular movements. In aggregate, Japanese JFUAs showed little systematic pattern of 'sequential shift' during the 1980s.

6.4.4. JFUAs with Prefectural Capital Cities

As explained in Chapter 4, Japan has 47 prefectures, each one holding its prefectural capital city. There are 42 JFUAs with such prefectural capital cities, and they have mostly grown in terms of population from the 1970s to 1980s. In

addition, even if at a first glance this growth rate is small, in comparison to other areas, they seem to have been attracting people (Chapter 4). Furthermore, when considering the changes in the economic and the industrial structures and its effect, it is necessary to examine JFUAs with political functions separately from those without.

Table 6-8A examines 42 JFUAs with prefectural capital cities in terms of urban development stages over the past twenty years. From this, it is possible to say the following. Firstly, the vast majority of JFUAs with prefectural capital cities belong to stage 4 in both decades. Although there is a slight change in the make-up, there were 22 JFUAs in stage 4 in both the 1970s and 1980s.

Secondly, although there are a few exceptions, JFUAs with prefectural capital cities showed a greater tendency to exhibit a sequential movement than JFUAs without prefectural capital cities. For example, if we compare the number of JFUAs that were in stage 4 in the 1970s to those in either stage 4 or 5 in the 1980s, 20 out of 22 still remain in these two stages. This rule applies to all the stages of this group.

Consequently, there seems to be a slight bias towards decentralisation over centralisation in terms of the overall distribution. However, it must be noted that this bias is very small. If we take stages 1 to 4 as centralisation stages, and 5 to 8 as decentralisation stages, those in decentralisation only increased from 14 (33.3%) to 15 (35.7%). If we think in term of the actual number of JFUAs, this increase is minimal.

Table 6-8A: 42 JFUAs with Prefectural Capital Cities: Population Sequential Shifts 1970—1990

1970 - 1980 \ 1980-1990	1	2	3	4	5	6	7	8	No. of JFUAs
1									0
2									0
3	1		3	2					6
4			1	18	2	1			22
5				2	7	3			12
6						2			2
7									0
8									0
No. of JFUAs	1	0	4	22	9	6	0	0	42

Source: Author

Table 6-8B: 57 JFUAs without a Prefectural Capital City (JFUA Population>200,000): Population Sequential Shifts 1970—1990

1970 - 1980 \ 1980-1990	1	2	3	4	5	6	7	8	No. of JFUAs
1									0
2		1							1
3	3	1	2	1					7
4	4	1	5	12	3			2	27
5					12	4	2		18
6						1	1	1	3
7								1	1
8									0
No. of JFUAs	7	3	7	13	15	5	3	4	57

Source: Author

This characteristic becomes even clearer when compared to the change in another type of JFUAs. Table 6-8B represents 54 JFUAs that do not have prefectural capital cities but have a core population of over 100,000. It may be noted that the population of 100,000 equates to that of the smallest JFUA with a prefectural capital city.[52] From this, it is found that these JFUAs show

[52] The smallest prefectural capital city is Yamaguchi. The population of Yamaguchi-*shi*, its prefectural capital city, was 129,000 in 1990.

characteristics that are directly opposite to those with prefectural capital cities. In other words, JFUAs in stages 3 and 4 do not show sequential movements as much as JFUAs with prefectural capital cities. For example, if we compare the number of JFUAs that were in stage 4 in the 1970s to that of those that were in stage 4 or 5 in the 1980s, we find that there were only 15 from a total of 24 (62.7%). If we chart the distribution of JFUAs in each stage, it turns out that both the mode and median of the distribution shifted from stage 4 to 5.

From the comparison, we can see that the JFUAs with prefectural capital cities show higher levels of centralisation than those without a prefectural capital city. In the 1970s, the percentage of JFUAs in centralisation stages to the total JFUAs with prefectural capital cities was 66.7%. On the other hand, the percentage of the JFUAs without prefectural capitals during the same period was 61.4%. In the 1980s, the gap between these two groups of the JFUAs became wider. The percentage of JFUAs with prefectural capital cities that were centralising was 64.3% compared to that of the JFUAs without prefectural capital cities which was 52.6%. From these results, it can be said that the JFUAs with a prefectural capital city had a greater likelihood of centralising than the non-prefectural capital areas. The role of the prefectural capital city should be considered. At a prefectural level, the prefectural capital city has more political functions than rest of the prefecture. In addition, prefectural capital cities tend to have other functions acting as regional transport and service centres (Sanuki 1983). In other words, the JFUAs with prefectural capital cities are potentially multi-functional centres of regions and these non-industrial functions tend to be located in the centre of cities which not only produced relatively more central jobs but also a lower level of pollution from which residents may wish to escape by decentralising (Thurston and Yezer, 1994)

6.5. Urban Stage of Individual JFUAs and the Background of the Growth Pattern

Unlike the US or UK, in Japan, the largest urban settlements generally grew throughout the 1970s and 1980s (Chapter 4). Of course, there were differences in growth rates between JFUAs with some experiencing explosive growth, whilst others showed decline. These differences in growth experience were reflected in differences in development stages as well. This section examines the urban development pattern of selected JFUAs, i.e. fastest and slowest growing JFUAs, and investigates the background of the different growth pattern using two population indexes.

6.5.1. Urban Stage of the Fastest and Slowest Growing JFUAs

As seen in Chapter 4, JFUAs that did experience fastest growth can be split into the following two groups. The first group contains JFUAs with a prefectural capital city. Many of these areas managed to maintain high growth rates despite large population sizes, e.g. Sapporo, Sendai, Fukuoka and Hiroshima JFUAs. The second group consists of JFUAs located near the largest JFUAs, such as Tsuchiura, Atsugi, and Narita JFUAs. On the other hand, JFUAs that were showing trends towards decline or where already in decline have three following characteristics. Firstly, they did not have a prefectural capital city[53]. Secondly, these areas are recognised as old manufacturing centres such as Muroran and Kure JFUAs. In Japan, these areas tend to be overwhelmingly cities with ports, as these have historically developed their industries earlier through imports of resources and

[53] Although Aomori JFUA recorded a population decline in the 1980s, this JFUA showed a population concentration within its prefecture (Chapter 4). Rather than class this as a decline, Aomori prefecture can be said to have suffered from the problem of regional disparity.

exports of products. Thirdly, in cases of remote areas from the Japanese metropolitan areas, there has been evidence of stagnation and population decline.

Table 6-9: Urban Stages of Selected JFUAs

6-9A: 15 Fastest Growing JFUAs in Relative Terms (The 1980s)

Rank	JFUA Code	JFUA Name	Region	Size	With Prefectural Capital Cities?	Urban Stages 1970s	Urban Stages 1980s
1	52	Atsugi JFUA	Kanto	Medium-Sized	-	4	4
2	33	Tsuchiura JFUA	Kanto	Medium-Sized	-	4	5
3	49	Narita JFUA	Kanto	Small	-	4	4
4	39	Koyama JFUA	Kanto	Small	-	5	5
5	116	Higashihiroshima JFUA	Chugoku	Small	-	3	3
6	86	Toyota JFUA	Chubu	Medium-Sized	-	4	4
7	1	Sapporo JFUA	Hokkaido	Largest	Yes	4	4
8	8	Chitose JFUA	Hokkaido	Small	-	3	3
9	40	Mooka JFUA	Kanto	Small	-	4	4
10	46	Ota JFUA	Kanto	Small	-	4	5
11	18	Sendai JFUA	Tohoku	Largest	Yes	4	4
12	82	Iwata JFUA	Chubu	Small	-	4	5
13	132	Fukuoka JFUA	Kyushu-Okinawa	Largest	Yes	5	4
14	35	Katsuta JFUA	Kanto	Small	-	4	3
15	84	Handa JFUA	Chubu	Small	-	5	5

6-9B: 15 Slowest Growing JFUAs in Relative Terms (The 1980s)

Rank	JFUA Code	JFUA Name	Region	Size	With Prefectural Capital Cities?	Urban Stages 1970s	Urban Stages 1980s
1	4	Muroran JFUA	Hokkaido	Small	-	6	8
2	128	Uwajima JFUA	Shikoku	Small	-	2	1
3	23	Odate JFUA	Tohoku	Small	-	1	8
4	133	Omuta JFUA	Kyushu-Okinawa	Medium-Sized	-	7	8
5	113	Kure JFUA	Chugoku	Medium-Sized	-	6	7
6	21	Kesennuma JFUA	Tohoku	Small	-	3	8
7	149	Nobeoka JFUA	Kyushu-Okinawa	Small	-	4	8
8	117	Shimonoseki JFUA	Chugoku	Medium-Sized	-	4	1
9	2	Hakodate JFUA	Hokkaido	Medium-Sized	-	5	7
10	70	Okaya JFUA	Chubu	Small	-	4	8
11	121	Iwakuni JFUA	Chugoku	Small	-	4	1
12	143	Yatsushiro JFUA	Kyushu-Okinawa	Small	-	3	1
13	27	Sakata JFUA	Tohoku	Small	-	3	1
14	10	Hirosaki JFUA	Tohoku	Medium-Sized	-	3	1
15	146	Hita JFUA	Kyushu-Okinawa	Small	-	2	1

Source: Author

Let us now examine the actual patterns of the development stages of these two JFUA groups. Table 6-9A shows the urban development stage of the 15 fastest growing JFUAs in relative terms during the 1980s. There are two points from this

table. Firstly, 10 out of 15 JFUAs stayed at the same stage in both decades. The five JFUAs that changed their development stages in the two decades are as follows. There are two JFUAs that shifted leftwards; Fukuoka JFUA shifted from stage 5 in the 1970s to stage 4 in the 1980s, and Katsuta JFUA shifted from stage 4 to stage 3 in the 1980s. three JFUAs, i.e. Tsuchiura, Ota and Iwata JFUAs, shifted from stage 4 in the 1970s to stage 5 in the 1980s. Secondly, the JFUAs with the fastest growth stayed only at stages 3, 4 and 5 over the two decades.

Table 6-9B shows the urban development stage of 15 slowest growing JFUAs in relative terms during the 1980s. All of these 15 JFUAs changed their urban stages in the 1970s and the 1980s. In terms of development stages, there seem to be many JFUAs that either showed a random movement if one tries to interpret the patterns of change in terms of a sequential model of stages of development, or have rapidly moved towards decentralisation. In the 1970s, 9 JFUAs in this group stayed at stages 3, 4 and 5, however, all JFUAs in this group stayed at stages 1, 7 and 8.

6.5.2. Relationship between Industrial Structure of the JFUA Cores and Urban Stage

What are the factors behind the differences between the fastest and the slowest growing JFUAs? In section 6.3, the notion was considered that (1) changes in the functions of cities and the resulting shift in industrial structure, and (2) the development of the transport network caused this disparity. Therefore, industrial structure of the JFUA cores should be examined to clarify the relationship between urban growth pattern and urban functions.

Table 6-10: Industrial Structure of Selected JFUA Cores in 1990 (Classified by 3 Types of Industries)[54]

6-10A: The JFUA Cores of 15 Fastest Growing JFUAs in Relative Terms during the 1980s

Rank	JFUA Code	JFUA Name	Region	Size	With Prefectural Capital Cities?	Types of Industries (%)		
						Primary	Secondary	Tertiary
1	52	Atsugi JFUA	Kanto	Medium-Sized	-	1.7	36.9	61.0
2	33	Tsuchiura JFUA	Kanto	Medium-Sized	-	4.3	29.2	66.3
3	49	Narita JFUA	Kanto	Small	-	3.5	15.2	80.8
4	39	Koyama JFUA	Kanto	Small	-	8.8	42.6	48.5
5	116	Higashihiroshima JFUA	Chugoku	Small	-	9.1	42.9	47.6
6	86	Toyota JFUA	Chubu	Medium-Sized	-	2.3	60.2	37.2
7	1	Sapporo JFUA	Hokkaido	Largest	Yes	0.6	21.0	77.5
8	8	Chitose JFUA	Hokkaido	Small	-	3.8	24.1	72.1
9	40	Mooka JFUA	Kanto	Small	-	11.3	52.9	35.7
10	46	Ota JFUA	Kanto	Small	-	4.3	48.0	47.6
11	18	Sendai JFUA	Tohoku	Largest	Yes	1.6	21.2	76.6
12	82	Iwata JFUA	Chubu	Small	-	6.3	53.6	39.9
13	132	Fukuoka JFUA	Kyushu-Okinawa	Largest	Yes	1.0	20.2	77.9
14	35	Katsuta JFUA	Kanto	Small	-	4.1	52.4	43.1
15	84	Handa JFUA	Chubu	Small	-	2.3	42.2	55.4

6-10B: The JFUA Cores of 15 Slowest Growing JFUAs in Relative Terms during the 1980s

Rank	JFUA Code	JFUA Name	Region	Size	With Prefectural Capital Cities?	Types of Industries (%)		
						Primary	Secondary	Tertiary
1	4	Muroran JFUA	Hokkaido	Small	-	0.9	31.1	67.9
2	128	Uwajima JFUA	Shikoku	Small	-	15.2	20.5	64.3
3	23	Odate JFUA	Tohoku	Small	-	11.3	29.7	59.0
4	133	Omuta JFUA	Kyushu-Okinawa	Medium-Sized	-	3.4	30.9	65.5
5	113	Kure JFUA	Chugoku	Medium-Sized	-	1.3	35.1	63.4
6	21	Kesennuma JFUA	Tohoku	Small	-	20.6	27.9	51.5
7	149	Nobeoka JFUA	Kyushu-Okinawa	Small	-	5.2	36.8	57.9
8	117	Shimonoseki JFUA	Chugoku	Medium-Sized	-	5.2	28.6	66.2
9	2	Hakodate JFUA	Hokkaido	Medium-Sized	-	2.7	21.2	75.7
10	70	Okaya JFUA	Chubu	Small	-	2.4	56.9	40.6
11	121	Iwakuni JFUA	Chugoku	Small	-	4.3	33.7	61.9
12	143	Yatsushiro JFUA	Kyushu-Okinawa	Small	-	15.3	27.0	57.7
13	27	Sakata JFUA	Tohoku	Small	-	10.8	33.7	55.4
14	10	Hirosaki JFUA	Tohoku	Medium-Sized	-	18.5	19.6	61.7
15	146	Hita JFUA	Kyushu-Okinawa	Small	-	8.8	34.3	56.8

6-10C: Selected JFUA Cores (Prefectural Capital Cities and Cities of Slowest Growing JFUAs)

JFUA Code	JFUA Name	Prefecture	Size	With Prefectural Capital Cities?	Types of Industries (%)		
					Primary	Secondary	Tertiary
1	Sapporo JFUA	Hokkaido	Largest	Yes	0.6	21.0	77.5
2	Hakodate JFUA	Hokkaido	Medium-Sized	-	2.7	21.2	75.7
4	Muroran JFUA	Hokkaido	Small	-	0.9	31.1	67.9
112	Hiroshima JFUA	Hiroshima	Largest	Yes	1.8	26.9	70.6
113	Kure JFUA	Hiroshima	Medium-Sized	-	1.3	35.1	63.4
119	Yamaguchi JFUA	Yamaguchi	Small	Yes	8.6	18.4	72.7
117	Shimonoseki JFUA	Yamaguchi	Medium-Sized	-	5.2	28.6	66.2
121	Iwakuni JFUA	Yamaguchi	Small	-	4.3	33.7	61.9

Source: Author

[54] Some people were employed in unclassifiable jobs, therefore, in some cases, the sum of the three ratios of employments would not be 100%.

Table 6-10A shows the percentage distribution of employment in 1990 between the three main sectors (i.e. primary, secondary, and tertiary) of industry within the JFUA cores of the 15 fastest growing JFUAs during the 1980s. From this, the following can be said. Firstly, prefectural capital cities showed a greater share of employment within the tertiary sector than any other JFUAs. In Fukuoka JFUA, this ratio was 78.6%, 78.2% in Sapporo JFUA and 77.0% in Sendai JFUAs.

Secondly, some JFUA cores of this group in the Kanto region also had a substantial share of employment within the tertiary sector. For example, in Narita, the proportion of the employment in the tertiary sector was 81.2%. Narita is at the centre of the international transport network of the Tokyo area, thus gradually bolstering the growth of its tertiary sector[55]. Not only Narita, but also Tsuchiura recorded a relatively high share of those employed in the tertiary sector at 66.9% of the total employment, and this applies to Atsugi at 61.2%. The concentration of tertiary sector employment in these two cities is thought to be the result of the mass migration of research facilities.

Thirdly, the other JFUA cores of this group did not witness this trend. These JFUA cores had a bias towards the secondary sector. Toyota represents a good example. In Toyota, 60.4% of the workers were involved in the manufacturing sector whereas the tertiary sector only commanded 37.3%. This was as a result of its specialisation in car production which inevitably reinforced manufacturing. In this case, the reason for the growth of the region can be put down to its specialisation in growth industries.

Table 6-10B shows the ratio of employment in 1990 within three different sectors of industry within the JFUA cores of the 15 slowest growing JFUAs during the 1980s. If we examine the structure of these core cities, some JFUA cores in this group showed a relatively higher proportion of employment within the primary sector. In 6 out of 15 JFUA cores, it was over 10%. In addition, in some cases it

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[55] The New Tokyo International Airport is located in Narita.

would be difficult to say that the tertiary sector enjoys a rapidly growing share. These JFUA cores depended on the old style industries, and do not have growing industries. Some JFUA cores of this group showed a relatively larger share of people employed in the tertiary sector than the other JFUA cores. For example, Muroran, Kure, Hakodate, and Shimonoseki, JFUA cores with the slowest growth in the 1980s, showed a relatively larger share of people employed in the tertiary sector than the other JFUA cores in this group.

Table 6-10C highlights the differences in the industrial structure by contrasting selected cities which either are prefectural capitals or are not. It shows (1) some JFUA cores of slowest growing JFUAs, i.e. Hakodate, Muroran, Kure Shimonoseki and Iwakuni, and (2) prefectural capital cities in which those slowest growing JFUAs are located, i.e. Sapporo, Hiroshima and Yamaguchi. From this table, it can be seen that the share of people employed in the tertiary sector in the JFUA cores of the slowest growing JFUAs was smaller than that in their prefectural capital cities. This is easily discernible when comparing Muroran to Sapporo, Kure to Hiroshima, and Shimonoseki and Iwakuni to Yamaguchi. The percentage of people employed within the tertiary sector in Hakodate was similar to that in Sapporo, however, so perhaps Hakodate's case should be examined using other indexes.

6.5.3. Relationship between the Main Types of Occupation of the JFUA Core and the Urban Stage

A set of table such as 6-10 only provides a broad indication of the industrial structure of different JFUAs because of the highly aggregated classification but even within a single corporation, various types of jobs exist. Under the classification by industries, people in management may be statistically classed as being in the same group as factory workers. In reality, it is difficult to distinguish

between the various job types under this sort of analysis. Therefore, it is important to look at the percentage of employment by occupations.

Table 6-11 shows the occupational structure in 1990 arranged by four types of occupation in the selected JFUA cores examined in previous sections. According to the 1990 Population Census of Japan, in Japan, all occupations are divided in the following four general sectors; (Type I) agriculture, forestry and fishing, (Type II) manufacturing and distribution, (Type III) retail and service sector, and (Type IV) management and administration.

From Table 6-11A and 6-11B, it can be observed that some cores of the fastest growing JFUAs showed a concentration of employment within the management and administration sector relative to the cores of slowest growing JFUAs. In Atsugi, Sapporo, Sendai and Fukuoka, the population in the highest occupational group was over 40%. On the other hand, this proportion in the cores with slowest growth was relatively low; the highest was 35.7% in Muroran.

The importance of the management and administration group was confirmed by comparison of cores of slowest growing JFUAs with their prefectural capital cities. Table 6-11C shows the structure of employment within four occupations in selected JFUA cores. Comparison of Hakodate with Sapporo shows a good example because these two JFUA cores showed a similar proportion of employment in the service sector, 76.0% in Hakodate and 78.2% in Sapporo. Table 6-11C, however, provides evidence that the structure of the service sector differed substantially between the cities. The percentage of management and administration was 41.3% in Sapporo but only 35.3% in Hakodate.

Table 6-11: Industrial Structure of Selected JFUA Cores in 1990 (Classified by 4 Types of Occupation)[56]

6-11A: The JFUA Cores of 15 Fastest Growing JFUAs in Relative Terms during the 1980s

Rank	JFUA Code	JFUA Name	Region	Size	With Prefectural Capital Cities?	Types of Occupations (%) I	II	III	IV
1	52	Atsugi JFUA	Kanto	Medium-Sized	-	1.7	37.4	19.0	41.4
2	33	Tsuchiura JFUA	Kanto	Medium-Sized	-	4.2	33.4	26.8	35.3
3	49	Narita JFUA	Kanto	Small	-	3.5	34.1	31.0	31.0
4	39	Koyama JFUA	Kanto	Small	-	8.8	44.0	18.3	28.8
5	116	Higashihiroshima JFUA	Chugoku	Small	-	9.1	40.4	16.5	33.6
6	86	Toyota JFUA	Chubu	Medium-Sized	-	2.3	54.1	14.8	28.5
7	1	Sapporo JFUA	Hokkaido	Largest	Yes	0.6	27.7	30.0	40.9
8	8	Chitose JFUA	Hokkaido	Small	-	3.6	31.2	42.1	23.0
9	40	Mooka JFUA	Kanto	Small	-	11.4	52.0	12.8	23.8
10	46	Ota JFUA	Kanto	Small	-	4.3	45.8	19.3	30.6
11	18	Sendai JFUA	Tohoku	Largest	Yes	1.6	25.6	29.2	43.0
12	82	Iwata JFUA	Chubu	Small	-	6.3	49.6	15.2	28.7
13	132	Fukuoka JFUA	Kyushu-Okinawa	Largest	Yes	1.0	23.9	31.7	42.5
14	35	Katsuta JFUA	Kanto	Small	-	4.1	47.2	17.2	31.2
15	84	Handa JFUA	Chubu	Small	-	2.3	45.1	21.5	31.0

6-11B: The JFUA Cores of 15 Slowest Growing JFUAs in Relative Terms during the 1980s

Rank	JFUA Code	JFUA Name	Region	Size	With Prefectural Capital Cities?	Types of Occupations (%) I	II	III	IV
1	4	Muroran JFUA	Hokkaido	Small	-	0.9	39.6	23.8	35.7
2	128	Uwajima JFUA	Shikoku	Small	-	14.7	30.7	25.4	29.2
3	23	Odate JFUA	Tohoku	Small	-	10.9	38.9	21.9	28.2
4	133	Omuta JFUA	Kyushu-Okinawa	Medium-Sized	-	3.3	37.2	26.1	33.0
5	113	Kure JFUA	Chugoku	Medium-Sized	-	1.3	38.0	27.1	33.4
6	21	Kesennuma JFUA	Tohoku	Small	-	18.0	35.2	21.3	25.5
7	149	Nobeoka JFUA	Kyushu-Okinawa	Small	-	5.0	40.8	22.0	32.0
8	117	Shimonoseki JFUA	Chugoku	Medium-Sized	-	4.9	35.3	26.3	33.3
9	2	Hakodate JFUA	Hokkaido	Medium-Sized	-	2.3	31.9	30.4	35.3
10	70	Okaya JFUA	Chubu	Small	-	2.4	50.6	16.3	30.6
11	121	Iwakuni JFUA	Chugoku	Small	-	4.4	39.8	24.2	31.6
12	143	Yatsushiro JFUA	Kyushu-Okinawa	Small	-	13.4	36.4	22.5	27.7
13	27	Sakata JFUA	Tohoku	Small	-	10.7	40.6	20.8	27.8
14	10	Hirosaki JFUA	Tohoku	Medium-Sized	-	18.4	28.9	24.4	28.2
15	146	Hita JFUA	Kyushu-Okinawa	Small	-	8.7	39.8	23.4	28.1

6-11C: Selected JFUA Cores (Prefectural Capital Cities and Slowest Growing JFUAs)

JFUA Code	JFUA Name	Prefecture	Size	With Prefectural Capital Cities?	Types of Occupations (%) I	II	III	IV
1	Sapporo JFUA	Hokkaido	Largest	Yes	0.6	27.7	30.0	40.9
2	Hakodate JFUA	Hokkaido	Medium-Sized	-	2.3	31.9	30.4	35.3
4	Muroran JFUA	Hokkaido	Small	-	0.9	39.6	23.8	35.7
112	Hiroshima JFUA	Hiroshima	Largest	Yes	1.7	29.9	27.2	40.5
113	Kure JFUA	Hiroshima	Medium-Sized	-	1.3	38.0	27.1	33.4
119	Yamaguchi JFUA	Yamaguchi	Small	Yes	8.6	25.8	25.3	40.1
117	Shimonoseki JFUA	Yamaguchi	Medium-Sized	-	4.9	35.3	26.3	33.3
121	Iwakuni JFUA	Yamaguchi	Small	-	4.4	39.8	24.2	31.6

Four Types of Occupation

Type I **Agriculture, forestry and fishing**
Type II **Manufacturing and distribution**
Type III **Retail and service sector**
Type IV **Management and administration**

Source: Author

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[56] Some people were employed unclassifiable jobs, therefore, in some cases, the sum of the four ratios of employments would not be 100%.

Although the structure of employment – especially a concentration of management and administration – seems to be positively related to population growth, it is not essential for cities to grow fast. For example, in Narita, which experienced growth, the size of the administrative or management group is relatively small despite the importance of the service sector. However in general declining cities can be characterised as having a relatively small ratio of people in administrative and managerial jobs.

6.5.4. Comments

So far, we have provided insights into the relationship between the development stages of JFUAs and the urban functions of their cores. Prefectural capital cities showed two important characteristics. Firstly, these cities showed an overall tendency of de-industrialisation and a growth in the tertiary sector. This result is consistent with Cheshire's study in 1995. Secondly, these capital cities showed a specialisation of employment in management and administration. This urban function would have an important role in urban growth.

Having said this, it is also possible to see some JFUAs that recorded the fastest growth during the 1980s by virtue of the fact that they have specialised in growth industries even though they have quite a low share of administration and management employments, such as Toyota. It may be argued that the problem with these cities is that when these industries have ended their role, the cities themselves are in danger of declining as well.

Furthermore, JFUAs that grew slowest in the 1980s were known as the old industrial centres. These areas depended on the old style manufacturing and the service sector did not have an important role in these areas. Thus when the growth of their core industries slowed down or declined, there was very little that could

cover for the decline and as a result, either the core began to show a relative decline or in some cases, the overall region experienced decentralisation and loss.

6.6. Conclusion

In this study, we have analysed the 154 JFUAs using the classification into stages of urban development following the approach of the Hall/Cheshire/Hay model. There are two reasons for this choice; the first is that urban growth does not seem to fit the simple model of the urban life cycle hypothesis and our analysis of urban development in Japan provides further evidence to support that conclusion. Despite this the approach provides a 'useful tool' to classify the pattern of urban development. Another point is that this study focuses on the characteristics of JFUA cores and the Hall/Cheshire/Hay model is convenient because it has a symmetric structure. The first half is composed of centralisation stages and later half is composed of decentralisation stages.

The 154 JFUAs were examined from various aspects. The relationship between the population size of the whole JFUA and the JFUA core shows various trends. When JFUAs were examined in geographical context, the frequency distribution of urban stages showed different patterns in each region and a changing pattern in the last two decades. The Kanto region showed a strong pattern of centralisation and this tendency remained for twenty years. The Chubu region showed a more stable pattern of changing distribution. On the other hand, the Kinki region showed a clearly shifting pattern towards decentralisation.

From European studies, Cheshire (1995) remarked that the type of urban functions of core cities appeared to play an important role in the urban stages, and this idea can also be applied to the Japanese urban settlements. Some JFUAs have showed decentralisation since the 1970s. Except for the two largest JFUAs,

decentralisation is formed to be typical of those areas that depend on the old style industry or areas that are port cities. On the other hand, JFUAs with other urban functions, e.g. administrative and management functions, mainly showed a relative centralisation pattern. In this sense, JFUAs with prefectural capitals show a clear pattern of centralisation.

From these results, it can be said that a general feature of the Japanese urban settlement system was that it exhibited centralisation into the Kanto region at a national level, and that JFUAs with a prefectural capital had been in centralisation at the prefectural level.

Appendix 6.1. Frequency Distribution of Urban Stages

Figure A6-1: Largest JFUAs

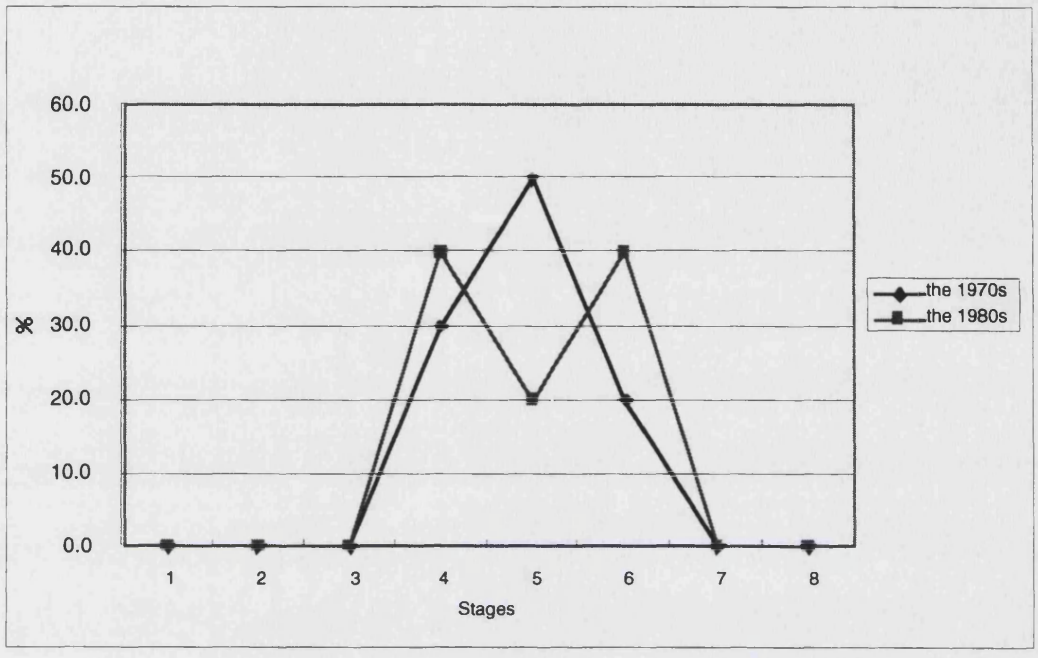


Figure A6-2: Large JFUAs

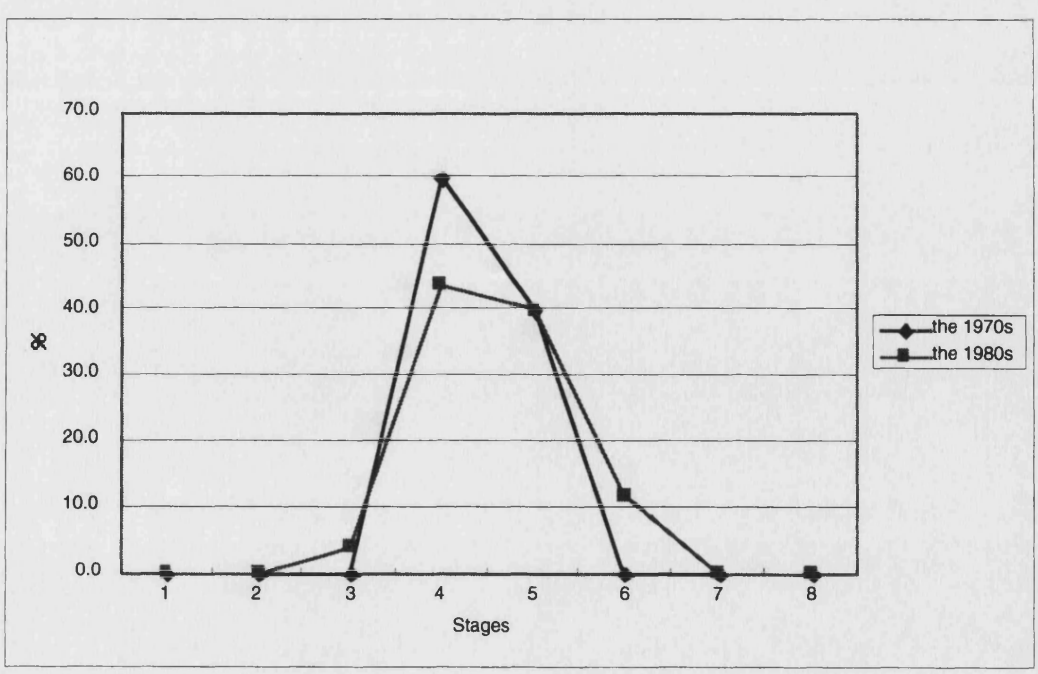


Figure A6-3: Medium-sized JFUAs

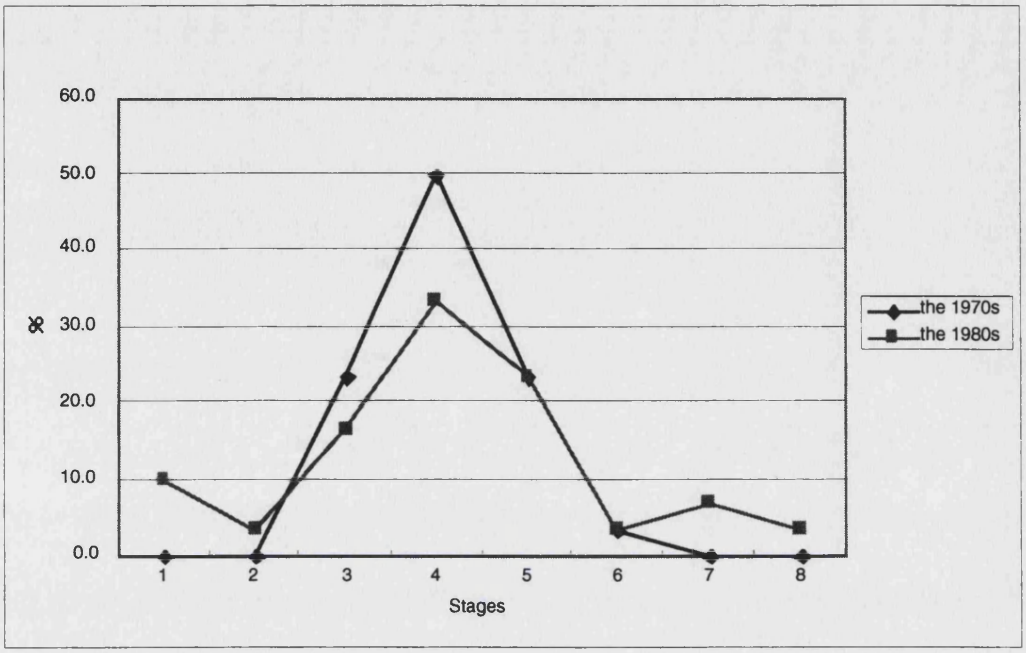


Figure A6-4: Small JFUAs

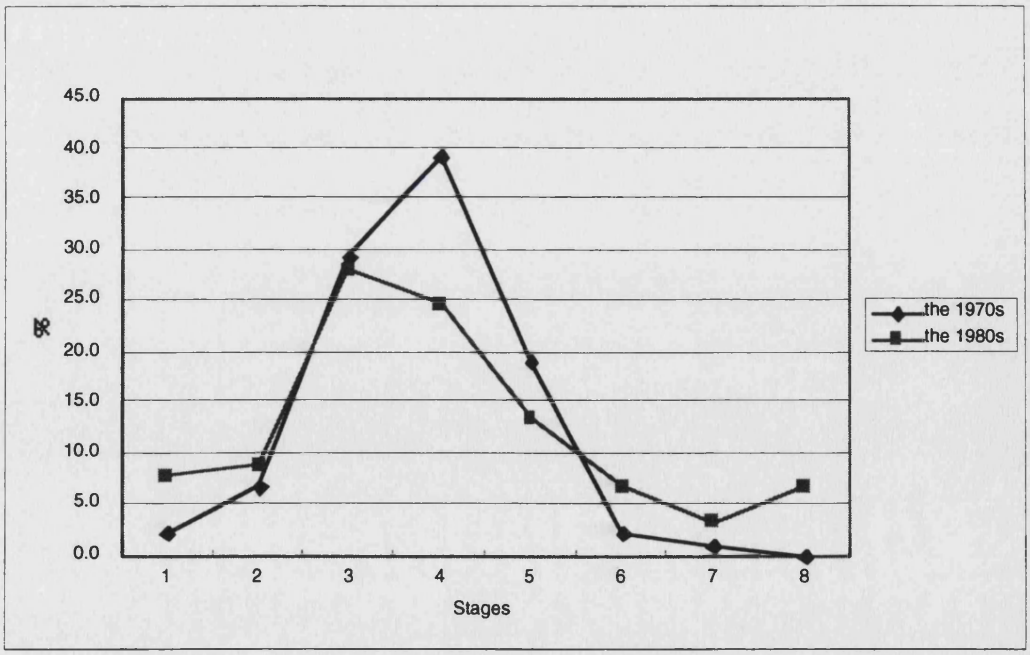


Figure A6-5: Hokkaido

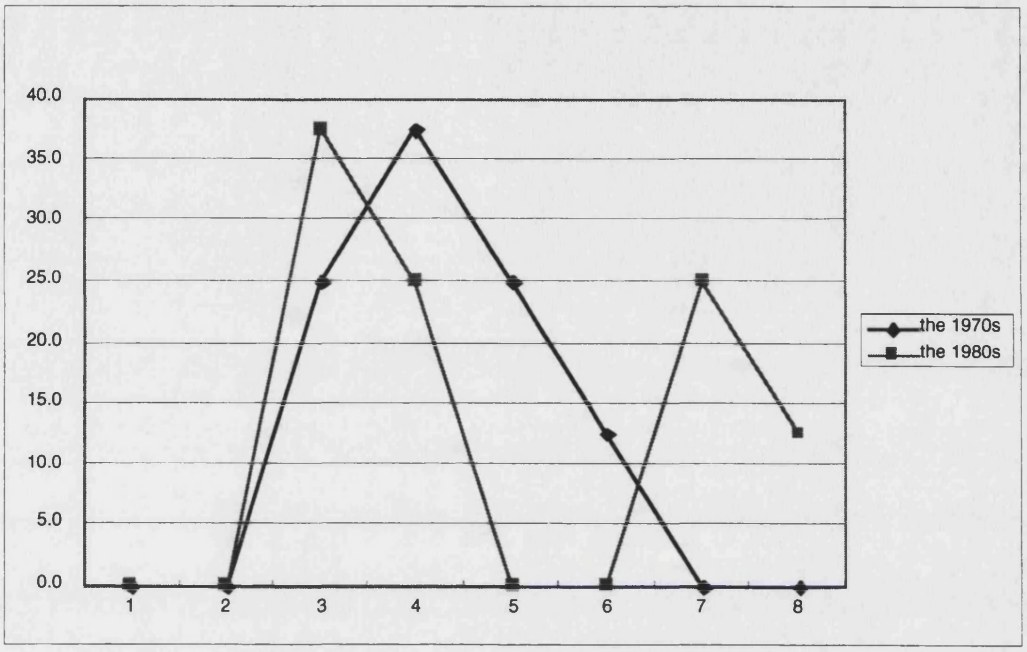


Figure A6-6: Tohoku

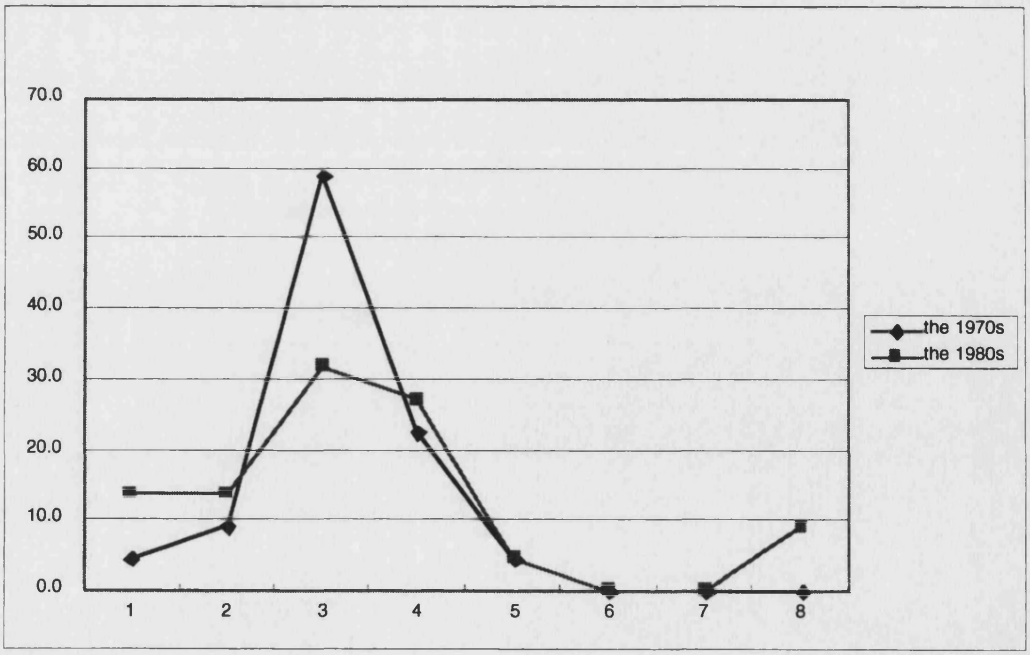


Figure A6-7: Kanto

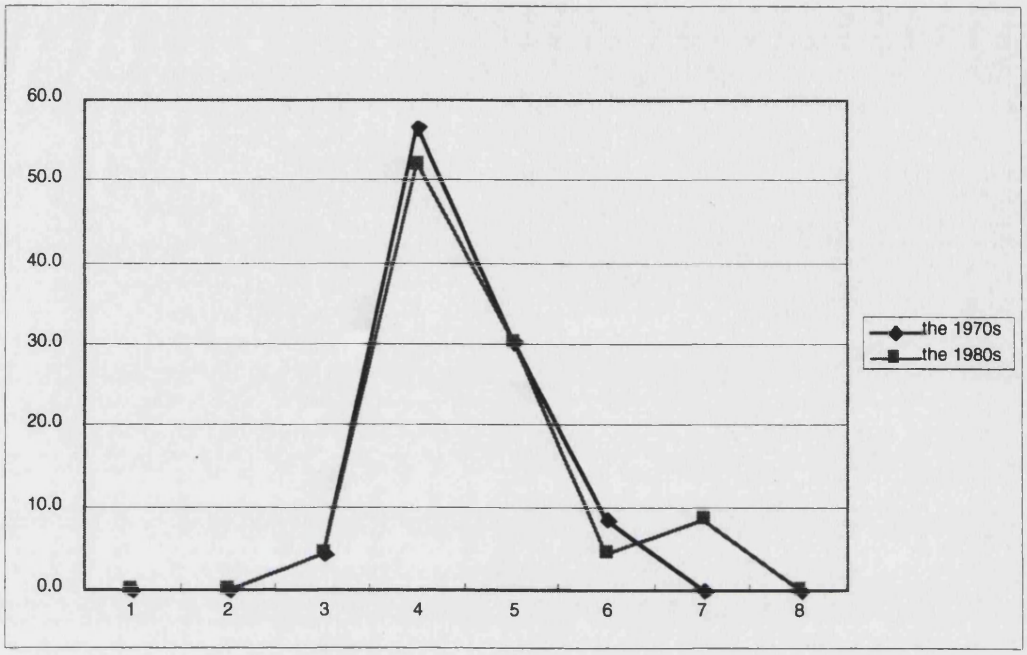


Figure A6-8: Chubu

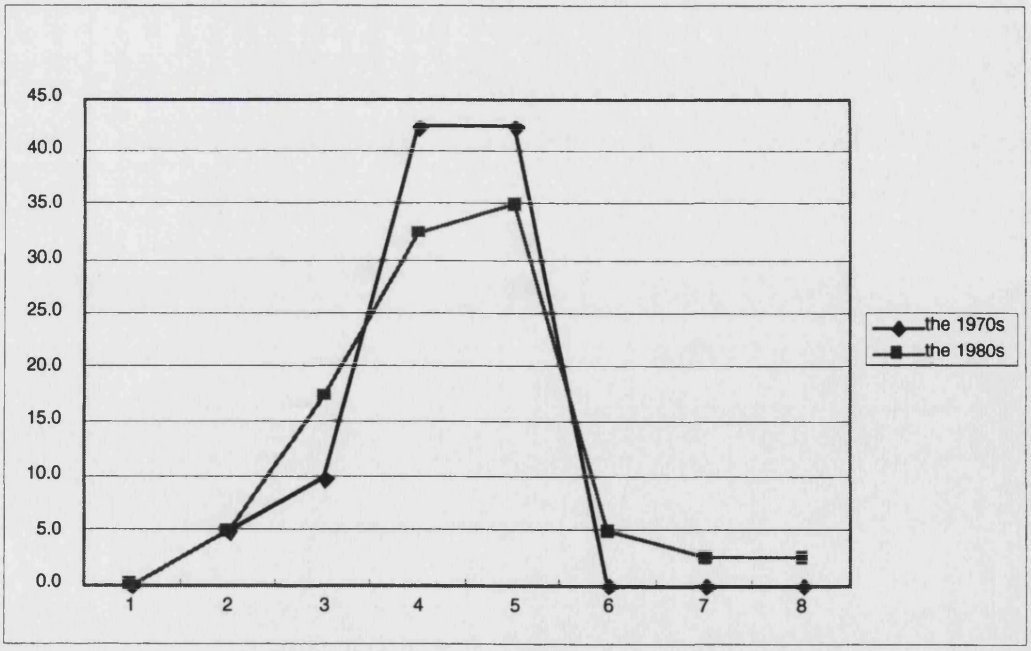


Figure A6-9: Kinki

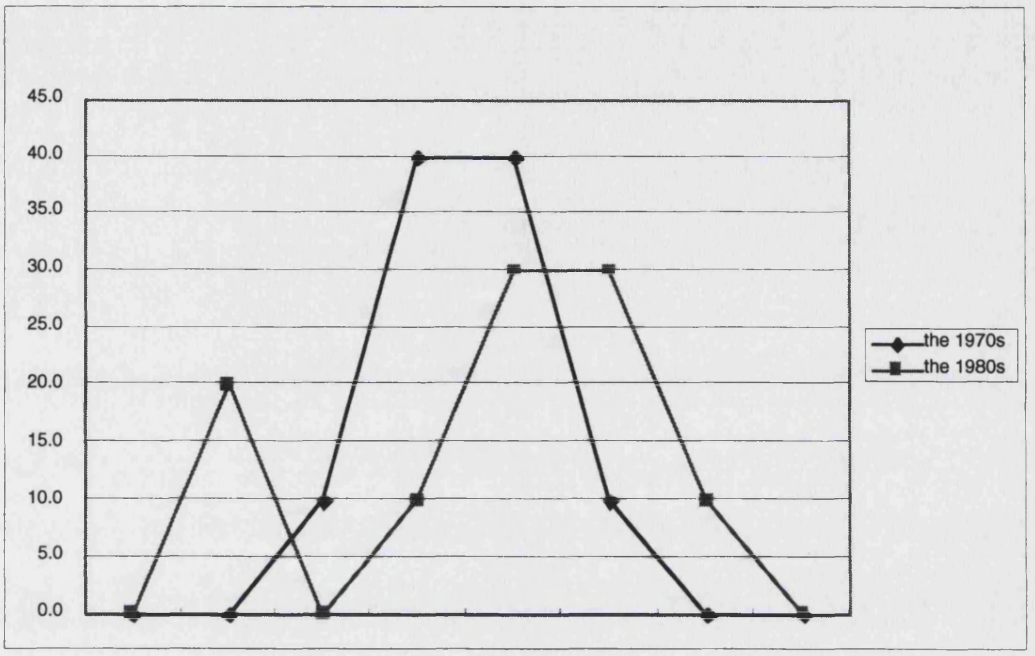


Figure A6-10: Chugoku

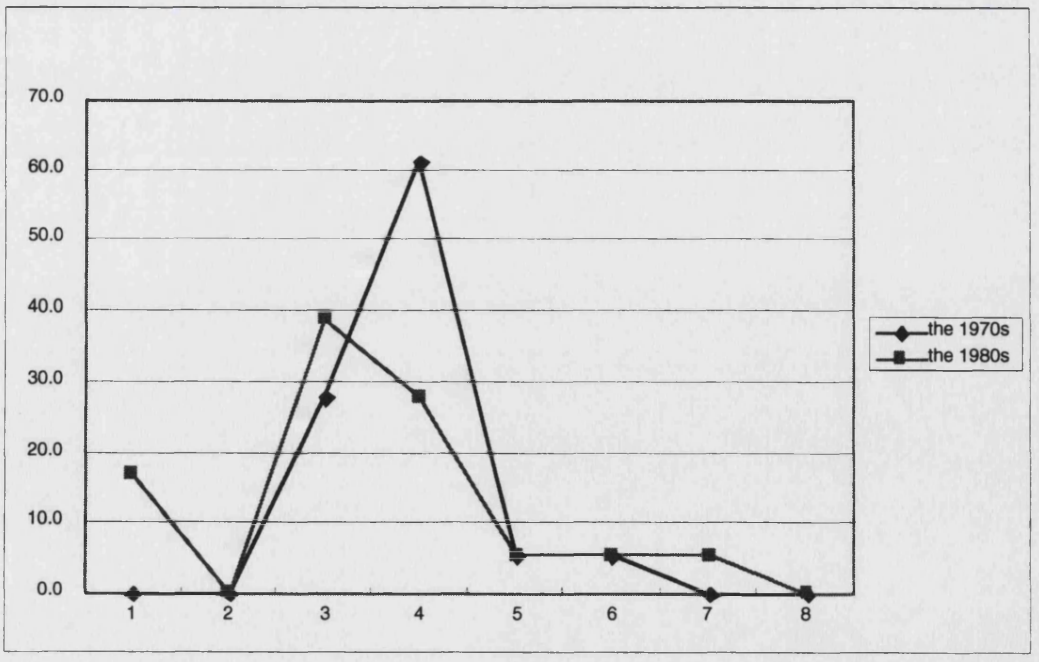


Figure A6-11: Shikoku

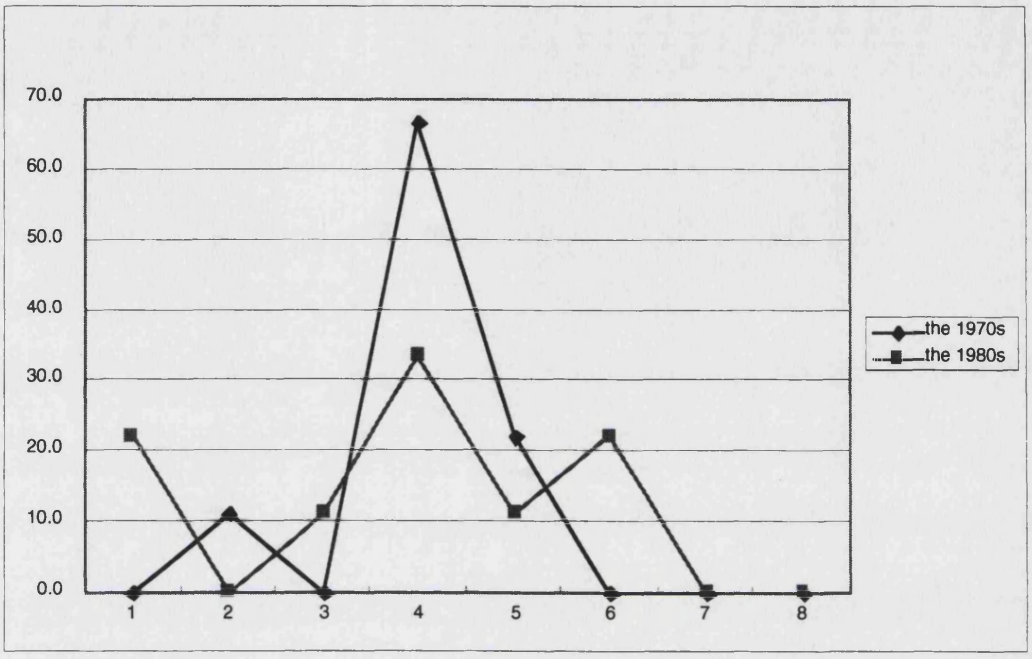


Figure A6-12: Kyushu-Okinawa

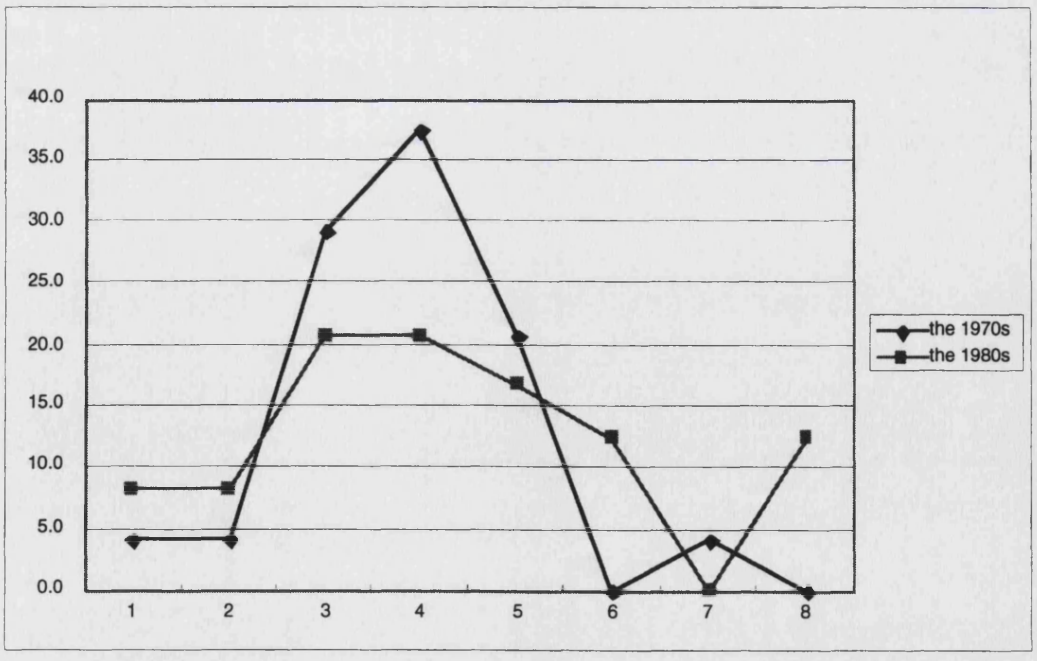


Figure A6-13: 42 JFUAs with Prefectural Capital Cities

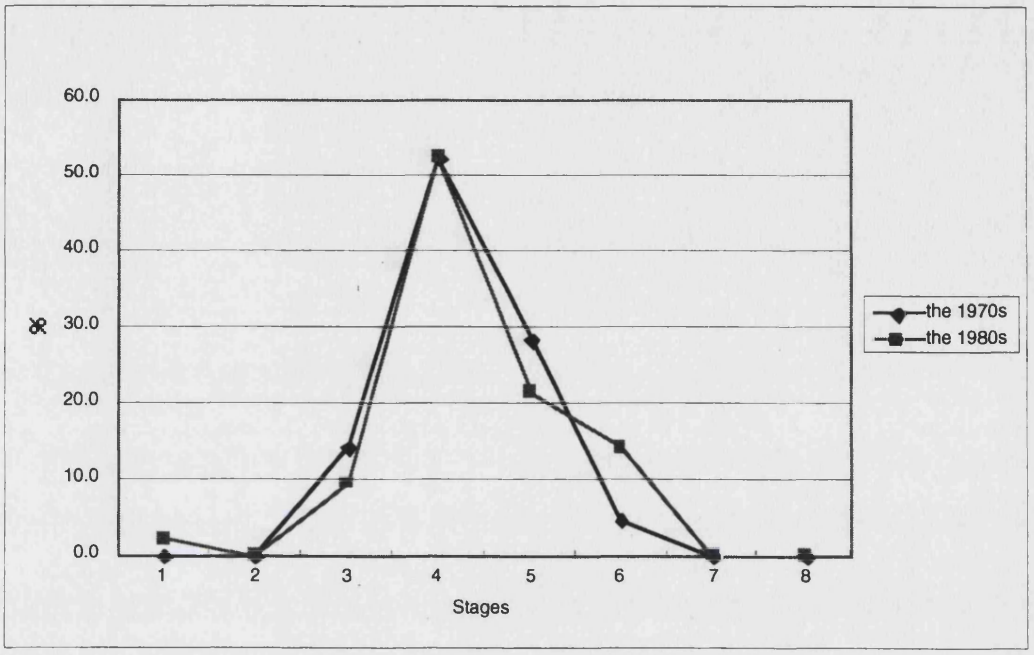
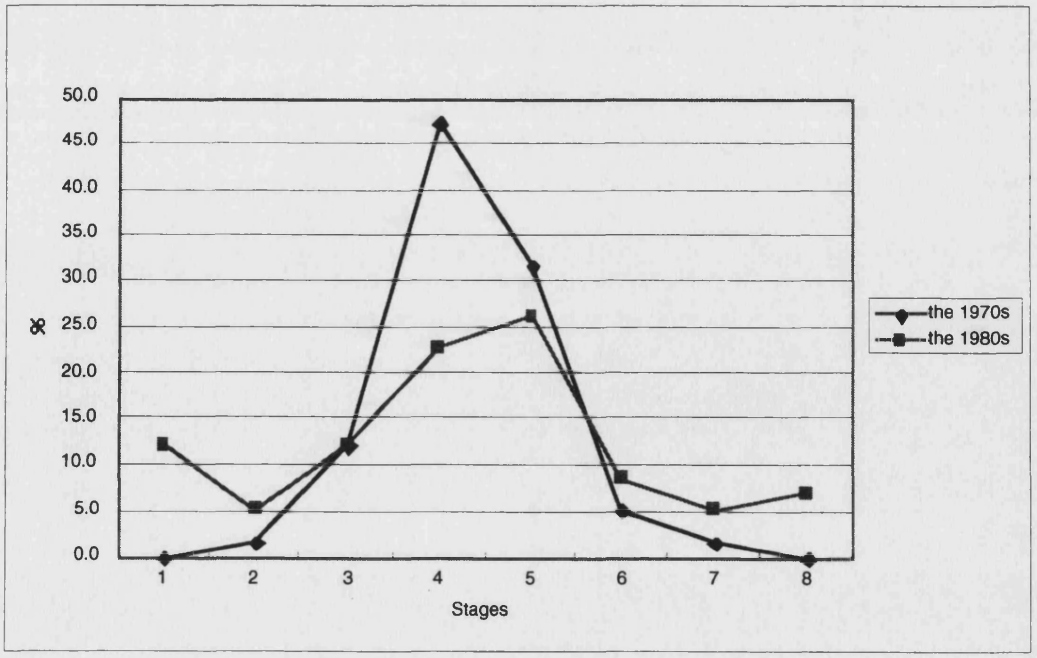


Figure A6-14: 57 JFUAs without a Prefectural Capital City (JFUA Population>200,000)



Chapter 7 Japanese Regional Development Policies and Urban Settlements

7.1. Introduction

In the previous chapters, which analysed various aspects of the Japanese urban system using the JFUA as the basic statistical unit, several conclusions were reached. The first finding was that the Japanese urban settlement system showed an increasing concentration of population in larger settlements during the two decades from 1970 to 1990. The second was that those JFUAs showing rapid population growth in the two decades in question, tended to be close to the largest JFUAs such as the Ku-Areas of Tokyo-to JFUA. On the other hand, most small local JFUAs experienced stagnation, and the population of some JFUAs declined, especially during the 1980s. The areas that suffered the most substantial population losses are located around the coastal area, where the key industries, e.g. steel and shipbuilding, have been in decline.

We now turn to the question of how far the national government has recognised these patterns of settlement change and the problems they may entail, and to what extent has it developed policies relating to what may be perceived as more favourable directions of settlement change. To answer these questions, it is worth examining national policies for the national settlement system. In Japan, for this purpose, the Comprehensive National Land Development Act was passed in 1950, and four further Comprehensive National Development Plans were formulated until 1990. The main aim of these plans has been to establish a nation

where all citizens receive a high standard of living by regionally balanced economic growth and the raising national welfare (Economic Planning Agency, 1962: Preface).

What is meant by regionally balanced economic growth? How can it be investigated at a regional level? According to the Japanese government, various indexes have been used as measures such as income per capita and population growth (Economic Planning Agency, 1962: Appendix). As an extension of the investigation of Japanese settlements, this chapter examines population change of some selected JFUAs in the context of the relationship between national policy and the actual changes that occurred. Of course, the target areas of the government's policies do not match the JFUAs completely and some modifications will be required for this analysis. However, the JFUA definition reflects real spatial systems, and, therefore, this JFUA based approach might show new aspects of the relationship between the policies and settlement change.

The main objective of this chapter is to evaluate the effects of these national policies on the Japanese settlement system. To clarify this objective, this chapter has been divided into four parts. To understand the Japanese government's attitude to the national settlement system, section 7.2 will outline the four Comprehensive National Development Plans and the economic and social background for these plans. In the following three sections, three selected important elements of the Japanese settlement policies will be examined. Firstly, in section 7.3, the population changing patterns of JFUAs related to the three metropolitan areas will be examined. Section 7.4 examines the effects of this policy on the New Industrial Cities (NICs) and Special Areas for Industrial Consolidation (SAICs) that were used as target areas for the 1960s policy. Thirdly, the Technopolises that were target areas in the 1980s will be evaluated.

7.2. The Four Comprehensive National Development Plans and the Japanese Circumstances until 1990

Whenever we consider policy that relates to the Japanese settlement system between 1970 and 1990, it will be worth examining the first four Comprehensive National Development Plans. These plans show the basis of the decisions for national policy on settlement change and indicate the strategic intentions of the national government for the settlement system. Therefore, to outline the government's plans would be helpful to understand what the government observed in the settlement system.

This section outlines the national policies that were formulated between 1945 and 1962 and the four Comprehensive National Development Plans formulated until 1990 with a brief explanation of the economic and social background. In this section, detailed policies will not be considered because the government's Comprehensive National Development Plan was only established to show the general direction of the national policy. Therefore, the most important point is to understand the core concept of the plans with respect to any effects on the national settlement system.

7.2.1. The Period Preceding the First Comprehensive National Development Plan (1945-1962)

In the aftermath of World War II, the national government's main concern was to guarantee food and energy supplies, and prevent floods (Ohta, 1989; Yamasaki, 1998). In 1950, the Comprehensive National Land Development Act was formulated. This act formed the basis of Japan's land planning policy and determined that the comprehensive national development plan should cover the following topics: (1) the use of land, water, and other natural resources, (2) the

prevention of natural disasters, (3) adjustment of the imbalance between urban and rural communities, (4) appropriate distribution of industries to each region, (5) the proper allocation of power stations, transportation, communications, and other vital public facilities, and (6) the protection of resources relating to culture, welfare, and tourism and the proper distribution of the relevant facilities (Ohta, 1989).

The Comprehensive National Development Plan was not formulated in the 1950s because the first priority of the government at that time was simply to promote economic recovery and development. The Japanese government could not afford to establish comprehensive plans that covering a wide range of topics (Shimokobe, 1994). Instead in the absence of the national development plan, various development plans for the specific areas were formulated by the late 1950s. Before the first Comprehensive National Development Plan was announced, 19 regions had been designated as target areas for growth.

To further promote economic growth, the National Income Doubling Plan was announced in 1960, which aimed to doubling the national income in the 1960s.[57] To achieve this goal, the government focused on two strategies. The first was to promote rationalisation in heavy industry and the manufacturing sector.[58] The second was a massive shift in the labour force from the agricultural to the manufacturing sector. Thus, the National Income Doubling Plan played a crucial role in the liberalisation of labour in the Japanese economy. It also led to the publication of a wide range of reports which emphasised the necessity of flexibility, adjustment, and restructuring in the areas of labour, enterprise, and large-scale industry. The so-called 'Pacific Coastal Belt Zone Concept' is the most important and well-known idea to emerge from Japan's industrial policy for economic growth. The aim was to utilise the four existing major industrial centres, Keihin (Tokyo and Yokohama), Chukyo (Nagoya), Keihanshin (Kyoto, Osaka and Kobe),

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[57] This means that the expected achievement for the decade should have reached a 7.2% annual economic growth.

[58] In 1950, 40% of the Japanese workforce belonged to the primary sector.

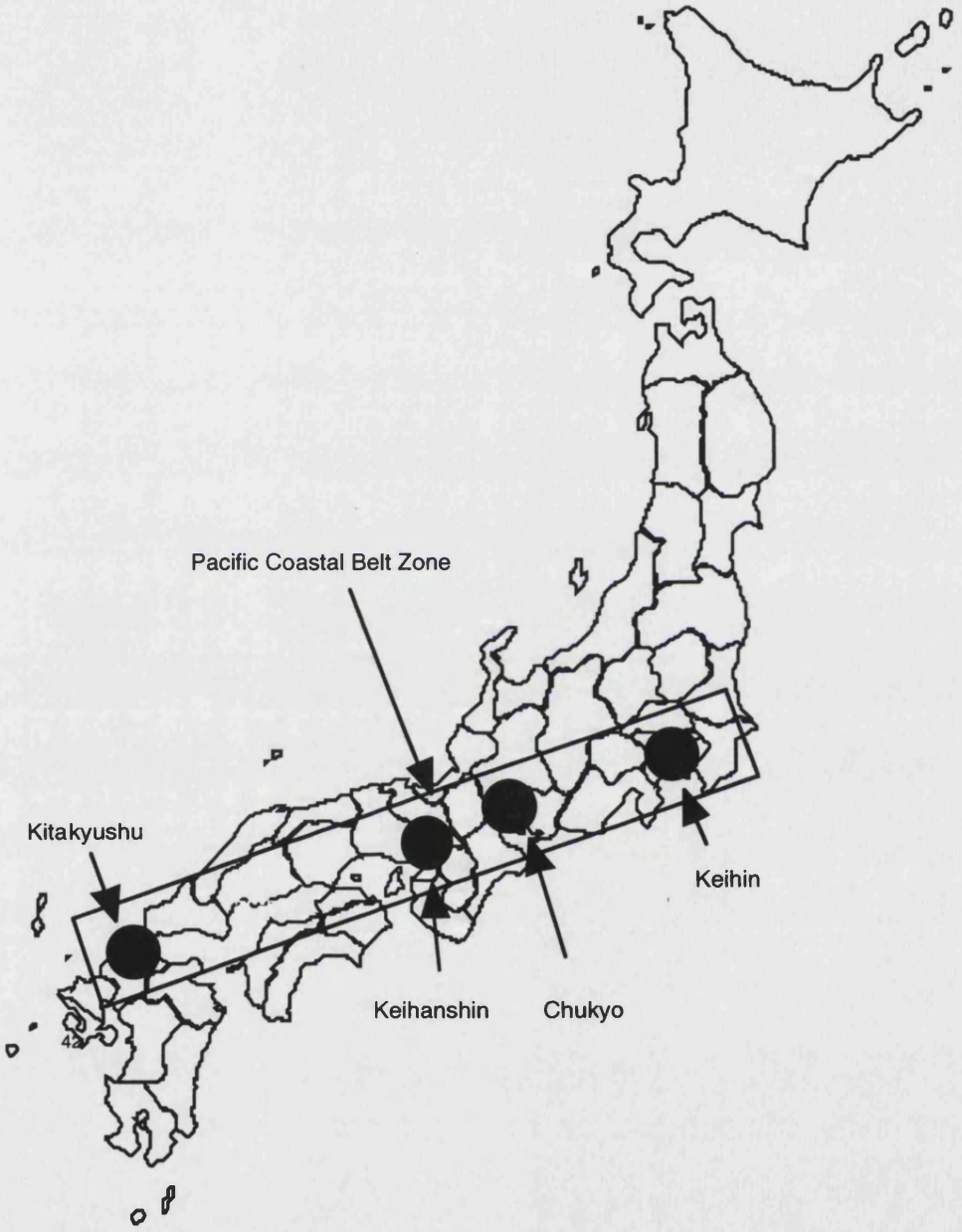
and northern Kyushu, and thus foster these as the industrial centres of Japan (Figure 7-1).

However, there were two serious obstacles preventing the achievement of this goal. The first concern was the spatial distribution of economic growth. Although the establishment of the Pacific Coastal Belt Zone was necessary in order to achieve a rapid economic growth within a short period, people and industries were concentrated in three metropolitan areas, and this caused an inequality to the economic development. Industrial restructuring from an agriculture-oriented economy to one based on manufacturing caused massive migration from the country into the three metropolitan areas (Ito, 1995).

The second obstacle involved the facilities needed for economic growth. Industrial harbours played an important role in the Japanese economy since Japan relies on imported natural resources. However, there were two problems in this area: firstly, there were simply not enough harbours in Japan, and secondly, the capacity of the existing harbours was not sufficient. These problems seriously hindered the development of the manufacturing centres. In addition, the three metropolitan areas suffered increasingly from traffic and commuting problems, so serious traffic bottlenecks arose. These serious capacity problems let to the construction of major new transport facilities like the high speed Tokaido Shinkansen express, and the Meishin Expressway (Ohta, 1989).[59]

[59] The highway linking Nagoya to Kobe.

Figure 7-1: Four Major Industrial Centres and the Pacific Coastal Belt Zone



Source: Author

The national government invested public money in the industrial infrastructure in preparation for the country's economic development. This policy led to the expansion of the market for heavy industrial goods and offered a further incentive for investment in the technological upgrading of plants and equipment. At the same time, efforts were made to maintain secure overseas supplies of raw materials, while reparations and negotiations with Southeast Asia were used to guarantee both a resource base and a market for the products of heavy industry (Ito, 1995).

7.2.2. The Comprehensive National Development Plan (1962)

The first Comprehensive National Development Plan was formulated in 1962. This plan was based on the Comprehensive National Land Development Act of 1950. The target period of the plan was until 1970 and there were three main aims. The first was to curtail excessive growth in the largest cities at the expense of other areas, and to correct regional disparities. The second was the effective use of natural resources. The third was the proper, nationwide distribution of capital, labour and technology (Economic Planning Agency, 1962: Chapter 1 Section 2). Therefore, it can be said that this first plan had close links with the National Income Doubling Plan. The main concern of the National Income Doubling Plan was economic growth at the national level so that it ignored issues relating to regionally balanced economic development. Therefore, a policy aimed towards the increase of regional equality was required. This was done via the first Comprehensive National Development Plan, which focused on (regionally) balanced growth (Shimokobe, 1994).

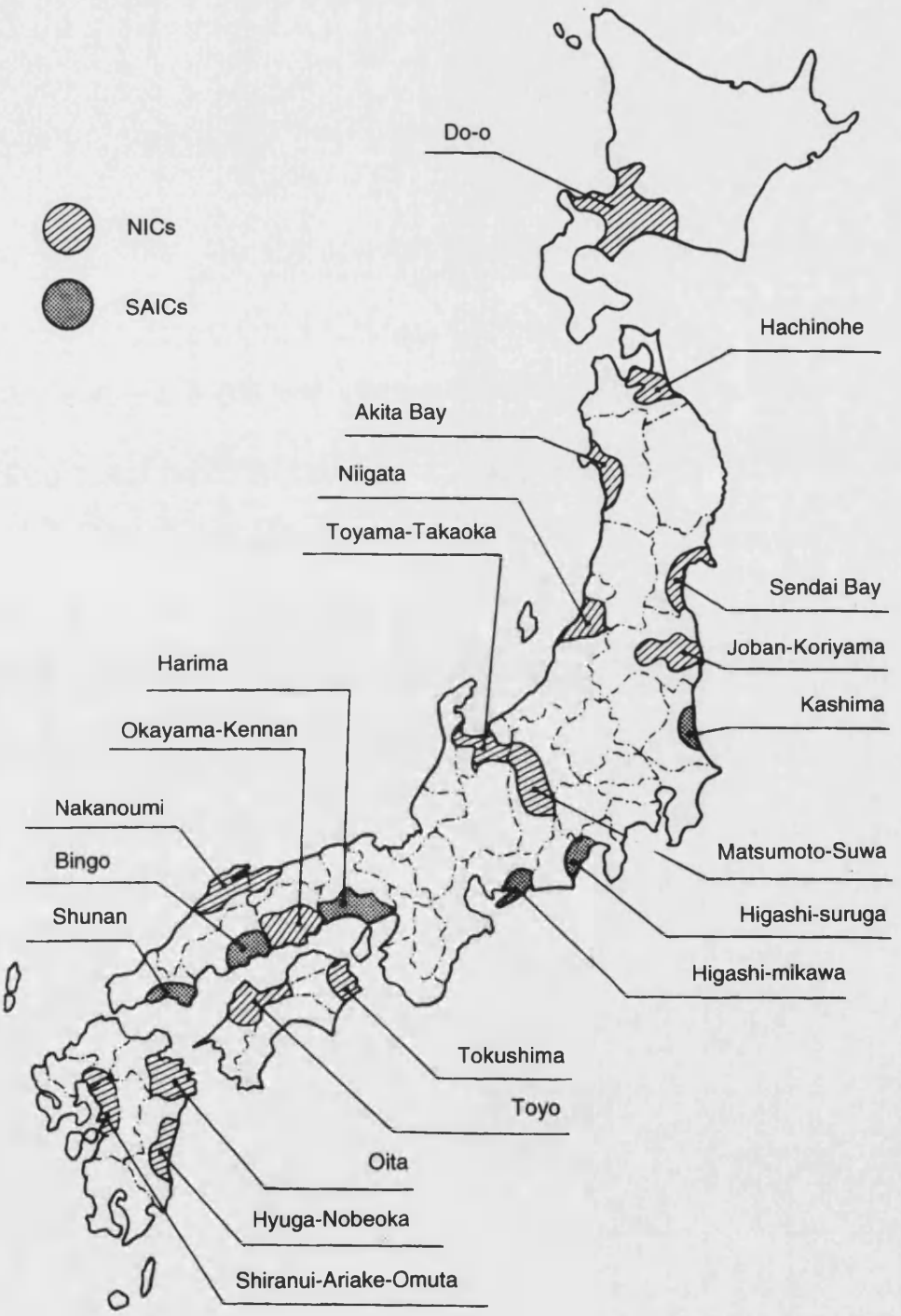
The plan identified rural areas as suffering from poor access to the urban facilities and lifestyles of the three metropolitan areas (Tokyo, Kansai and Nagoya). These rural areas were thus treated as development promotion areas, with the

government supporting their establishment as industrial development centres. This concept of the plan is called the 'growth poles development'. Areas that were remote from existing major metropolises and lagging behind were seen as targets for development, and industry was to be dispersed among them. The growth pole strategy consisted of the following three steps: firstly a key industry, usually heavy or chemical industry was established in certain areas designated by the government. Secondly, other industries were supposed to develop as a result of the establishment of key industries. Finally, the standard of living in the relevant areas was expected to rise due to this overall regional development (Economic Planning Agency, 1962: Chapter 1 Section 4). To implement the concept, the New Industrial Cities Promotion Policy specified 15 NICs and 6 SAICs which were nominated as growth poles were distributed across the nation (Glickman, 1979; Ito and Takahashi, 1985; Yamasaki, 1998) (Figure 7-2).[60]

To promote regional development, it was essential to improve transport facilities to connect these growth pole areas with the metropolitan areas (Economic Planning Agency, 1962: Chapter 4 Section 1). To resolve bottlenecks, harbours and land transportation systems (such as expressways, double-track electrification of trunk rail lines, the Shinkansen between Tokyo and Osaka) were improved during this period, with the aim of creating an organic link between the growth poles and the existing large-scale agglomerations (Ohta, 1989).

[60] For further detailed information about NICs and SAICs, see section 7.4.

Figure 7-2: New Industrial Cities (NICs) and Special Areas of Industrial Consolidation (SAICs)



Source: National Land Agency (1987)

7.2.3. The New Comprehensive National Development Plan (1969)

During the rapid economic growth that occurred, exceeding all expectations, the structure of the nation underwent a major transformation from an industrial structure based on agriculture and light industry to heavy and chemical industries.[61] Industries such as steel, shipbuilding, and petrochemicals led the way in the growth of the Japanese economy throughout the 1960s, flourishing amongst the coastal industrial zones (Shimokobe, 1994).

However, in the context of the regional distribution of industries, the gap between metropolitan areas and other areas was not solved. Population and industry became increasingly concentrated in the three metropolitan areas and these recorded an increase of some 5,500,000 in-coming migrants from outside between 1960 and 1965. In contrast, only four non-metropolitan prefectures recorded a growth in population in the same period (Miyamoto, 1969). In other words, the 1962 plan did not solve the problem that had been identified: the overpopulation of the three metropolitan areas and rural depopulation. Although the 1962 Comprehensive National Development Plan had aimed to correct inequalities in growth among regions, what actually happened was that population and industry became even more concentrated in the metropolitan areas (Economic Planning Agency, 1969: Preface).

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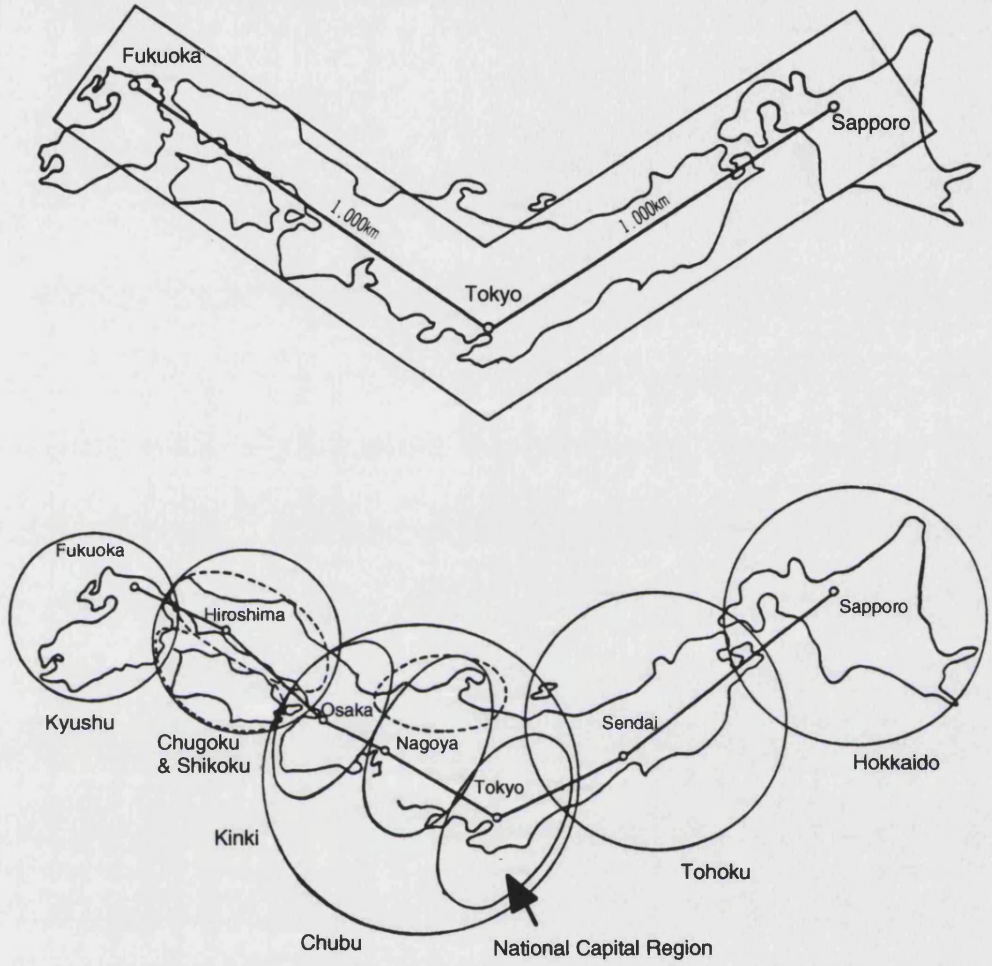
[61] In the 1960s, the average annual growth rate of Japan's GNP was 10.7%; the 1970 output was four times that of 1960 (Shimokobe, 1994).

In response to these problems, the government devised the New Comprehensive National Development Plan in 1969, and this plan was expected to be the basis of the national policy lasting until 1980. Its aim was to correct the continuing perceived 'imbalance' in the distribution of the population and the disparity in the way land was utilised, and also to redress regional differences in income, by extending development throughout the nation (Economic Planning Agency, 1969: Part 1). In other words, the main objective of the plan was to develop a more balanced use of resources, e.g. land and natural resources, throughout Japan, and this was to be realised by extending the development possibilities of the nation as a whole (Honma, 1993).

To this end, the concept of 'large-scale development projects' was introduced in depopulated regions remote from existing agglomerations of population and industry. This concept planned to establish larger industrial bases to further develop the national economy (Honma, 1993). Three places were selected as the target areas of the large-scale development project: Tomakomai in Hokkaido, Mutsu-Ogawa in Aomori, and the Shibushi area in northern Kyushu. The government invested in these three areas to build up major industrial centres, on a larger scale than the NICs and SAICs (National Land Agency, 1994).

One of the most important elements under the New Comprehensive National Development Plan was the construction of a new national transport network and the introduction of a modern telecommunications network. The thinking behind the plan was essentially to further enhance the transformation of Japan into one vast industrial zone linked by the expanded telecommunications and transport networks. To establish the network system, the government introduced the concept of the national axis, which linked the seven major cities, from Sapporo through Tokyo, to Fukuoka, with local networks branching off from the axis (Economic Planning Agency, 1969: Part 1, Section 3) (Figure 7-3).

Figure 7-3: The National Axis and The Seven Major Cities



Source: National Land Agency (1994)

7.2.4. The Third Comprehensive National Development Plan (1977)

The first oil crisis of 1973 put an end to the period of rapid economic growth in Japan, and the national economy entered a period of steady growth in the 1970s. These changing economic and social circumstances lead to changes in the spatial distribution of industry and population associated with a decline in the number of in-coming migrants to the three metropolitan areas.[62] Around this time, environmental problems such as industrial water and air pollution also became a pressing social concern. These social and economic changes indicated the need for a second restructuring of the Japanese economy (National Land Agency, 1977: Preface).

Reflecting on these changes, the government required to freeze the New Comprehensive National Development Plan and setting up a new plan. The Third Comprehensive National Development Plan was drawn up in 1977. This plan was different from the two previous ones. This plan recognised the importance of the environmental issues. From this point, taking into account the limited land resources available, its goal was to improve general environmental locations in human settlements while respecting local history and traditions and ensuring a balance between man and nature (National Land Agency, 1977: Preface).

The Third Comprehensive National Development Plan advocated regional development via a 'Bottom-up' approach, meaning that local authorities were to have a primary role. The fundamental concept underpinning this plan was the 'Integrated Local Settlement Policy', a strategy which focused on making concrete improvements to local communities with relatively permanent populations, and encouraged local governments to improve living conditions within their own areas.

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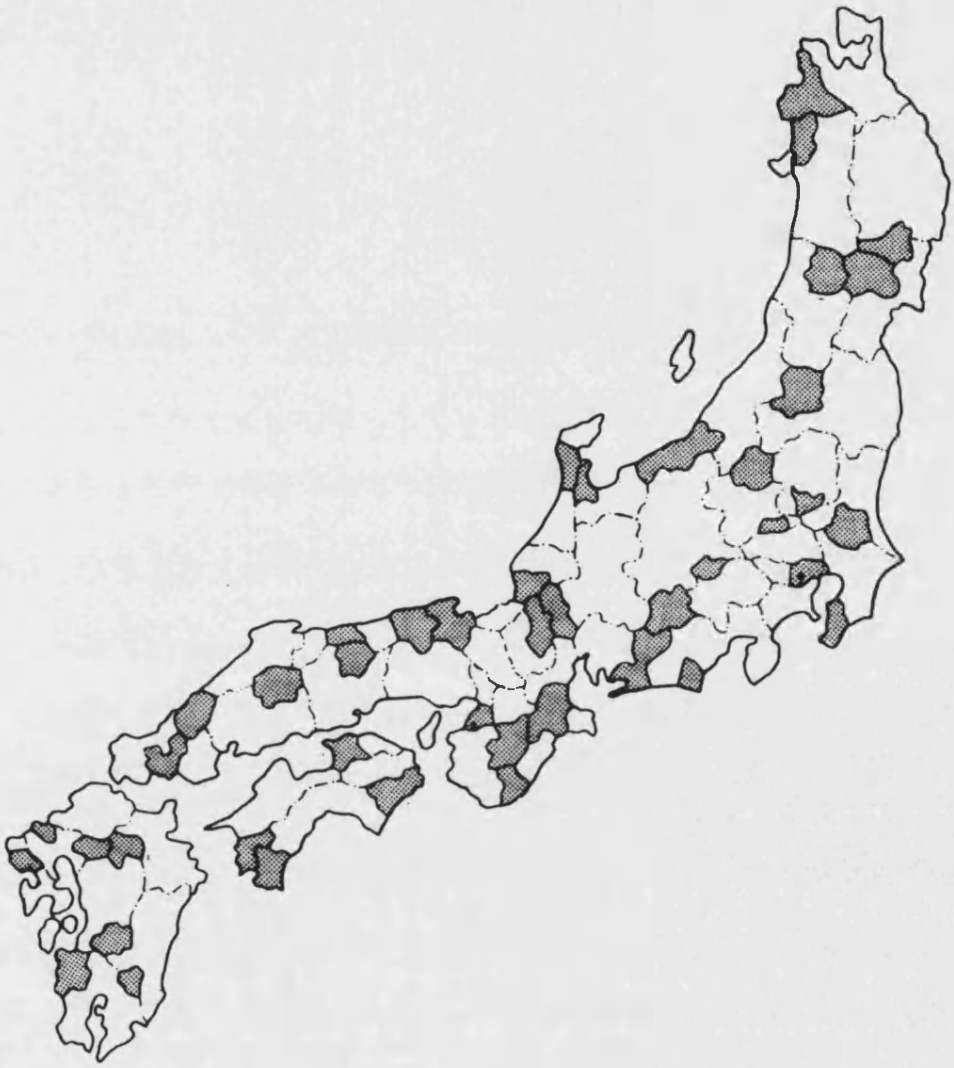
[62] See section 2.6.

To promote this strategy, the government introduced the concept of the Integrated Local Settlement Area, i.e. the basic spatial unit for the local improvement. According to the plan, each Integrated Local Settlement Area should cover three aspects, i.e. the water system taking into account the natural environment, the commuting areas taking into account the economic circumstances, and the daily settlement system taking into account social circumstances. Japan would be divided into approximately 300 areas by this concept (Honma, 1993; Shimokobe, 1994). According to the plan, each Integrated Local Settlement Area should not be determined by the national government but by local authorities. To demonstrate the concept, the government set up the 44 model areas of the Integrated Local Settlement Areas (Honma, 1993; National Land Agency, 1994; Yamasaki, 1998) (Figure 7-4).

Although local governments aimed at developing their regions, exploiting their own special characteristics, there was no actual plan for this development. The reason is that local conditions were dependent on each area's situation at the time, so it was impossible for the government to draft a concrete policy. Therefore, practical details were left unmentioned, and the plans for the establishment of transport networks and industrial policies were simply carried over from the earlier New Comprehensive National Development Plan (Ohta, 1989; Yamasaki, 1998).

Figure 7-4: 44 Model Areas of Integrated Local Settlement Areas



Source: National Land Agency (1994)

7.2.5. The Fourth Comprehensive National Development Plan (1987)

Conditions in Japan underwent a further social and economic transformation in the period following the formulation of the Third Comprehensive National Development Plan. The Tokyo area had shown a renewed pattern of population growth by in-coming migrants from outside. The other two metropolitan areas, Kansai and Nagoya, recorded a slower population growth than that of the Tokyo area. Tokyo had taken on much more of a global role, especially in finance, since about 1980. In addition, enterprises based outside the Tokyo area had been setting up headquarters in the city – or in some cases moving whole operations there (Miyao, 1994). With this further concentration of economic activities into Tokyo, the city's role had changed from the national capital of Japan to a major player in the world economy (National Land Agency, 1987: Chapter I, Section 1).

It was against this background that the Fourth Comprehensive National Development Plan was drawn up in 1987. The plan's primary aim was to transform the structure of the country from the existing Tokyo unipolar concentration pattern around the area into a dispersed multi-polar pattern. The plan was formulated in response to the recent concentration of global functions into the Tokyo area and Japan's full-scale international integration, and can be seen as a recognition of the globalisation of the Tokyo area whilst at the same time aiming to distribute some of its functions to other metropolitan areas (National Land Agency, 1987: Chapter I, Section 1). In other words, it can be said that the government officially accepted the transformation of the Japanese structure from 'the three metropolitan areas vs. the rest of Japan' into 'the Tokyo area vs. the rest of Japan' (Takahashi ed., 1988).

The concept of a 'multi-polar pattern of national land use' was based on the Integrated Local Settlement Areas as basic units, and composed of wider areas beyond Integrated Local Settlement Areas depending on the size and the functions of their respective central cities. These wider areas were linked to one another to form a nationwide network. This network was supposed to embody the conventional 'vertical' links between these metropolitan areas, regional centres, i.e. Sapporo, Sendai, Hiroshima, and Fukuoka, and regional core cities. In addition to these 'vertical' links between large cities, a network of 'horizontal' links, i.e. between local small cities, was also necessary to realise the government's target. This was because relations between areas could be established through their respective characteristic functions such as technology, culture, education and tourism (National Land Agency, 1987: Chapter II).

For the purposes of the 1987 plan, the government focused on the interaction with other areas, introducing the concept of 'Integrated Interaction Policy'. The basic idea for regional development was to build up areas using their own regional initiatives. To support this, the formation of transportation, information and communications systems and the expansion of interaction opportunities were also essential. Each area was based on the arrangement of Integrated Local Settlement Areas with the government having three stages for implementing achieving the goals of this Integrated Interaction Policy (National Land Agency, 1987: Chapter II, Section3).

The first stage was to promote the advantages present in each area, e.g. local resources, unique landscapes, human skills and technologies. Under such an approach, unique areas would develop with various individual strengths as follows; (1) bases for core city functions, (2) centres of advanced technology, (3) bases for specialised agriculture, forestry and fisheries, (4) bases for public access to nature, and (5) bases for international interaction.

The second stage was to organise some principal transportation systems as well as information and communications systems. This should be carried out by the government itself or via government's co-operation guidelines for the smooth flow of people, goods and information both domestically and internationally. As far as transport was concerned, connections between the country's major cities including small local cities and the prefectural centre would be strengthened through the nationwide extension of the transportation systems, such as the high-speed Shinkansen Express and expressways. This would enable people to make return trips between major cities in a single day (Nationwide One-day Traffic Ranges). In addition, airports in rural areas were required for promoting international transportation in rural areas. As for the establishment of information and communications networks, access to information was to be increased nationwide through the installation of advanced information and communications systems, lowering the cost of long-distance telecommunications costs.

The third and final stage involved 'soft' policies, whereby interactions between areas would be built up. The Fourth Comprehensive National Development Plan suggested that 'soft' policies provided various opportunities for interactions which extend over culture, sports, industry, economy, etc, and should be set up through co-operation between central and local governments, as well as private organisations.

7.3. Population Change in the Three Metropolitan Areas

As mentioned in the previous section, one of the main objectives of the four Comprehensive National Development Plans was to establish a regionally balanced economic growth throughout Japan, in response to the concentration of both people and economic activity in the three metropolitan areas. This section examines the population change in these metropolitan areas.

There are three parts to this section. The first is to establish the three metropolitan areas. When the Comprehensive National Development Plans were drawn up, policymakers used their own definition of metropolitan areas. In this thesis, the analysis has been based on the JFUA definition, where boundaries of settlement change and definitions are defined by economic activity, i.e. commuting. However, the areas based on the JFUA definition are different from the various definitions of the national government, and modification will be required for the purpose of this section. The second part will analyse population change in the three metropolitan areas, and the final part will examine the background to their changing pattern.

7.3.1. The Three Metropolitan Areas and Japanese Consolidated Metropolitan Areas (J-CMAs)

According to the Fourth Comprehensive National Development Plan of 1987, the definition of the three metropolitan areas was outlined as follows. Tokyo metropolitan area was the area that contains Ku-Areas of Tokyo as its core, Hachioji, Tachikawa, Urawa, Omiya, Chiba, Yokohama, Kawasaki, Tsuchiura city and the Tsukuba Research and Academy City as its Business Core, Narita etc. as sub-core Cities. Kansai metropolitan area was made up from Kyoto, Osaka and Kobe as its core cities, Otsu, Nara, Wakayama and the Kansai Culture Academy and Research City[63]. Nagoya metropolitan area includes Nagoya as its core, and cities which are located circularly around it such as Gifu, Toyota, Yokkaichi etc (National Land Agency, 1987) (Figures 7-5A, B and C).

From the above, it is difficult to derive a clear definition of the areas. However, it is clear from this that the government decided that each of the three metropolitan areas should have larger areas than those of the single local authorities or prefectures. In order to evaluate population change in the three metropolitan areas in the context of the national government's plans, it is necessary to determine the areas of each metropolitan area. In this thesis, metropolitan areas are determined by aggregation of JFUAs, and since the early chapters, various analyses were based on JFUAs, it will be convenient to continue on that basis.

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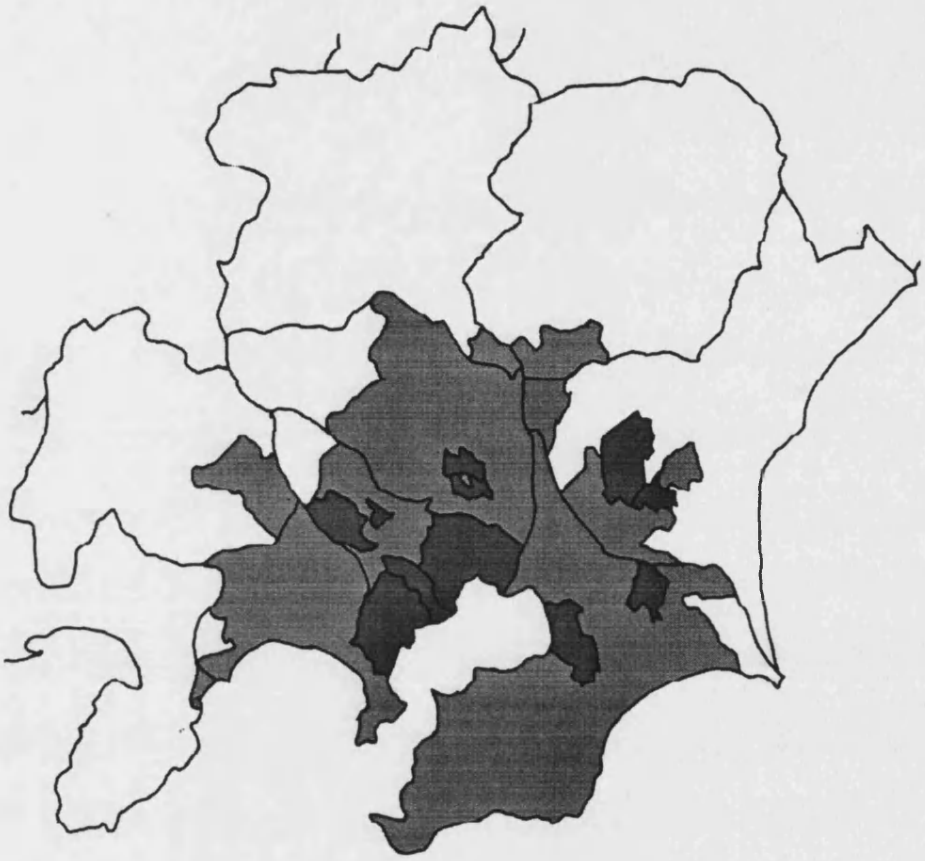
[63] The area which is located between three prefectures; Kyoto, Osaka and Nara was designed for fostering research and development centre.

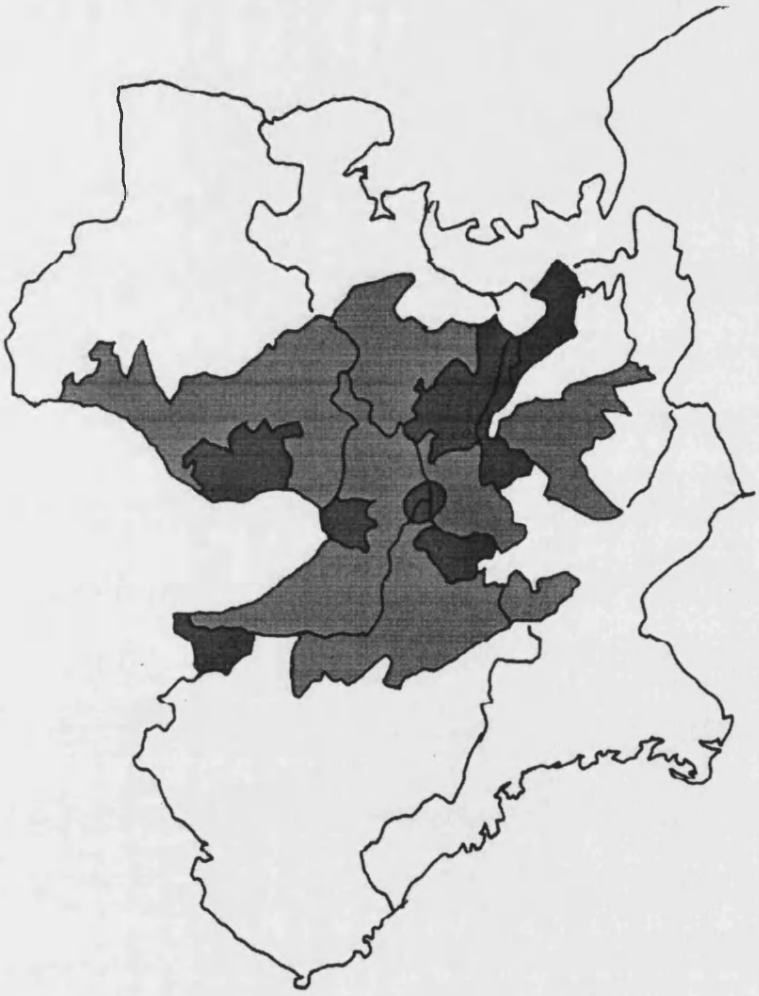
Figure 7-5A: Core Cities of the Three Metropolitan Areas and the Three Major Metropolitan Areas (Tokyo Metropolitan Area and Keihin MMA)



MMAs

Core cities of the metropolitan areas

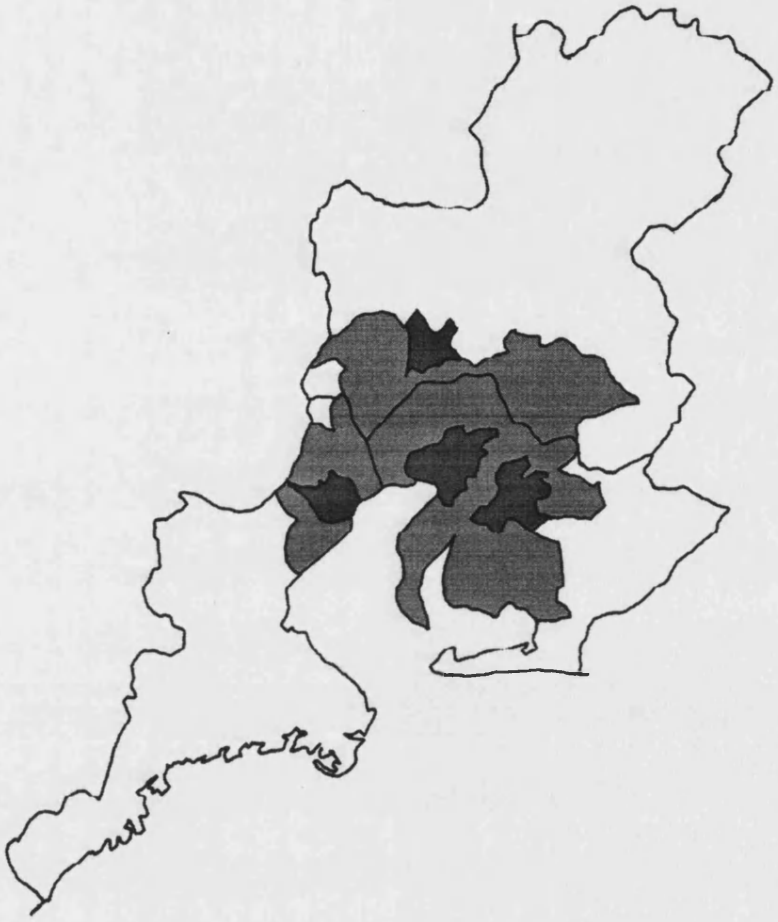
Figure 7-5B: Core Cities of the Three Metropolitan Areas and the Three Major Metropolitan Areas (Kansai Metropolitan Area and Keihanshin MMA)



MMAs

Core cities of the metropolitan areas

Figure 7-5C: Core Cities of the Three Metropolitan Areas and the Three Major Metropolitan Areas (Nagoya Metropolitan Area and Chukyo MMA)



MMAs

Core cities of the metropolitan areas

To adjust the concept of JFUA to the three metropolitan areas in the context of the National Land Agency (1987), each metropolitan area will be defined in terms of an aggregation of JFUAs. There are three basic criteria. Firstly, all core and sub cities belonging to the three metropolitan areas of the National Land Agency (1987) must be contained in an aggregation. Secondly, to set up the areas, the three Major Metropolitan Areas (MMAs)[64], Keihin[65], Keihanshin[66] and Chukyo[67], are used to check the maximum expanse of the metropolitan areas in terms of their geographical size (Figures 7-5A, B and C). The reason for the use of the MMAs is that the Japanese metropolitan areas are closely located and thus it is difficult to pick up the JFUAs belonging to the metropolitan areas. Thirdly, components of the metropolitan areas should be continuously located. In line with these modifications, the concept of Japanese Consolidated Metropolitan Area (J-CMA) is now introduced. A J-CMA is made up of a group of JFUAs and is equivalent to a 'metropolitan area'. Each J-CMA is defined as follows.

The Tokyo J-CMA consists of seven JFUAs: the Ku-Areas of Tokyo-to JFUA, the Tsuchiura JFUA, the Koyama JFUA, the Kumagaya JFUA, the Narita JFUA, the Mobara JFUA and the Atsugi JFUA. The Kansai J-CMA consists of four JFUAs: the Kyoto JFUA, the Osaka JFUA, the Kobe JFUA, and the Wakayama JFUA.[68] The Nagoya J-CMA consists of nine JFUAs: the Nagoya JFUA, the Gifu JFUA, the Ogaki JFUA, the Handa JFUA, the Kariya JFUA, the Toyota JFUA, the Anjo JFUA, the Nishio JFUA, and the Yokkaichi JFUA (Figures 7-6A,B and C).

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[64] See section 3.3.3 for the definition of the MMAs.

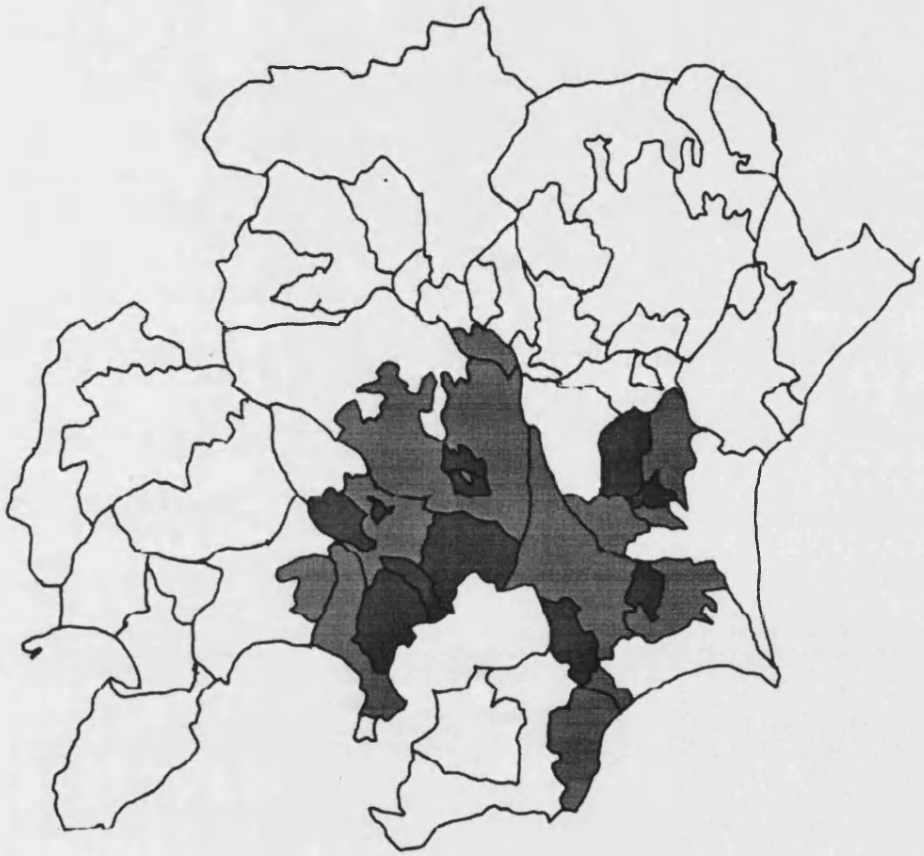
[65] According to the 1990 Census, Keihin MMA was the area that treated the Ku-Areas of Tokyo-to, Yokohama and Kawasaki as its core.

[66] Keihanshin MMA treated Kyoto, Osaka and Kobe as its core area.

[67] Chukyo MMA treated Nagoya as its core area.

[68] Himeji JFUA was excluded from Kansai J-CMA because this area was treated as the target area of the other policies. For detailed information, see section 7.4 and 7.5.

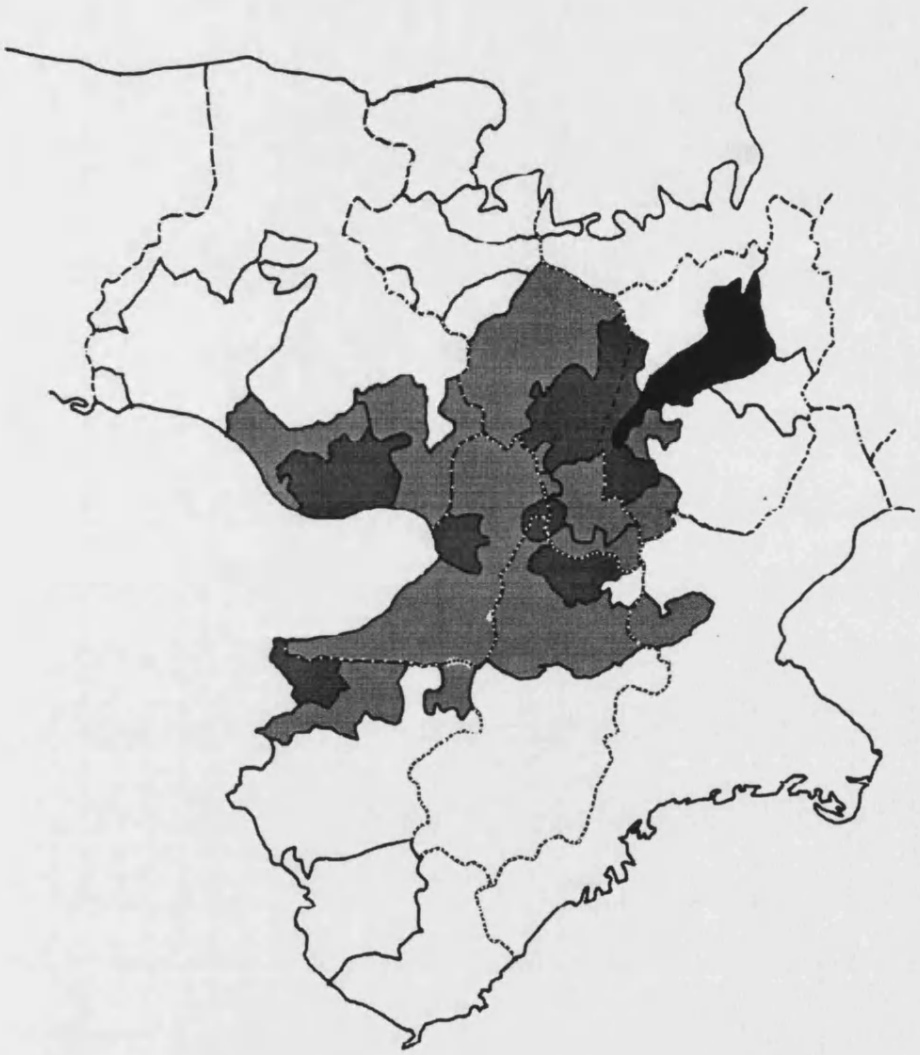
Figure 7-6A: Core Cities of the Three Metropolitan Areas and the Three J-CMAs (Tokyo Metropolitan Area and Tokyo J-CMA)



JFUAs

Core cities of the metropolitan areas

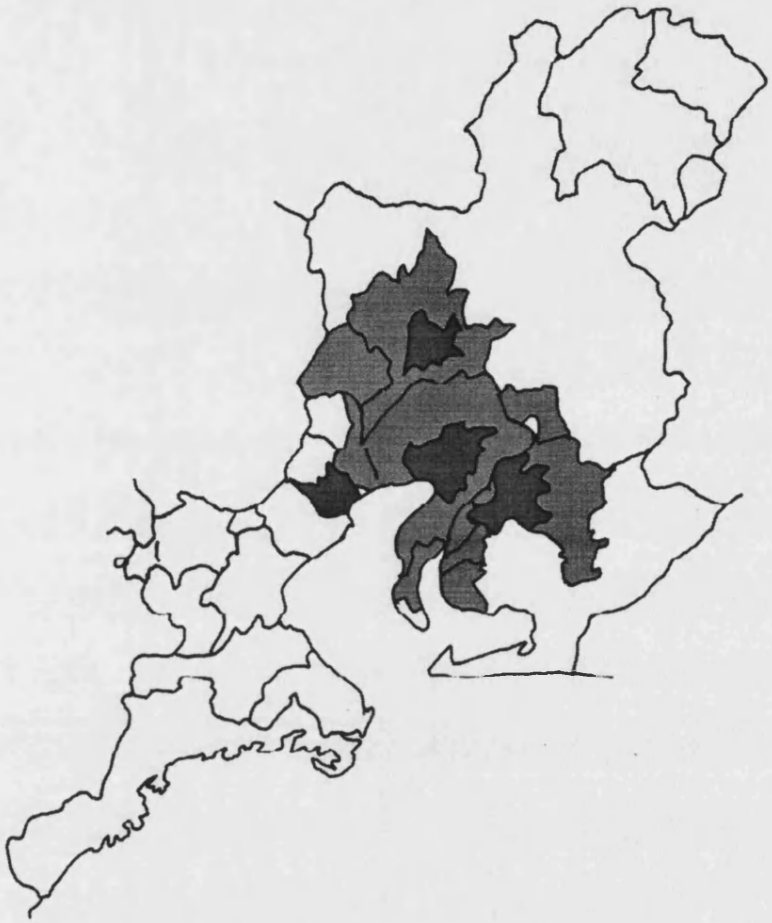
Figure 7-6B: Core Cities of the Three Metropolitan Areas and the Three J-CMAs (Kansai Metropolitan Area and Kansai J-CMA)



JFUAs

Core cities of the metropolitan areas

Figure 7-6C: Core Cities of the Three Metropolitan Areas and the Three J-CMAs (Nagoya Metropolitan Area and Nagoya J-CMA)



JFUAs

Core cities of the metropolitan areas

Table 7-1 shows the population of the three MMAs and the three J-CMAs based on the 1990 Population Census of Japan. The population in J-CMAs recorded over 93.0% of that in the MMAs; Tokyo J-CMA recorded 92% of Keihin MMA, Kansai J-CMA recorded 91.9% of Keihanshin MMA, and Nagoya J-CMA recorded 91.2% of Chukyo MMA.

Table 7-1: J-CMAs and MMAs: 1990

J-CMA Name	Population (A) (000s)	MMA Name	Population (B) (000s)	(A)/(B) %
Tokyo J-CMA	29,919	Keihin MMA	32,158	93.0
Kansai J-CMA	16,947	Keihanshin MMA	18,431	91.9
Nagoya J-CMA	7,684	Chukyo MMA	8,427	91.2

Source: Author

7.3.2. Population Change

Tables 7-2 and 7-3 depict population change in the 3 J-CMAs. As these tables show, all three have experienced growth over the last two decades. The 3 J-CMAs show a faster population growth than the growth rate of the 154 JFUAs, i.e. 16.6% in the 1970s and 8.9% in the 1980s. As a result, the proportion of the population in the 3 J-CMAs compared to the national population had increased. These 3 J-CMAs contained 44.4% of the national population in 1990, compared with 41.2% in 1970.

Looking at the population growth rate of each J-CMA individually, the growth pattern of each area was as follows. The Tokyo J-CMA recorded 19.5% growth in the 1970s and 10.8% in the 1980s, both rates were higher than those of the 154 JFUAs. On the other hand, the Kansai J-CMA had a rather different pattern. This J-CMA showed the slowest growth in both the relevant decades,

namely 12.4% in the 1970s and 6.2% in the 1980s. These rates are lower than those of the 154 JFUAs in the same period. The Nagoya J-CMA fell between the other two J-CMAs in terms of its growth pattern, with a population growth of 15.6% in the 1970s and 7.6% in the 1980s. JFUAs outside the 3 J-CMAs exhibited a different growth pattern. The total population growth in this group was 12.8% in the 1970s and 5.2% in the 1980s. This result supports the tendency of 'Unipolar Concentration into the Tokyo Area' that was described in the Fourth Comprehensive National Development Plan.

Table 7-2: Population in 3 J-CMAs

	1970		1980		1990	
	Population (000s)	% of the National Population	Population (000s)	% of the National Population	Population (000s)	% of the National Population
Tokyo J-CMA	22,739	21.7	27,172	23.2	30,115	24.4
Kansai J-CMA	14,201	13.6	15,963	13.6	16,947	13.7
Nagoya J-CMA	6,180	5.9	7,144	6.1	7,684	6.2
3 J-CMA Total	43,120	41.2	50,279	43.0	54,746	44.4

Source: Author

Table 7-3: Population Growth Rate in 3 J-CMAs (%)

	1970s	1980s
Tokyo J-CMA	19.5	10.8
Kansai J-CMA	12.4	6.2
Nagoya J-CMA	15.6	7.6
3 J-CMAs	16.6	8.9
JFUAs outside 3 J-CMAs	12.8	5.2
154 JFUAs	14.8	7.2

Source: Author

7.3.3. The Background of the Growth Pattern

As shown above, the Tokyo metropolitan area recorded a faster growth during the 1970s and 1980s than any other metropolitan area. Turning to the reasons behind this rapid growth, we can point out the following several factors. Firstly, Tokyo is the obvious political centre of Japan; the national government is located here and this does not extend to other areas. Because of the nature of the Japanese political system, central government is more powerful than local government, and local authorities have to negotiate anything they do with the national government (Takahashi and Sugiura, 1992). Secondly, Tokyo also plays a leading role in Japan's business and financial/administration affairs, having enjoyed the status of an international financial centre since the 1980s. In addition to this, the headquarters of businesses are concentrated there, a tendency which began after the first oil crisis of 1973 (Miyao, 1994). According to Miyao (1994), these enterprises' activity in Tokyo focuses on advanced information, partly international, partly internal such as the national government's information. Thirdly, Tokyo is also the centre of Research & Development (R&D), both with respect to private enterprise and academic institutions and research centres (Takahashi and Sugiura, 1992; Yada, 1994). These are treated as the key to economic development. Finally, the media industry is also based in the Tokyo area, and this has an effect on the cultural sectors, which is crucial for the next stage of development.

Ades and Glaeser (1995) examined the relation between the degree of the concentration of population into the largest city of a country and the political function. They concluded that a strong central government played an important role in urban concentration. The Japanese settlement system matches their conclusion as outlined in their study. As above, not only local authorities but also enterprises require access to the national government. However, in Tokyo, the industrial structure has also an important role. As discussed in Chapter 6, the service sector ,

rapidly growing industry, has effects on a settlement's growth. In addition, Tokyo has strong management function as shown by Miyao (1994), e.g. concentration of enterprises' headquarters in this area.

To clarify the effects of the industrial structure, the structure of the Kansai area should be examined. Historically, textile, heavy and chemical industries played an important role in the development of this area up until the 1960s. However, they are no longer a key industry in the development of the Japanese economy (National Land Agency, 1987). In addition, Kansai businesses have tended to move their headquarters to the Tokyo area, which has affected both regions (Miyao, 1994). Tokyo is the base for the coming generation of industry and research while Kansai is merely an area of declining industries. Thus, it is possible to say that Kansai has had to face up to the challenge of industrial restructuring.

7.4. New Industrial Cities (NICs) and Special Areas for Industrial Consolidation (SAICs)

As the second topic of policy evaluation, the changes in NICs and SAICs will be examined in this section. These areas are important in terms of the economic growth at both national and regional level. These areas were introduced as a result of the first Comprehensive National Development Plan of 1962. This section will examine the NICs and SAICs in terms of their population growth rates in the 1970s and 1980s in the following three parts. The first part outlines the NICs and SAICs. The second part is to examine the previous studies that evaluated NICs and SAICs. The final part examines these areas based on the JFUA definition. In this part, the background to the changes will then be explored.

7.4.1. What Are NICs and SAICs?

The first Comprehensive National Development Plan of 1962 was based on the so-called 'growth pole strategy'. This plan aimed at the distribution of growth poles for economic development, in relation to existing integrated industrial areas such as those of Tokyo, Kansai and Nagoya, in order to achieve the decentralisation of industry. To this end, 15 NICs were designated under the New Industrial City Promotion Policy in 1962.[69] In addition, the government subsequently decided that this was insufficient, and promoted the further development of regional industrial centres, designating 6 SAICs in 1964 to supplement the NICs. The NICs and SAICs were supposed to be major centres for the consolidation of the industrial area, and industrial zones and harbours were established there.

When the NICs and SAICs were designated, the government was aiming to make the heavy and petrochemical industries Japan's main industries. These needed to be located in coastal areas where industrial harbours could be built, because Japan depends heavily on imported natural resources. Accordingly, NICs and SAICs are indeed located around the coast, except for the Matsumoto-Suwa NIC in the Nagano prefecture. In addition, all SAICs are located in Pacific Coastal Areas, to provide further support for the Pacific Coastal Belt Zone (Figure 7-2).

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[69] 13 NICs were designated in 1962 and 2 NICs were added in 1963.

7.4.2. NICs and SAICs Assessed from Previous Studies

NICs and SAICs are an important topic in the context of the Japanese policy for the regional development, and some studies have examined the changes in these areas. In this section, some of these studies are reviewed.

Glickman (1979) pointed out the effects of the NICs and SAICs on the regional population and economy between 1965 and 1975. To evaluate these areas, he compared NIC areas with the areas that were not NIC areas but had similar economic and social circumstances. From this comparison, Glickman concluded that NICs and SAICs were not effective. Firstly, he thought there was no real evidence that the government genuinely promoted investment in these areas by showing the level of public investment per capita there. It was clear that this was not particularly high in NICs and SAICs compared to regional areas in general. Secondly, he also pointed to a clear pattern of population growth in the NICs and SAICs. The growth of the NICs was polarised: 77.7% of the population growth took place within the large cities in NICs and SAICs, while the rest of NICs and SAICs did not grow fast or declined.

Ito and Takahashi (1985) evaluated the effects of this policy on local authorities which were part of NICs and SAICs between 1965 and 1975. They evaluated NICs and SAICs by comparing the average rate of population growth in these areas with that of all other provincial cities in Japan. From this comparison, they observed several characteristics. During the period in question, NICs and SAICs contained a higher proportion of local authorities where the inflow of migrants exceeded the outflow of migrants between 1965 and 1975. It can therefore be said that the policy promoted local population growth in that period. Secondly, Ito and Takahashi (1985) noted that the SAICs performed better than the NICs in terms of population growth. Thirdly, they remarked that the NICs fell into

two types: those containing a prefectural capital city and those without one. The former exhibited a higher growth than the latter.

Yamasaki (1998) simply compared the population and economic growth rates in the NICs and SAICs with those of the national level for the period between 1965 and 1990 (Table 7-4). NICs and SAICs recorded a faster population growth between 1965 and 1975, however, population and economic growths in these areas were lower than that of the national level between 1985 and 1990. Yamasaki concluded that the NICs and SAICs are at present suffering from relative population loss.

Table 7-4: The Growth Rate of Population and Manufacturing Output in NICs and SAICs (%)

	Population		Manufacturing Output	
	NICs & SAICs	National Total	NICs & SAICs	National Total
1967-75	31.4	18.7	909.4	718.0
75-80	5.9	4.6	68.9	68.5
80-85	3.7	3.4	15.8	19.4
85-89	1.5	2.2	10.2	12.7

Source: Yamasaki (1998)

7.4.3. Evaluation of NICs and SAICs in the 1970s and 1980s

To investigate the settlement change of the target areas for the New Industrial Cities Promotion Policy on the basis of the JFUA definition, it is necessary to adjust JFUAs to NICs and SAICs. One distinct advantage of JFUAs is that it is possible to evaluate functional settlement change directly since each JFUA is defined by real economic activity. By contrast, NICs and SAICs are defined by the government guidelines, and the actual areas may not be reflecting the circumstance of today's functional settlements. The rule of the modification was that the local authorities that were covered by government's NIC and SAIC definition should be contained as much as possible. By this operation, JFUAs or aggregations of them can cover most NICs and SAICs, although JFUAs do not match with NICs and SAICs completely in geographical terms.

Table 7-5 shows the list of JFUAs that can be taken as equivalent to NICs and SAICs, referred to as NIC-JFUAs and SAIC-JFUAs. There are two points to mention. Firstly, in most areas, NICs and SAICs cover a wider area than two or more JFUAs. From this, it can be said that the government treated broader areas to promote the development rather than real settlements. Secondly, Kashima and Higashi-mikawa SAICs could not be covered by this adaptation. The Kashima area is excluded because it is composed of towns and villages, thus not meeting the JFUA criteria. The Higashi-mikawa SAIC is excluded because the ratio of daytime workers to night-time workers was not sufficient in Toyohashi, the central city of the area.

Table 7-5: NIC-JFUAs and SAIC-JFUAs

NIC-JFUAs

JFUA Code	JFUA Name	NIC Name
1	Sapporo JFUA	Do-o
4	Muroran JFUA	Do-o
7	Tomakomai JFUA	Do-o
8	Chitose JFUA	Do-o
11	Hachinohe JFUA	Hachinohe
12	Towada JFUA	Hachinohe
18	Sendai JFUA	Sendai-Bay
19	Ishimaki JFUA	Sendai-Bay
22	Akita JFUA	Akita bay
29	Aizuwakamatsu JFUA	Joban-Koriyama
30	Koriyama JFUA	Joban-Koriyama
53	Niigata JFUA	Niigata
58	Toyama JFUA	Toyama-Takaoka
59	Takaoka JFUA	Toyama-Takaoka
68	Matsumoto JFUA	Matsumoto-Suwa
70	Okaya JFUA	Matsumoto-Suwa
72	Suwa JFUA	Matsumoto-Suwa
105	Yonago JFUA	Nakanoumi
107	Matsue JFUA	Nakanoumi
108	Izumo JFUA	Nakanoumi
109	Okayama JFUA	Okayama-Kennan
110	Kurashiki JFUA	Okayama-Kennan
122	Tokushima JFUA	Tokushima
127	Imabari JFUA	Toyo
129	Niihama JFUA	Toyo
133	Omuta JFUA	Shiranui-Ariake-Omuta
142	Kumamoto JFUA	Shiranui-Ariake-Omuta
143	Yatsushiro JFUA	Shiranui-Ariake-Omuta
144	Oita JFUA	Oita
149	Nobeoka JFUA	Hyuga-Nobeoka

SAIC-JFUAs

JFUA Code	JFUA Name	SAIC Name
80	Numazu JFUA	Higashi-suruga
81	Fuji JFUA	Higashi-suruga
101	Himeji JFUA	Harima
114	Mihara JFUA	Bingo
115	Fukuyama JFUA	Bingo
120	Tokuyama JFUA	Shunan

Source: Author

Table 7-6: Population Growth Rate in NIC-JFUAs and SAIC-JFUAs (%)

	1970s	1980s
3 J-CMAs	16.6	8.9
Non NIC-JFUAs and Non-SAIC-JFUAs outside 3 J-CMAs	11.8	4.9
NIC-JFUAs	15.0	6.2
SAIC-JFUAs	13.3	4.9
154 JFUAs	14.8	7.2

Source: Author

When the NIC-JFUAs and the SAIC-JFUAs are treated as groups, are there any characteristics in these groups? Table 7-6 shows population growth in NIC-JFUAs and SAIC-JFUAs during the 1970s and 1980s. To compare the growth rate of NIC-JFUAs and SAIC-JFUAs, the growth rate of the following three groups will be used as reference points; (1) 154 JFUAs, (2) 3 J-CMAs, and (3) non NIC-JFUAs and non SAIC-JFUAs outside 3 J-CMAs. From this table, there are several findings as follows. Firstly, as mentioned in section 7.3, the 3 J-CMAs showed a different pattern to other areas, and this had an effect on the national average. Secondly, the NIC-JFUAs grew faster than non NIC-JFUAs and non SAIC-JFUAs outside 3 J-CMAs. NIC-JFUAs grew by 15.0% in the 1970s and 6.2% in the 1980s. Thirdly, the SAIC-JFUAs showed a different pattern from that of the NIC-JFUAs. Although the SAIC-JFUAs grew faster than non NIC-JFUAs and non SAIC-JFUAs outside the 3 J-CMAs during the 1970s, this tendency ceased to exist in the 1980s.

By examining the population growth rate of individual NIC-JFUAs and SAIC-JFUAs, what will be observed? Table 7-7 shows the NIC-JFUAs and SAIC-JFUAs ranked according to the population growth rate of JFUAs as a whole in the two decades.[70] From this table, several characteristics were observed. Firstly, it is clear that the JFUAs with a prefectural capital city show a faster growth. For example, Sapporo and Sendai JFUAs show the most rapid growth for the two decades in question. On the other hand, most of the local JFUAs without a prefectural capital city do not show a high growth rate. Secondly, the number of declining NIC-JFUAs and SAIC-JFUAs increased from the 1970s to the 1980s. In the 1970s, Omuta JFUA was the only exception that recorded population decline in this group. This number increased to 10 JFUAs of this group in the 1980s. Thirdly, NIC-JFUAs and SAIC-JFUAs shows various population growth rates

[70] Appendix 7.1. shows more detailed data of the JFUA ranking arranged by growth rate.

from the top to the bottom so it is difficult to find a clear relationship between the growth pattern of the area and the effects of the policy.

Table 7-7: NIC-JFUAs and SAIC-JFUAs by Population Growth Rate (%)

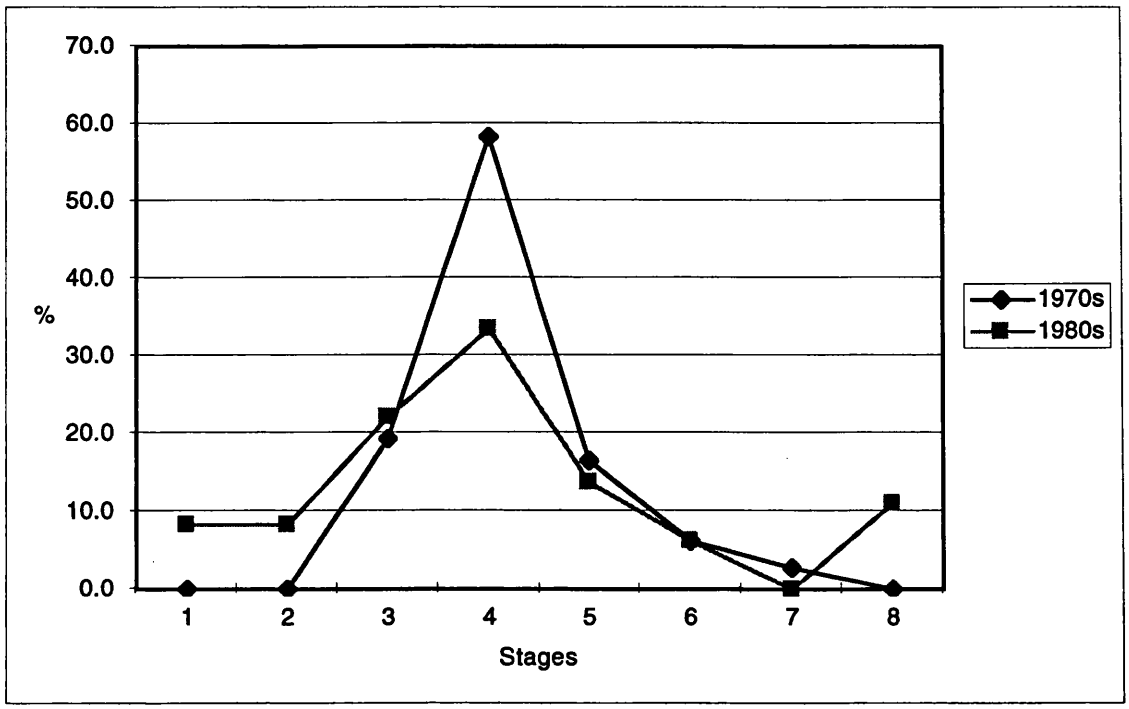
The 1970s						The 1980s				
Code	Name	*1	*2	%		Code	Name	*1	*2	%
7	Tomakomai JFUA			42.3		1	Sapporo JFUA		P	16.5
1	Sapporo JFUA		P	33.6		8	Chitose JFUA			15.4
18	Sendai JFUA		P	24.7		18	Sendai JFUA		P	14.5
144	Oita JFUA		P	19.9		142	Kumamoto JFUA		P	9.8
115	Fukuyama JFUA	S		18.3		80	Numazu JFUA	S		8.7
80	Numazu JFUA	S		16.7		72	Suwa JFUA			8.0
8	Chitose JFUA			16.0		30	Koriyama JFUA			7.1
109	Okayama JFUA		P	15.8		81	Fuji JFUA	S		6.9
142	Kumamoto JFUA		P	15.01		109	Okayama JFUA		P	6.0
110	Kurashiki JFUA			14.96		68	Matsumoto JFUA			5.8
81	Fuji JFUA	S		13.6		144	Oita JFUA		P	5.4
53	Niigata JFUA		P	12.3		53	Niigata JFUA		P	5.2
30	Koriyama JFUA			12.11		115	Fukuyama JFUA	S		4.9
120	Tokuyama JFUA	S		12.05		122	Tokushima JFUA		P	4.1
101	Himeji JFUA	S		11.31		107	Matsue JFUA		P	3.6
68	Matsumoto JFUA			11.26		58	Toyama JFUA		P	3.4
22	Akita JFUA		P	11.0		7	Tomakomai JFUA			3.2
122	Tokushima JFUA		P	10.9		101	Himeji JFUA	S		2.9
58	Toyama JFUA		P	10.7		110	Kurashiki JFUA			2.8
72	Suwa JFUA			10.3		108	Izumo JFUA			2.7
105	Yonago JFUA			10.2		29	Aizuwakamatsu JFUA			2.4
11	Hachinohe JFUA			9.5		22	Akita JFUA		P	2.3
107	Matsue JFUA		P	9.3		105	Yonago JFUA			1.4
12	Towada JFUA			8.9		114	Mihara JFUA	S		1.0
127	Imabari JFUA			7.6		11	Hachinohe JFUA			0.9
19	Ishimaki JFUA			6.2		129	Niihama JFUA			0.01
149	Nobeoka JFUA			5.53		12	Towada JFUA			-0.01
59	Takaoka JFUA			5.51		19	Ishimaki JFUA			-0.1
108	Izumo JFUA			5.4		59	Takaoka JFUA			-0.5
129	Niihama JFUA			5.3		127	Imabari JFUA			-1.2
70	Okaya JFUA			2.8		120	Tokuyama JFUA	S		-1.9
29	Aizuwakamatsu JFUA			2.6		143	Yatsushiro JFUA			-2.9
114	Mihara JFUA	S		1.7		70	Okaya JFUA			-3.0
4	Muroran JFUA			1.4		149	Nobeoka JFUA			-4.3
143	Yatsushiro JFUA			0.9		133	Omuta JFUA			-5.5
133	Omuta JFUA			-2.2		4	Muroran JFUA			-14.0

***1: Classification of JFUAs Part 1 : S = SAIC-JFUAs**
Others = NIC-JFUAs

***2: Classification of JFUAs Part 2 : P = JFUAs with Prefectural Capital City**

Source: Author

Figure 7-7: NIC-JFUAs and SAIC-JFUAs: Frequency Distribution of Urban Stages



Source: Author

Figure 7-7 shows the urban growth patterns of NIC-JFUAs and SAIC-JFUAs between the years 1970 and 1990.[71] In the 1970s, 21 JFUAs were in stage 4, in terms of the 8 stages of urban development elaborated in Chapter 5 (both the core and ring areas grow but the core grows faster than the ring). Only 8 JFUAs out of this group showed a decentralisation pattern. In the 1980s, the JFUAs that were in stage 4 in the 1970s were dispersed widely between stage 1 and stage 8. In addition, the number of decentralising JFUAs only increased from 8 to 10. The number of declining cores rose from 2 to 8, and the number of the declining JFUAs increased from 3 to 8 in the 1980s. This seems to indicate that the JFUA core of this group has a relatively strong centrality but that the JFUA cores have weakened due to regional development.

[71] For further information on the concept of matrix of sequential shift arranged by the urban development stage, see Chapter 6.

From various analyses as shown above, it can be said that it is difficult to find a positive relationship between this promotion policy and the growth pattern of the target areas in the 1970s and the 1980s. Of, course, the target areas combined had a slightly faster growth than the other JFUAs outside J-CMAs, however, it was not as fast as J-CMAs. The main reason for the stagnation of the NICs and SAICs was related to the main industry of these areas. NICs and SAICs were targeted for building a manufacturing centre based on heavy and chemical industry. However, since the 1970s, the Japanese economy had revolved around the high tech industry to an increasing degree. The heavy and chemical industries were no longer in the growth sectors for regional development, yet NICs and SAICs tended to rely on precisely these industries. In other words, the main industry has had an effect on population growth in the NICs and SAICs. A good example is the Nobeoka JFUA. This JFUA depends on the steel industry and experienced massive population loss during the 1980s. In addition, since the 1970s, the service sector outperformed all other sectors of the economy. However, most of NICs and SAICs are solely industrial centres, fulfilling no other significant functions, e.g. political and commercial centre.

Now compare this with the Chitose JFUA which recorded a rapid growth. In this JFUA, the establishment of an airport had a crucial role in the development of the region. JFUAs with a prefectural capital city had a different industrial structure from the declining areas. These capitals are the political centre of the prefectures and the service sector tended to develop there supported by relatively advanced transport infrastructures. As a result, it is relatively difficult for JFUAs with prefectural capital cities to be affected directly by the decline in industry.

Finally, let us briefly consider the relationship between the government's investment and regional development. Investment has had an effect on the target areas in the short term, but seemingly not in the long term. The Tomakomai JFUA is a good example. This JFUA in Hokkaido saw rapid growth in the 1970s, but not

in the subsequent decade. Originally, this area was designated not only as a part of the Do-o NIC, but also as a target area for one of the three large-scale projects in the New Comprehensive National Development Plan (section 7.2.3). The government poured money into building up a huge industrial centre in the 1970s, and consequently, this JFUA recorded a faster growth during that period (Table 7-5). After the investment was stopped in the late 1970s due to altered economic circumstances (section 7.2), this JFUA was unable to grow as fast as it had done in the 1970s.

7.5. The Technopolis Programme

Japan's first concrete policy for fostering regional economic development in the 1980s was the technopolis programme. This programme has attracted the attention of many researchers (Tatsuno, 1986; Maser, 1990). The programme takes the new 'bottom up' approach to regional development, focusing on the regional characteristics for the regional economic growth. In this case, there are two fundamental questions: "Is it true that the present policy is 'Bottom-up'?" and "Does the policy have positive (or negative) effects on the local areas?" The examination of these questions is the main purpose of this section.

7.5.1. Technopolis – Its Concept and Characteristics

'Technopolis' is a coined word which combines 'technology' with the word 'polis', for the ancient Greek city-state. As the etymology suggests, the technopolis programme involved a combination of scientific, industrial and urban development. The technopolis programme can be traced back to 'Vision for the 1980s' by Ministry of International Trade and Industry (MITI). As the legal

underpinning for the technopolis programme, the Law for Accelerating the Regional Development Based on High Technology Industrial Complexes (the Technopolis Law) was passed in 1983 (Tatsuno, 1986; Kawashima and Stöhr, 1988). The Technopolis programme promoted economic development and industrial restructuring outside the three metropolitan areas, and was supposed to be the 1980s answer to Japan's regional disparity problem. One of its aims was to create jobs in the non-metropolitan regions of the country, where there were not enough jobs for highly educated people (Ito et al., 1995).

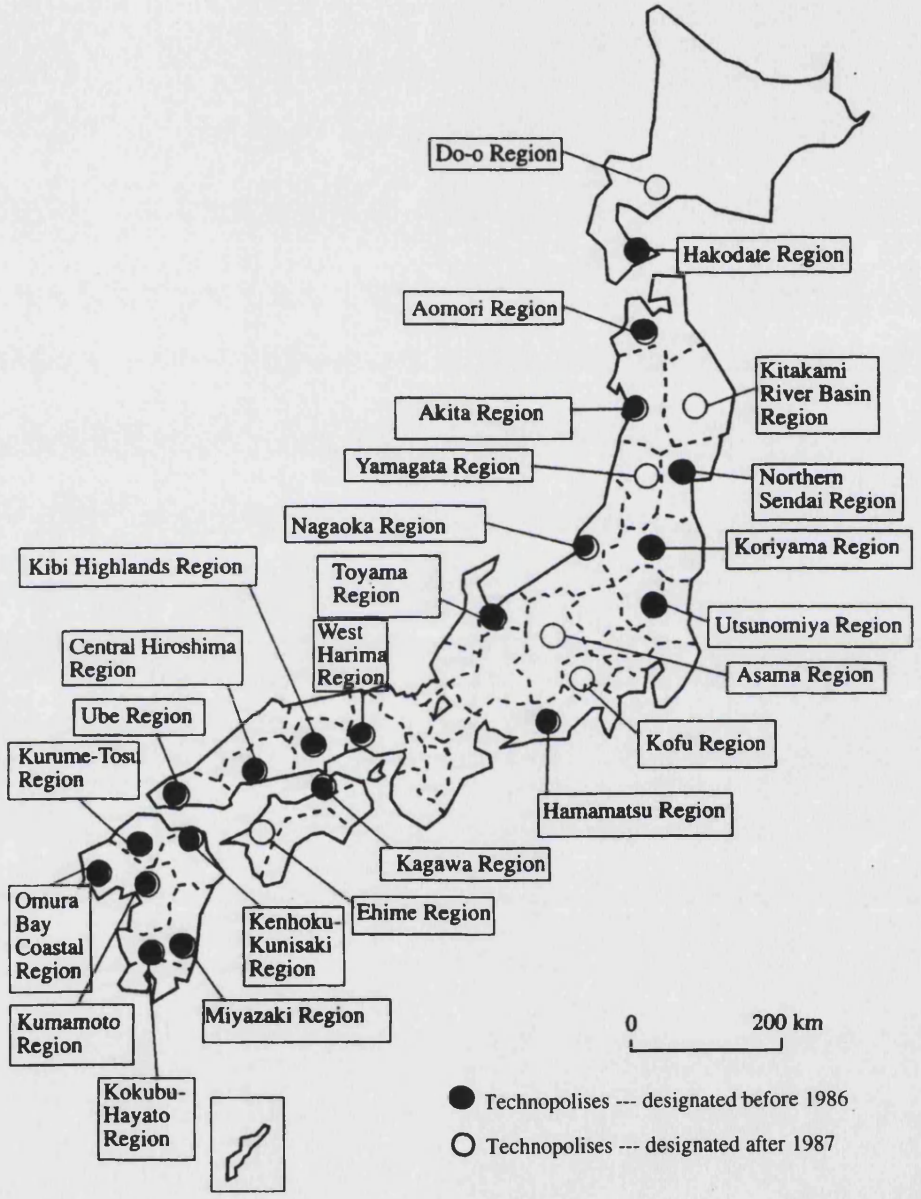
This programme had to take into account the following points. Firstly, the main goals for local industrial development must be realised by industries based on high technology. The programme promoted the industrial restructuring of Japan, in particular attempting to transform the key sector of the regional economy from heavy and chemical industries to high tech industry. Secondly, each technopolis must contain a 'mother city' with a population of 150,000 or more which would play the role of the "parent", providing certain urban facilities. Thirdly, each technopolis should offer favourable physical, economic and social conditions for its development. Target areas must already have a considerable number of businesses with high technology activities, or else have the potential for development of a high tech industry. Fourthly, the area should not only have industrial infrastructure but also be equipped with housing and urban services. As a guideline, each technopolis should be located near an airport or rail system, for easy access to Tokyo, Osaka or Nagoya. Finally, programmes must indicate how a local high technology promotion organisation is to be established, bringing together the public, private sector institutions, and academic bodies. There should be easy access to a university or other institute of advanced technology where relevant courses and research facilities would be available (Glasmeier, 1988; Ito et al., 1995).

The characteristics of technopolises were as follows. In contrast with NICs and SAICs, technopolises tended to contain a prefectural capital city. There were

two main reasons for this. Firstly, in the non-metropolitan areas, most academic research institutes which were expected to play an important role for the technopolis plan, were located in, or near, prefectural capital cities, and academic research centres had an important role in the programme. Another reason related to the existing urban facilities. The programme tried to use existing facilities as much as possible, and these facilities tended to be concentrated in prefectural capital cities. From a geographical distribution pattern, it can be said that each technopolis is located in inland areas, unlike most NICs and SAICs. NICs and SAICs were expected to be industrial centre of heavy and chemical industries so most areas were on the coast since they required industrial harbours for the trade of natural resources. The high tech industries on which the technopolis programme was focused do not depend on a port as heavy industries do, so their location was clearly less restricted.

The most important feature of the technopolis programme was that each prefectural government made its own basic plan for regional development. This 'bottom up' approach was different from the previous NICs and SAICs, in which the national government had the initiative. In total, 26 areas were designated as technopolises. These divide into two categories according to designated period: 20 technopolises designated before 1986 as 'earlier designated Technopolises', while 6 technopolises designated after 1987 are 'later designated Technopolises' (National Land Agency, 1994) (Figure 7-8).

Figure 7-8: 26 Technopolises



Source:Japan Industrial Location Center (JILC), 1994

Although the technopolis programme was positively accepted for local areas in the 1980s, there were various criticisms, and there have been various questions about the 'bottom up' approach. The technopolis programme emphasised the role of prefectural governments for local development, but in reality, MITI still had a strong influence in deciding the direction of the development (Yazawa, 1990; Ito et.al., 1995). In addition, the technopolis programme was for the most part devised by research institutes in Tokyo, so that the local economy and people could not really participate. Moreover, there was a "bandwagon effect", with others wanting to participate in the programme, and the government's official approval became too broad. From these circumstances, it was difficult to reflect specific regional characteristics for each technopolis plan (Glasmeier, 1988).

As a result, most plans tried promoting one of just four basic types of industry: electronics, mechatronics, biotechnology or new materials. The new plans failed to promote any significant specialisation in technopolises, or the localisation of industry. There are also some questions about the effect of high tech industry on regional economic development. It is difficult for local economies to foster high tech industries because of their limited structure and facilities. The linkage with Research and Development centres is an important part for the high tech industry, but 69% of R&D centres are located in or around the Tokyo area (Yazawa, 1990). While Japan's economy has shifted over to the high-tech and service sectors, the technopolis programme focused on the promotion of high-tech industries, while more or less neglecting the service sector. It is therefore clear that the technopolis programme was effective only at the level of industrial location, and did not actually introduce a new style of regional development.

7.5.2. Assessment of the Technopolis Programme - from Previous Studies

In 1992, MITI released the first report on the technopolis programme. According to MITI (1992), the technopolis programme had had positive effects and the programme worked well. As a background, they mentioned the following four indexes in technopolises which were positive compared to those of the total national value. The four indexes were (1) output by manufacturing sector; (2) the growth rate of value added by manufacturing sector; (3) the growth rate of the people who engaged in the manufacturing sector, and (4) population growth. 26 technopolises recorded higher growth rates for these four indexes than that of non-technopolises.

On the other hand, the effects of the programme were called into question by some researchers with the usage of similar indexes. The problems were found in two points. The first was that there was no area that achieved the level that the programme expected although there were some areas that showed a high growth level in terms of some indexes (Tsukahara, 1994; Stöhr and Pönighaus, 1994). The second was that of geographical disparity. In looking at the target areas individually, areas were classified into two groups by growth pattern. One was the relatively high growth area and another the low growth area. The former was located near three metropolitan areas and the southern Kyushu area. From these characteristics, the technopolis programme was not successful.

7.5.3. The Population Changing Pattern in Technopolises – Based on the JFUA Definition

Section 7.5.2 showed the various aspects of the technopolis programme. This section examines the population growth rate in the technopolises as a basic evaluation of the programme, which is also the additional analysis that MITI (1992) examined for population growth. For this examination, the JFUA definition is used as the basic spatial unit as in section 7.3 and 7.4. The JFUAs and the Technopolises are designated by different definitions, however, when they are defined as JFUAs they can be approximated by all the 'mother cities' of the technopolis programme. Therefore, the JFUAs that contain a 'mother city' of a technopolis are treated as 'Technopolis-JFUAs' in this section. Table 7-8 gives the list of Technopolis-JFUAs. In this thesis, the Technopolis-JFUAs were classified by their designated period as mentioned in the previous section.[72]

Table 7-8: Technopolis-JFUAs

JFUA Code	JFUA Name	Technopolis Name		JFUA Code	JFUA Name	Technopolis Name
1	Sapporo JFUA	Do-o		67	Nagano JFUA	Asama
2	Hakodate JFUA	Hakodate		79	Hamamatsu JFUA	Hamamatsu
9	Aomori JFUA	Aomori		101	Himeji JFUA	Nishi-Harima
10	Hirosaki JFUA	Aomori		109	Okayama JFUA	Kibi-Kogen
13	Morioka JFUA	Kitakamigawa		113	Kure JFUA	Hirosima-Chuo
18	Sendai JFUA	Northern Sendai		118	Ube JFUA	Ube
22	Akita JFUA	Akita bay		123	Takamatsu JFUA	Kagawa
24	Yamagata JFUA	Yamagata		126	Matsuyama JFUA	Ehime
30	Koriyama JFUA	Koriyama		134	Kurume JFUA	Kurume-Tosu
36	Utsunomiya JFUA	Utsunomiya		140	Sasebo JFUA	Kan-Omurawan
54	Nagaoka JFUA	Nagaoka		142	Kumamoto JFUA	Kumamoto
58	Toyama JFUA	Toyama		144	Oita JFUA	KenhokuKokuto
59	Takaoka JFUA	Toyama		147	Miyazaki JFUA	Miyazaki
66	Kofu JFUA	Kofu		150	Kagoshima JFUA	Kokubu-Hayato

Source: Author

[72] MITI (1992) also focused on the 20 earlier designated Technopolises. To evaluate the change in the 1980s for these areas, other academics examined the same areas.

To compare the growth rate of NIC-JFUAs and SAIC-JFUAs, the growth rate of the three following groups will be used as reference points; (1) 154 JFUAs, (2) 3 J-CMAs, and (3) non Technopolis-JFUAs outside the 3 J-CMAs. Table 7-9 shows the growth rate of Technopolis-JFUAs and those three groups. From the comparison with these groups, the Technopolis-JFUAs have certain general characteristics.

Table 7-9: Population Growth Rate in Technopolis-JFUAs (%)

	1970s	1980s
3 J-CMAs	16.6	8.9
Non Technopolis-JFUAs outside 3 J-CMAs	11.2	4.3
Earlier Designated Technopolis-JFUAs	13.7	5.4
Later Designated Technopolis-JFUAs	21.4	10.9
Technopolis-JFUAs Total	15.7	6.8
154 JFUAs	14.8	7.2

Source: Author

Firstly, they showed a faster growth in the two decades in question. In the 1970s, the period before the technopolis programme started, the JFUAs grew faster than the non Technopolis-JFUAs outside the 3 J-CMAs. However, once the programme had been introduced in the 1980s, the growth rate of the Technopolis-JFUAs dropped to 5.4%, this was similar to the rate in the non-Technopolis-JFUAs outside the 3 J-CMAs. Secondly, it was clearly observed that the Technopolis-JFUAs for the later designated areas recorded faster growth than the JFUAs for the earlier designated areas. In the 1980s, the growth rate in the JFUAs for the later designated areas was 10.9%, almost double than that of the JFUAs designated in the earlier period. Why did the later designated Technopolis-JFUAs demonstrate a better growth rate than the earlier ones? This is because of the original character of the target areas. All later designated Technopolis-JFUAs are JFUAs with a

prefectural capital city, which tend to grow faster than JFUAs without a prefectural capital city. On the other hand, the earlier designated Technopolis-JFUAs were dominated by the JFUAs without a prefectural capital city.

Table 7-10: Population Growth Rate in Technopolis-JFUAs and Other JFUAs (%)

	1970s	1980s
Technopolis-JFUAs with a Prefectural Capital City	19.3	8.8
Technopolis-JFUAs without a Prefectural Capital City	8.3	2.1
Non-Technopolis-JFUAs without a Prefectural Capital City outside J-CMAs	8.1	2.6
Non-Technopolis-JFUAs with a Prefectural Capital City outside J-CMAs	16.2	7.1
154 JFUAs	14.8	7.2

Source: Author

Table 7-10 shows the growth rate of Technopolis-JFUAs classified into two groups; (1) Technopolis JFUAs with a prefectural capital city and (2) Technopolis JFUAs without a prefectural capital city, and other two groups; (3) non-Technopolis-JFUAs with a prefectural capital city outside J-CMAs and (4) non-Technopolis-JFUAs with a prefectural capital city outside J-CMAs. From this table it is clearly observed that the Technopolis JFUAs with a prefectural capital city recorded faster growth rate than those without a capital city. In addition, the growth rate of the Technopolis JFUAs with a prefectural capital city recorded the highest rate of all four groups during the two decades; 19.3% in the 1970s and 8.8% in the 1980s. From this fast growth tendency, it is difficult to find the policy effectiveness. On the other hand, the Technopolis–JFUAs without prefectural capital city recorded the lowest population growth rate in the 1980s, 2.1%. From this result, the policy effects are questionable.

Table 7-11: Technopolis-JFUAs Ranked by Population Growth Rate

The 1970s

Code	Name	*1	*2	%
1	Sapporo JFUA	L	P	33.6
18	Sendai JFUA		P	24.7
147	Miyazaki JFUA		P	23.0
126	Matsuyama JFUA	L	P	21.1
144	Oita JFUA		P	19.9
36	Utsunomiya JFUA		P	19.21
150	Kagoshima JFUA		P	19.19
13	Morioka JFUA	L	P	19.0
109	Okayama JFUA		P	15.8
9	Aomori JFUA		P	15.5
142	Kumamoto JFUA		P	15.0
79	Hamamatsu JFUA			14.8
123	Takamatsu JFUA		P	14.5
30	Koriyama JFUA			12.1
101	Himeji JFUA			11.31
24	Yamagata JFUA	L	P	11.26
22	Akita JFUA		P	11.0
58	Toyama JFUA		P	10.7
67	Nagano JFUA	L	P	9.9
2	Hakodate JFUA			9.7
66	Kofu JFUA	L	P	9.5
118	Ube JFUA			8.7
134	Kurume JFUA			8.1
59	Takaoka JFUA			5.5
10	Hirosaki JFUA			5.3
54	Nagaoka JFUA			3.2
140	Sasebo JFUA			1.1
113	Kure JFUA			0.9

The 1980s

Code	Name	*1	*2	%
1	Sapporo JFUA	L	P	16.5
18	Sendai JFUA		P	14.5
36	Utsunomiya JFUA		P	10.9
142	Kumamoto JFUA		P	9.8
79	Hamamatsu JFUA			8.92
147	Miyazaki JFUA		P	8.88
13	Morioka JFUA	L	P	8.84
126	Matsuyama JFUA	L	P	8.4
66	Kofu JFUA	L	P	7.9
30	Koriyama JFUA			7.1
109	Okayama JFUA		P	6.0
150	Kagoshima JFUA		P	5.6
144	Oita JFUA		P	5.4
123	Takamatsu JFUA		P	4.7
67	Nagano JFUA	L	P	4.31
24	Yamagata JFUA	L	P	4.28
134	Kurume JFUA			4.27
58	Toyama JFUA		P	3.4
118	Ube JFUA			3.3
101	Himeji JFUA			2.9
22	Akita JFUA		P	2.3
54	Nagaoka JFUA			0.5
59	Takaoka JFUA			-0.5
9	Aomori JFUA		P	-1.4
140	Sasebo JFUA			-2.2
10	Hirosaki JFUA			-2.6
2	Hakodate JFUA			-3.1
113	Kure JFUA			-5.2

***1: Classification of JFUAs Part 1 : L= Technopolis-JFUAs for Technopolis Areas designated after 1987**
Others = Technopolis-JFUAs for Technopolis Areas designated before 1986

***2: Classification of JFUAs Part 2 : P = JFUAs with Prefectural Capital City**

Source: Author

To look at the target areas individually, Table 7-11 shows the JFUAs ranked by growth rate in the two decades.[73] From this table, it can be seen that the Technopolis-JFUAs showed some distinctive characteristics. The first characteristic was that the JFUAs with a prefectural capital city recorded a higher population growth rate. In the 1970s, all of the top 10 JFUAs were JFUAs with a prefectural capital city. In the 1980s, the JFUAs with a prefectural capital city still showed a higher growth rate of population although there were two JFUAs without a prefectural capital city, Hamamatsu and Koriyama in the fastest growing 10.

The second characteristic is the relation between the distance to Tokyo and the higher growing areas. As Tsukahara (1994), and Stöhr and Pönighaus (1994) remarked, Technopolis-JFUAs near Tokyo performed better among the group in the 1980s. The Utsunomiya, Koriyama, and Sendai JFUAs have easy access to Tokyo because they have a Tohoku Shinkansen express station. Hamamatsu is located between Tokyo and Nagoya and has a Tokaido Shinkansen express station. On the other hand, JFUAs containing old industrial cities, e.g. the Kure and Sasebo JFUAs, showed lower growth rates. Finally, most JFUAs without a prefectural capital city also showed a lower growth.

Examining the JFUA ranking of the non J-CMAs arranged by the population growth rate in the 1970s and the 1980s, it is difficult to find any strong relationship between the Technopolis programme and the growth rate. Some Technopolis JFUAs recorded the fastest level of the population growth and some areas had amongst the slowest rates of the population growth. This tendency is the same as the NIC-JFUAs and SAIC-JFUAs.

Figure 7-9 illustrates the changing pattern of urban growth in the Technopolis-JFUAs. In the 1970s, 13 JFUAs were in stage 4, constituting 62.5% of the group. In the 1980s, the distribution pattern fluctuated between centralisation and decentralisation. In addition to the characteristic of fluctuations, only those

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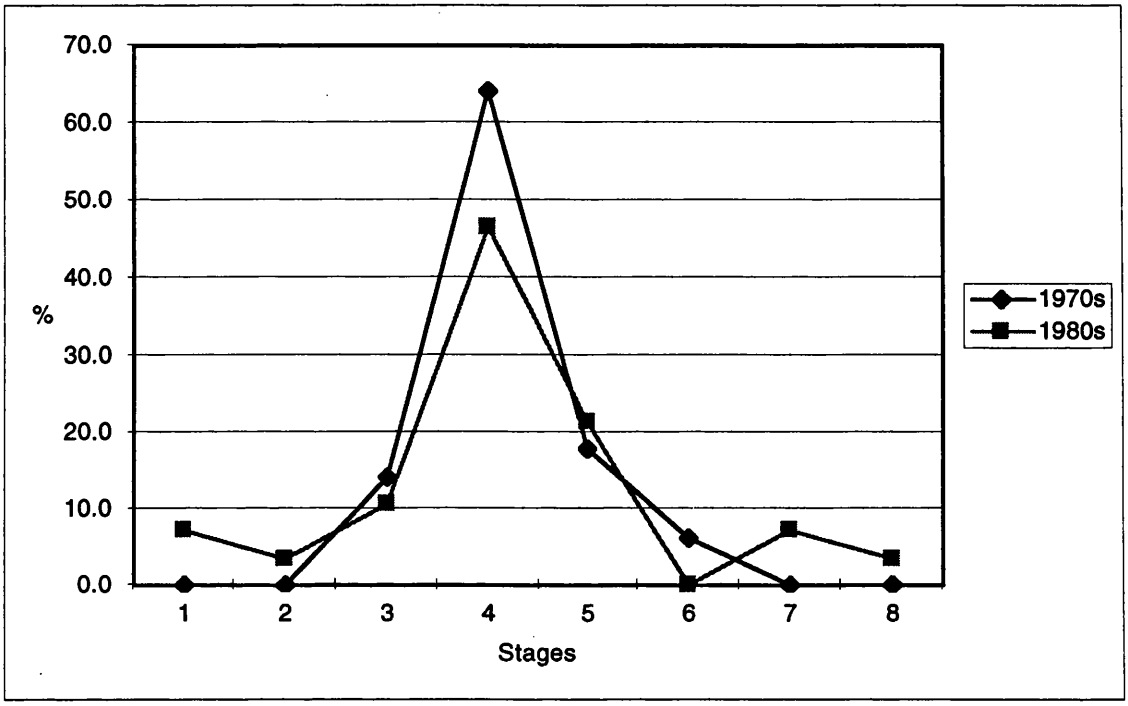
[73] Appendix 7.1. shows more detailed data of the JFUA ranking arranged by growth rate.

JFUAs without prefectural capital cities changed from stage 4. On the other hand, JFUAs with prefectural capitals did not change. This shows that the centrality of the JFUA cores did not hold for the ring areas.

Figure 7-9: Technopolis-JFUAs: Frequency Distribution of Urban Stages



Source: Author

Comparing the population change of the 1970s with that of the 1980s, the technopolis programme seems to have been less effective. This result does not support MITI's positive evaluation but confirms the arguments of researchers that criticised the plan. It can be said that the technopolis programme focused too heavily on transforming manufacturing in the regions at the expense of developing other urban functions which are of crucial relevance, e.g. the service sector.

7.6. Conclusion

After World War II, the Japanese government had two main objectives: for the national economy to grow, and for this growth to be balanced throughout the country. To achieve these objectives, the government drew up four Comprehensive National Development Plans. When Japan experienced rapid economic growth in the 1960s, its economic structure had transformed from one relying on agricultural and light industry, to one based on the heavy and chemical industries and this transformation was associated with a strong growth of regional inequality in economic and social circumstances.

Although the first Comprehensive National Development Plan mentioned regional development policies, the government focused on economic development at a national level as opposed to a nationwide balanced growth; regional development policy was devised with national development in mind. Hence NICs and SAICs were intended to contribute to the process of building up industrial centres which would boost the nation's economy. This tendency did not change when the New Comprehensive National Development Plan was announced in the late 1960s.

Due to economic and social circumstances, particularly from the 1970s with the first oil crisis of 1973, industry in Japan became more oriented towards high technology. The government's strategy for regional development also changed from the usual 'top-down' approach to a 'bottom-up' one. The Third Comprehensive National Development Plan was formulated during this period although this plan has been criticised for lacking a clear vision for regional development (Yamasaki, 1998), the idea behind it is highly thought of (Honma, 1993; Shimokobe, 1994).

The Fourth Comprehensive National Development Plan also took a 'bottom up' approach. In the 1980s, there was a change in not only the relationship between the three metropolitan areas and the regions, but also that between the Tokyo

metropolitan area and the other two metropolitan areas. Since the 1970s, many urban activities, e.g. international finance and multinational business, have concentrated in the Tokyo area. This was reflected in the Fourth Comprehensive National Development Plan, which mentioned the distribution patterns from the Tokyo Areas to the other two metropolitan areas, and treated Tokyo as a global city as far as the world economy was concerned.

In evaluating the effects of these policies, this chapter examined the population changes in three types of selected areas using JFUAs as the basic unit for the analysis; (1) the three metropolitan areas, (2) NICs and SAICs as the promoted areas designated in the 1960s and (3) Technopolises as the promoted areas designated in the 1980s. These areas were evaluated in terms of population growth rate to clarify the relationship between regional development policies and Japanese urban settlement change over the last two decades. From the results, several observations could be made.

When the three metropolitan areas were examined, it was clearly observed that the Tokyo metropolitan area showed an outstanding growth pattern. On the other hand, the Kansai metropolitan area showed slower growth than that of the Tokyo metropolitan area, and the Nagoya metropolitan area also could not demonstrate similar growth to the Tokyo area. These patterns confirmed the phenomena, 'Unipolar Concentration into the Tokyo Area'. As the background of this, political, financial and administrative functions contribute to the area's growth.

When the target areas of the national policy for regional development were examined, there were no obvious signs that the Japanese policy for regional development had any inpact in the last two decades. Not only was this true for the NICs and SAICs but also for the Technopolises, which showed similar patterns. Their growth performance was dispersed from the top to the bottom in the two decades; there was no clustering of the Technopolis-JFUAs in any special position

from their rate of the population growth. However, we do not know what would have happened if there had been no development policy.

Of course, it cannot be known what the development patterns would have been in the absence of the policies but in terms of population growth it is clear that the stated aims of the plans were not achieved. In that sense they can be said to have failed. It could, furthermore, be argued that the government needed to change its approach to regional economic development because the fastest growth sectors have changed from manufacturing towards services, as discussed in Chapter 6.

Appendix 7.1. 154 JFUAs Arranged by the Population Growth Rate

Table A7-1: The 1970s (Rank 1-50)

Rank	Code	Region	JFUA Name	J-CMA	Prefectural Capital	NIC or SAIC	Technopolis	%
1	52	Kanto	Atsugi JFUA	Tokyo J-CMA				68.23
2	7	Hokkaido	Tomakomai JFUA			NIC-JFUA		42.30
3	86	Chubu	Toyota JFUA	Nagoya J-CMA				35.65
4	1	Hokkaido	Sapporo JFUA		Prefectural Capital	NIC-JFUA	Technopolis-JFUA	33.64
5	116	Chugoku	Higashihiroshima JFUA					32.18
6	132	Kyushu-Okinawa	Fukuoka JFUA		Prefectural Capital			31.86
7	35	Kanto	Katsuta JFUA					26.37
8	49	Kanto	Narita JFUA	Tokyo J-CMA				25.79
9	153	Kyushu-Okinawa	Naha JFUA		Prefectural Capital			25.69
10	40	Kanto	Mooka JFUA					25.08
11	18	Tohoku	Sendai JFUA		Prefectural Capital	NIC-JFUA	Technopolis-JFUA	24.71
12	33	Kanto	Tsuchiura JFUA	Tokyo J-CMA				24.66
13	46	Kanto	Ota JFUA					24.48
14	147	Kyushu-Okinawa	Miyazaki JFUA		Prefectural Capital		Technopolis-JFUA	23.00
15	87	Chubu	Anjo JFUA	Nagoya J-CMA				22.89
16	112	Chugoku	Hiroshima JFUA		Prefectural Capital			21.85
17	39	Kanto	Koyama JFUA	Tokyo J-CMA				21.65
18	126	Shikoku	Matsuyama JFUA		Prefectural Capital		Technopolis-JFUA	21.08
19	50	Kanto	Kimizu JFUA					20.57
20	144	Kyushu-Okinawa	Oita JFUA		Prefectural Capital	NIC-JFUA	Technopolis-JFUA	19.91
21	36	Kanto	Utsunomiya JFUA		Prefectural Capital		Technopolis-JFUA	19.21
22	150	Kyushu-Okinawa	Kagoshima JFUA		Prefectural Capital		Technopolis-JFUA	19.19
23	51	Kanto	Ku-Areas of Tokyo-to JFUA	Tokyo J-CMA	Prefectural Capital			19.15
24	13	Tohoku	Morioka JFUA		Prefectural Capital		Technopolis-JFUA	18.99
25	60	Chubu	Kanazawa JFUA		Prefectural Capital			18.98
26	115	Chugoku	Fukuyama JFUA			SAIC-JFUA		18.27
27	82	Chubu	Iwata JFUA					17.67
28	154	Kyushu-Okinawa	Okinawa JFUA					17.53
29	6	Hokkaido	Obihiro JFUA					16.88
30	80	Chubu	Numazu JFUA					16.67
31	47	Kanto	Kumagaya JFUA	Tokyo J-CMA				16.58
32	41	Kanto	Otawara JFUA					16.29
33	85	Chubu	Kariya JFUA	Nagoya J-CMA				16.13
34	45	Kanto	Isesaki JFUA					16.01
35	8	Hokkaido	Chitose JFUA			NIC-JFUA		15.98
36	75	Chubu	Gifu JFUA	Nagoya J-CMA	Prefectural Capital			15.91
37	96	Kinki	Kyoto JFUA	Kansai J-CMA	Prefectural Capital			15.87
38	109	Chugoku	Okayama JFUA		Prefectural Capital	NIC-JFUA	Technopolis-JFUA	15.78
39	90	Kinki	Yokkaichi JFUA	Nagoya J-CMA				15.54
40	9	Tohoku	Aomori JFUA		Prefectural Capital		Technopolis-JFUA	15.52
41	142	Kyushu-Okinawa	Kumamoto JFUA		Prefectural Capital	NIC-JFUA	Technopolis-JFUA	15.01
42	110	Chugoku	Kurashiki JFUA			NIC-JFUA		14.96
43	79	Chubu	Hamamatsu JFUA			SAIC-JFUA	Technopolis-JFUA	14.83
44	84	Chubu	Handa JFUA	Nagoya J-CMA				14.82
45	31	Kanto	Mito JFUA		Prefectural Capital			14.72
46	3	Hokkaido	Asahikawa JFUA					14.61
47	43	Kanto	Takasaki JFUA					14.52
48	123	Shikoku	Takamatsu JFUA		Prefectural Capital		Technopolis-JFUA	14.47
49	83	Chubu	Nagoya JFUA	Nagoya J-CMA	Prefectural Capital			14.45
50	141	Kyushu-Okinawa	Isahaya JFUA					14.19

Source: Author

Table A7-2: The 1970s (Rank 51-100)

Rank	Code	Region	JFUA Name	J-CMA	Prefectural Capital	NIC or SAIC	Technopolis	%
51	100	Kinki	Kobe JFUA	Kansai J-CMA	Prefectural Capital			13.95
52	81	Chubu	Fuji JFUA					13.57
53	130	Shikoku	Kochi JFUA		Prefectural Capital			13.54
54	5	Hokkaido	Kushiro JFUA					12.75
55	16	Tohoku	Kitakami JFUA					12.57
56	53	Chubu	Niigata JFUA		Prefectural Capital	NIC-JFUA		12.34
57	65	Chubu	Sabae JFUA					12.21
58	42	Kanto	Maebashi JFUA		Prefectural Capital			12.15
59	30	Tohoku	Koriyama JFUA			NIC-JFUA	Technopolis-JFUA	12.11
60	120	Chugoku	Tokuyama JFUA			SAIC-JFUA		12.05
61	89	Kinki	Tsu JFUA		Prefectural Capital			11.76
62	99	Kinki	Osaka JFUA	Kansai J-CMA	Prefectural Capital			11.64
63	88	Chubu	Nishio JFUA	Nagoya J-CMA				11.53
64	61	Chubu	Komatsu JFUA					11.46
65	78	Chubu	Shizuoka JFUA		Prefectural Capital	SAIC-JFUA		11.41
66	101	Kinki	Himeji JFUA			SAIC-JFUA	Technopolis-JFUA	11.31
67	24	Tohoku	Yamagata JFUA		Prefectural Capital		Technopolis-JFUA	11.26
68	68	Chubu	Matsumoto JFUA			NIC-JFUA		11.26
69	22	Tohoku	Akita JFUA		Prefectural Capital	NIC-JFUA	Technopolis-JFUA	10.98
70	76	Chubu	Ogaki JFUA	Nagoya J-CMA				10.93
71	94	Kinki	Hikone JFUA					10.91
72	122	Shikoku	Tokushima JFUA		Prefectural Capital	NIC-JFUA		10.85
73	58	Chubu	Toyama JFUA		Prefectural Capital	NIC-JFUA	Technopolis-JFUA	10.67
74	34	Kanto	Shimodate JFUA					10.57
75	124	Shikoku	Marugame JFUA					10.50
76	72	Chubu	Suwa JFUA			NIC-JFUA		10.30
77	105	Chugoku	Yonago JFUA			NIC-JFUA		10.17
78	67	Chubu	Nagano JFUA		Prefectural Capital		Technopolis-JFUA	9.88
79	125	Shikoku	Sakaide JFUA					9.87
80	2	Hokkaido	Hakodate JFUA				Technopolis-JFUA	9.70
81	11	Tohoku	Hachinohe JFUA			NIC-JFUA		9.54
82	66	Chubu	Kofu JFUA		Prefectural Capital		Technopolis-JFUA	9.52
83	107	Chugoku	Matsue JFUA		Prefectural Capital	NIC-JFUA		9.30
84	12	Tohoku	Towada JFUA			NIC-JFUA		8.93
85	48	Kanto	Mobara JFUA	Tokyo J-CMA				8.89
86	119	Chugoku	Yamaguchi JFUA		Prefectural Capital			8.80
87	118	Chugoku	Ube JFUA				Technopolis-JFUA	8.71
88	139	Kyushu-Okinawa	Nagasaki JFUA		Prefectural Capital			8.67
89	28	Tohoku	Fukushima JFUA		Prefectural Capital			8.66
90	73	Chubu	Ina JFUA					8.60
91	134	Kyushu-Okinawa	Kurume JFUA				Technopolis-JFUA	8.11
92	102	Kinki	Wakayama JFUA	Kansai J-CMA	Prefectural Capital			8.07
93	62	Chubu	Fukui JFUA		Prefectural Capital			7.91
94	44	Kanto	Kiryu JFUA					7.83
95	38	Kanto	Kanuma JFUA					7.63
96	69	Chubu	Ueda JFUA					7.63
97	127	Shikoku	Imabari JFUA			NIC-JFUA		7.61
98	77	Chubu	Takayama JFUA					7.51
99	148	Kyushu-Okinawa	Miyakonojo JFUA					7.46
100	92	Kinki	Matsusaka JFUA					7.26

Source: Author

Table A7-3: The 1970s (Rank 101-154)

Rank	Code	Region	JFUA Name	J-CMA	Prefectural Capital	NIC or SAIC	Technopolis	%
101	63	Chubu	Tsuruga JFUA					6.63
102	19	Tohoku	Ishimaki JFUA			NIC-JFUA		6.23
103	37	Kanto	Sano JFUA					6.18
104	32	Kanto	Hitachi JFUA					5.90
105	131	Kyushu-Okinawa	Kitakyushu JFUA					5.90
106	149	Kyushu-Okinawa	Nobeoka JFUA			NIC-JFUA		5.53
107	59	Chubu	Takaoka JFUA			NIC-JFUA	Technopolis-JFUA	5.51
108	108	Chugoku	Izumo JFUA			NIC-JFUA		5.40
109	10	Tohoku	Hirosaki JFUA				Technopolis-JFUA	5.34
110	103	Kinki	Tanabe JFUA					5.29
111	104	Chugoku	Tottori JFUA		Prefectural Capital			5.26
112	129	Shikoku	Niihama JFUA			NIC-JFUA		5.25
113	55	Chubu	Sanjo JFUA					5.24
114	15	Tohoku	Hanamaki JFUA					5.16
115	121	Chugoku	Iwakuni JFUA					4.52
116	136	Kyushu-Okinawa	Saga JFUA		Prefectural Capital			4.43
117	91	Kinki	Ise JFUA					4.41
118	20	Tohoku	Furukawa JFUA					4.26
119	74	Chubu	Saku JFUA					4.04
120	95	Kinki	Nagahama JFUA					3.91
121	152	Kyushu-Okinawa	Kanoya JFUA					3.75
122	71	Chubu	Iida JFUA					3.55
123	21	Tohoku	Kesennuma JFUA					3.40
124	54	Chubu	Nagaoka JFUA				Technopolis-JFUA	3.20
125	117	Chugoku	Shimonoseki JFUA					3.19
126	14	Tohoku	Mizusawa JFUA					3.17
127	93	Kinki	Ueno JFUA					3.16
128	64	Chubu	Takefu JFUA					3.04
129	106	Chugoku	Kurayoshi JFUA					2.98
130	70	Chubu	Okaya JFUA			NIC-JFUA		2.78
131	135	Kyushu-Okinawa	Iizuka JFUA					2.70
132	29	Tohoku	Aizuwakamatsu JFUA			NIC-JFUA		2.62
133	98	Kinki	Maizuru JFUA					2.48
134	27	Tohoku	Sakata JFUA					2.04
135	151	Kyushu-Okinawa	Sendai JFUA					1.87
136	145	Kyushu-Okinawa	Nakatsu JFUA					1.75
137	114	Chugoku	Mihara JFUA			SAIC-JFUA		1.70
138	97	Kinki	Fukuchiyama JFUA					1.50
139	111	Chugoku	Tsuyama JFUA					1.46
140	4	Hokkaido	Muroran JFUA			NIC-JFUA		1.36
141	140	Kyushu-Okinawa	Sasebo JFUA				Technopolis-JFUA	1.12
142	17	Tohoku	Ichinoseki JFUA					1.06
143	113	Chugoku	Kure JFUA				Technopolis-JFUA	0.90
144	143	Kyushu-Okinawa	Yatsushiro JFUA			NIC-JFUA		0.89
145	137	Kyushu-Okinawa	Karatsu JFUA					0.71
146	26	Tohoku	Tsuruoka JFUA					-0.14
147	56	Chubu	Kashiwazaki JFUA					-0.28
148	25	Tohoku	Yonezawa JFUA					-1.11
149	57	Chubu	Joetsu JFUA					-1.22
150	128	Shikoku	Uwajima JFUA					-1.35
151	133	Kyushu-Okinawa	Omuta JFUA			NIC-JFUA		-2.19
152	146	Kyushu-Okinawa	Hita JFUA					-2.28
153	23	Tohoku	Odate JFUA					-2.39
154	138	Kyushu-Okinawa	Imari JFUA					-2.50

Source: Author

Table A7-4: The 1980s (Rank 1-50)

Rank	Code	Region	JFUA Name	J-CMA	Prefectural Capital	NIC or SAIC	Technopolis	%
1	52	Kanto	Atsugi JFUA	Tokyo J-CMA				32.73
2	33	Kanto	Tsuchiura JFUA	Tokyo J-CMA				22.62
3	49	Kanto	Narita JFUA	Tokyo J-CMA				20.66
4	39	Kanto	Koyama JFUA	Tokyo J-CMA				19.51
5	116	Chugoku	Higashihiroshima JFUA					18.52
6	86	Chubu	Toyota JFUA	Nagoya J-CMA				16.95
7	1	Hokkaido	Sapporo JFUA		Prefectural Capital	NIC-JFUA	Technopolis-JFUA	16.47
8	8	Hokkaido	Chitose JFUA			NIC-JFUA		15.41
9	40	Kanto	Mooka JFUA					14.96
10	46	Kanto	Ota JFUA					14.64
11	18	Tohoku	Sendai JFUA		Prefectural Capital	NIC-JFUA	Technopolis-JFUA	14.51
12	82	Chubu	Iwata JFUA					13.46
13	132	Kyushu-Okinawa	Fukuoka JFUA		Prefectural Capital			13.21
14	35	Kanto	Katsuta JFUA					12.81
15	84	Chubu	Handa JFUA	Nagoya J-CMA				12.61
16	47	Kanto	Kumagaya JFUA	Tokyo J-CMA				12.28
17	154	Kyushu-Okinawa	Okinawa JFUA					11.91
18	87	Chubu	Anjo JFUA	Nagoya J-CMA				11.87
19	41	Kanto	Otawara JFUA					11.85
20	85	Chubu	Kariya JFUA	Nagoya J-CMA				11.07
21	36	Kanto	Utsunomiya JFUA		Prefectural Capital		Technopolis-JFUA	10.87
22	153	Kyushu-Okinawa	Naha JFUA		Prefectural Capital			10.42
23	51	Kanto	Ku-Areas of Tokyo-to JFUA	Tokyo J-CMA	Prefectural Capital			10.30
24	45	Kanto	Isesaki JFUA					10.15
25	142	Kyushu-Okinawa	Kumamoto JFUA		Prefectural Capital	NIC-JFUA	Technopolis-JFUA	9.75
26	50	Kanto	Kimizu JFUA					9.43
27	112	Chugoku	Hiroshima JFUA		Prefectural Capital			9.20
28	119	Chugoku	Yamaguchi JFUA		Prefectural Capital			9.02
29	79	Chubu	Hamamatsu JFUA			SAIC-JFUA	Technopolis-JFUA	8.92
30	147	Kyushu-Okinawa	Miyazaki JFUA		Prefectural Capital		Technopolis-JFUA	8.88
31	13	Tohoku	Morioka JFUA		Prefectural Capital		Technopolis-JFUA	8.84
32	80	Chubu	Numazu JFUA					8.72
33	90	Kinki	Yokkaichi JFUA	Nagoya J-CMA				8.62
34	48	Kanto	Mobara JFUA	Tokyo J-CMA				8.45
35	126	Shikoku	Matsuyama JFUA		Prefectural Capital		Technopolis-JFUA	8.40
36	43	Kanto	Takasaki JFUA					8.34
37	60	Chubu	Kanazawa JFUA		Prefectural Capital			8.34
38	16	Tohoku	Kitakami JFUA					8.11
39	100	Kinki	Kobe JFUA	Kansai J-CMA	Prefectural Capital			8.06
40	72	Chubu	Suwa JFUA			NIC-JFUA		7.98
41	6	Hokkaido	Obihiro JFUA					7.92
42	66	Chubu	Kofu JFUA		Prefectural Capital		Technopolis-JFUA	7.91
43	73	Chubu	Ina JFUA					7.74
44	42	Kanto	Maebashi JFUA		Prefectural Capital			7.65
45	63	Chubu	Tsuruga JFUA					7.30
46	94	Kinki	Hikone JFUA					7.27
47	30	Tohoku	Koriyama JFUA			NIC-JFUA	Technopolis-JFUA	7.09
48	31	Kanto	Mito JFUA		Prefectural Capital			7.05
49	81	Chubu	Fuji JFUA					6.89
50	83	Chubu	Nagoya JFUA	Nagoya J-CMA	Prefectural Capital			6.79

Source: Author

Table A7-5: The 1980s (Rank 51-100)

Rank	Code	Region	JFUA Name	J-CMA	Prefectural Capital	NIC or SAIC	Technopolis	%
51	89	Kinki	Tsu JFUA		Prefectural Capital			6.78
52	88	Chubu	Nishio JFUA	Nagoya J-CMA				6.48
53	99	Kinki	Osaka JFUA	Kansai J-CMA	Prefectural Capital			6.32
54	109	Chugoku	Okayama JFUA		Prefectural Capital	NIC-JFUA	Technopolis-JFUA	5.95
55	75	Chubu	Gifu JFUA	Nagoya J-CMA	Prefectural Capital			5.91
56	68	Chubu	Matsumoto JFUA			NIC-JFUA		5.79
57	74	Chubu	Saku JFUA					5.72
58	150	Kyushu-Okinawa	Kagoshima JFUA		Prefectural Capital		Technopolis-JFUA	5.64
59	96	Kinki	Kyoto JFUA	Kansai J-CMA	Prefectural Capital			5.47
60	144	Kyushu-Okinawa	Oita JFUA		Prefectural Capital	NIC-JFUA	Technopolis-JFUA	5.40
61	38	Kanto	Kanuma JFUA					5.30
62	34	Kanto	Shimodate JFUA					5.20
63	53	Chubu	Niigata JFUA		Prefectural Capital	NIC-JFUA		5.17
64	69	Chubu	Ueda JFUA					4.98
65	115	Chugoku	Fukuyama JFUA			SAIC-JFUA		4.90
66	123	Shikoku	Takamatsu JFUA		Prefectural Capital		Technopolis-JFUA	4.65
67	141	Kyushu-Okinawa	Isahaya JFUA					4.46
68	67	Chubu	Nagano JFUA		Prefectural Capital		Technopolis-JFUA	4.31
69	20	Tohoku	Furukawa JFUA					4.29
70	24	Tohoku	Yamagata JFUA		Prefectural Capital		Technopolis-JFUA	4.28
71	134	Kyushu-Okinawa	Kurume JFUA				Technopolis-JFUA	4.27
72	76	Chubu	Ogaki JFUA	Nagoya J-CMA				4.21
73	78	Chubu	Shizuoka JFUA		Prefectural Capital	SAIC-JFUA		4.18
74	122	Shikoku	Tokushima JFUA		Prefectural Capital	NIC-JFUA		4.14
75	151	Kyushu-Okinawa	Sendai JFUA					4.04
76	65	Chubu	Sabae JFUA					4.03
77	37	Kanto	Sano JFUA					3.69
78	62	Chubu	Fukui JFUA		Prefectural Capital			3.69
79	107	Chugoku	Matsue JFUA		Prefectural Capital	NIC-JFUA		3.60
80	104	Chugoku	Tottori JFUA		Prefectural Capital			3.55
81	58	Chubu	Toyama JFUA		Prefectural Capital	NIC-JFUA	Technopolis-JFUA	3.43
82	61	Chubu	Komatsu JFUA					3.34
83	118	Chugoku	Ube JFUA				Technopolis-JFUA	3.33
84	130	Shikoku	Kochi JFUA		Prefectural Capital			3.32
85	7	Hokkaido	Tomakomai JFUA			NIC-JFUA		3.23
86	28	Tohoku	Fukushima JFUA		Prefectural Capital			3.02
87	101	Kinki	Himeji JFUA			SAIC-JFUA	Technopolis-JFUA	2.89
88	92	Kinki	Matsusaka JFUA					2.86
89	110	Chugoku	Kurashiki JFUA			NIC-JFUA		2.83
90	56	Chubu	Kashiwazaki JFUA					2.70
91	108	Chugoku	Izumo JFUA			NIC-JFUA		2.68
92	124	Shikoku	Marugame JFUA					2.62
93	152	Kyushu-Okinawa	Kanoya JFUA					2.54
94	136	Kyushu-Okinawa	Saga JFUA		Prefectural Capital			2.51
95	29	Tohoku	Aizuwakamatsu JFUA			NIC-JFUA		2.43
96	22	Tohoku	Akita JFUA		Prefectural Capital	NIC-JFUA	Technopolis-JFUA	2.34
97	111	Chugoku	Tsuyama JFUA					2.30
98	32	Kanto	Hitachi JFUA					2.19
99	139	Kyushu-Okinawa	Nagasaki JFUA		Prefectural Capital			1.94
100	14	Tohoku	Mizusawa JFUA					1.85

Source: Author

Table A7-6: The 1980s (Rank 101-154)

Rank	Code	Region	JFUA Name	J-CMA	Prefectural Capital	NIC or SAIC	Technopolis	%
101	64	Chubu	Takefu JFUA					1.72
102	15	Tohoku	Hanamaki JFUA					1.50
103	44	Kanto	Kiryu JFUA					1.43
104	105	Chugoku	Yonago JFUA			NIC-JFUA		1.43
105	95	Kinki	Nagahama JFUA					1.31
106	131	Kyushu-Okinawa	Kitakyushu JFUA					1.27
107	148	Kyushu-Okinawa	Miyakonojo JFUA					1.25
108	135	Kyushu-Okinawa	Iizuka JFUA					1.19
109	114	Chugoku	Mihara JFUA			SAIC-JFUA		1.02
110	11	Tohoku	Hachinohe JFUA			NIC-JFUA		0.93
111	71	Chubu	Iida JFUA					0.90
112	25	Tohoku	Yonezawa JFUA					0.79
113	77	Chubu	Takayama JFUA					0.73
114	3	Hokkaido	Asahikawa JFUA					0.56
115	17	Tohoku	Ichinoseki JFUA					0.56
116	54	Chubu	Nagaoka JFUA				Technopolis-JFUA	0.50
117	106	Chugoku	Kurayoshi JFUA					0.38
118	91	Kinki	Ise JFUA					0.26
119	125	Shikoku	Sakaide JFUA					0.26
120	55	Chubu	Sanjo JFUA					0.23
121	138	Kyushu-Okinawa	Imari JFUA					0.15
122	129	Shikoku	Niihama JFUA			NIC-JFUA		0.01
123	102	Kinki	Wakayama JFUA	Kansai J-CMA	Prefectural Capital			0.00
124	12	Tohoku	Towada JFUA			NIC-JFUA		-0.01
125	19	Tohoku	Ishimaki JFUA			NIC-JFUA		-0.11
126	145	Kyushu-Okinawa	Nakatsu JFUA					-0.18
127	93	Kinki	Ueno JFUA					-0.32
128	97	Kinki	Fukuchiyama JFUA					-0.46
129	59	Chubu	Takaoka JFUA			NIC-JFUA	Technopolis-JFUA	-0.48
130	98	Kinki	Maizuru JFUA					-0.64
131	103	Kinki	Tanabe JFUA					-0.77
132	127	Shikoku	Imabari JFUA			NIC-JFUA		-1.20
133	9	Tohoku	Aomori JFUA		Prefectural Capital		Technopolis-JFUA	-1.39
134	137	Kyushu-Okinawa	Karatsu JFUA					-1.56
135	26	Tohoku	Tsuruoka JFUA					-1.68
136	5	Hokkaido	Kushiro JFUA					-1.83
137	120	Chugoku	Tokuyama JFUA			SAIC-JFUA		-1.86
138	57	Chubu	Joetsu JFUA					-1.93
139	140	Kyushu-Okinawa	Sasebo JFUA				Technopolis-JFUA	-2.19
140	146	Kyushu-Okinawa	Hita JFUA					-2.57
141	10	Tohoku	Hirosaki JFUA				Technopolis-JFUA	-2.59
142	27	Tohoku	Sakata JFUA					-2.63
143	143	Kyushu-Okinawa	Yatsushiro JFUA			NIC-JFUA		-2.88
144	121	Chugoku	Iwakuni JFUA					-2.97
145	70	Chubu	Okaya JFUA			NIC-JFUA		-3.03
146	2	Hokkaido	Hakodate JFUA				Technopolis-JFUA	-3.05
147	117	Chugoku	Shimonoseki JFUA					-3.10
148	149	Kyushu-Okinawa	Nobeoka JFUA			NIC-JFUA		-4.28
149	21	Tohoku	Kesennuma JFUA					-4.54
150	113	Chugoku	Kure JFUA				Technopolis-JFUA	-5.23
151	133	Kyushu-Okinawa	Omuta JFUA			NIC-JFUA		-5.46
152	23	Tohoku	Odate JFUA					-5.71
153	128	Shikoku	Uwajima JFUA					-5.85
154	4	Hokkaido	Muroran JFUA			NIC-JFUA		-13.96

Source: Author

Chapter 8: Summary and Conclusion

8.1. Introduction

As noted in the first chapter, the main objective of this thesis has been to analyse the changing Japanese urban settlement system. The first prerequisite to achieve this objective was to compare the results based on different urban definitions, i.e. administrative boundaries and functional urban regions, and derive a definition of the urban areas of Japan appropriate for current analysis which would make it possible to compare changes in the Japanese pattern of urban settlement with those in other countries. Only on a foundation such as this was it possible to understand the fundamental question: 'what are the characteristics of the changing pattern in Japanese urban settlements over the last two decades?'

As a concluding chapter, this Chapter 8 contains four parts. In the first part, the summary and findings of this thesis will be outlined. In the previous chapters, we examined various topics of the Japanese urban settlement. This part will attempt to summarise the findings and relate them to the structure and the main objective of the thesis. As the second part of this chapter, the contribution of the research embodied in this thesis to the wider academic literature in the field will be discussed. In the third part, the limitations of this thesis will be discussed. The final section outlines some ideas for future research. This will show the possibilities of the development from this thesis.

8.2. Summary and Findings

As the first part of this chapter, the main empirical results of the analysis of these questions and their implications are summarised.

8.2.1. Basic Spatial Unit for Analysis – Administrative Boundaries and the Functional Urban Regions

To examine the Japanese settlement system, the administrative system of Japan was outlined in the beginning. There are two main points that had to be explained. The first was to understand the basic circumstances of the Japanese settlement system. The second point was to explain the basic unit for the Japanese statistical data collection. Therefore, the first part of Chapter 2 showed the Japanese settlement system in terms of administrative boundaries. Japan has a three-tier system of administration; national, prefectural and municipal. There are 47 prefecture in Japan. When Japan is divided into municipalities called *shi-cho-son* (city-town-village), then there are 3,246 local authorities (The 1990 Population Census of Japan).

Chapter 2 also explained two official definitions of the Japanese urban areas, the *shi* and the Densely Inhabited Districts (DIDs). The *shi* area is an administratively defined urban area and this definition is widely accepted in Japan. However, to try to approximate more closely the actual urban areas of Japan, the national government established the DID definition. The DID area, which is defined by the high density and settlement size, represents the built-up area. Most Japanese studies are based on one or both of these two definitions, i.e. on a prefectural basis or the *shi* area.

Although many studies of the Japanese settlement system are based on the administrative boundaries, prefecture or municipalities, these results are

questionable and as such cannot be compared the results obtained for other countries such as the UK or the US. In the US and European countries, to understand the real settlement system of a nation, the concept of functional urban regions has been used as the basic spatial unit for analysis. For example, the Metropolitan Standard Area (MSA) is used for the US settlements and the Local Labour Market Areas (LLMA) has been used for the UK settlements.

Therefore, another uniform definition of the Japanese settlement is required as well as a new definition of functional urban regions for the Japanese urban settlement system. Although there are some existing definitions of functional urban regions for the Japanese settlement system, approximating the SMSAs in the US, these definitions are not widely accepted in Japan. These definitions were reviewed, and the necessity was confirmed to establish a new definition for this thesis. The main reason was that previous definitions contained some questionable points regarding criteria and that modification would be required to analyse the 1990 Census data. As a result of that, an original definition of functional urban region, called the Japanese Functional Urban Area (JFUA), was established in Chapter 3.

The JFUA definition used the 1990 Census data and treated municipalities as a minimal unit. The criteria of each JFUA are as follows. The JFUA definition applied the 'Top-down' approach like the SMLA for the Japanese settlements; each JFUA consists of the core area as work place and the ring area as its residential place. To define the JFUA core, there are two criteria. The first is the settlement size; the number of workers on the working place basis should be greater than 40,000. Another criterion is based on the intensity of its links to other places; the balance between workers in the daytime should be greater than that in the night-time. The JFUA ring area has two criteria. The first is that 7.5% or more of its resident working population in the areas commute to the specific JFUA core. Another criterion is that the JFUA ring area should be contiguously located to the JFUA core or its ring area. Applying this JFUA definition divides Japan into 154

urban settlements and other areas. Various analysis based on the JFUA definition provided a range of results to compare with those that were discussed on the basis of the US and European settlement systems.

8.2.2. Population Change of Urban Settlement in Japan

The main results of this analysis of the changing Japanese urban settlement system were as follows.

8.2.2.1. Urban Population Based on the Various Definitions of Urban Areas

If the percentage of a territory's total population living in places classified as 'urban' is accepted as a measure of a country's degree of urbanisation, then this thesis examined the Japanese urbanisation on three different definitions. When the administratively defined urban area, the *shi* area, is treated as the basic urban area, it shows that Japan had experienced rapid urbanisation from 18% in 1920 to 78% in 1990. This analysis based on the *shi* areas is widely accepted as descriptive of Japanese urbanisation in the long term, and there are many previous studies that used this as their measure of Japanese urbanisation. Analysis based on the DID definition showed that in 1990 63% of Japan was urbanised. This means that Japanese urbanisation based on the DID areas is lower than that based on the *shi* areas. The DID based analysis more accurately reflects the real urban areas but the analysis based on the DID definition is not as widely accepted as that based on the *shi* areas. In Chapter 4, the urban population was also investigated on the basis of the JFUA definition. From this analysis, the JFUA population suggested an even higher level of urbanisation: 79% in 1970 and 82.5% in 1990. While the above

three analyses show different rates of urbanisation, all results show that Japan was highly urbanised.

8.2.2.2. Relationship between Settlement Size and Growth Speed

To find the characteristics of the Japanese urban population, the relationship between settlement size and the rate of growth of population was examined. In Chapter 2, the relationship between this growth rate and settlement size based on the administrative urban area was examined. From the result, one could see that medium-sized Japanese cities, whose population was between 300,000 and 499,999, grew fastest. Large cities whose population was more than 500,000 showed slower growth in proportion to national population growth than that of the medium-sized cities.

This relationship was also examined on the basis of the JFUA definition in Chapter 4, where a quite different picture of the relationship between settlement size and rate of growth emerged. 154 JFUAs were classified into four groups arranged by settlement size. According to the analysis based on the JFUA definition, there was a positive relationship between settlement size and its rate of growth. In other words, in Japan, larger settlements systematically grew faster than smaller settlements. This result showed a different pattern not only from the analysis based on the administratively defined urban areas but also from the pattern observed in the US and UK for the same period. In the US and UK, the larger settlements suffered population loss during the 1970s. At the same time, the smaller settlements recorded fast population growth. In the 1980s some large urban settlements in these countries recovered from population decline.

8.2.2.3. Geographical Characteristics

What are the geographical characteristics of the Japanese settlement system? When population in administratively defined urban areas is treated as urban population, it was found that only the prefectures that are parts of the three Japanese metropolitan areas recorded faster growth than the national average. This implies that the Japanese settlement system has been in the process of concentration into these metropolitan areas. This is also supported by the changing pattern of the internal migration pattern of Japan based on the 47 prefectures. Before 1970, the metropolitan areas shared the same pattern of internal migration: that is in-migrants from non-metropolitan areas were concentrated on the three metropolitan areas. This pattern was disrupted in the 1970s, but reappeared in the 1980s.

The characteristics of settlement change relating to geographical factor were also examined by two definitions (i.e. prefectural and the JFUA basis) in Chapters 2 and 4. Both definitions show that the Kanto region that contains the Tokyo area recorded massive population growth. The Kinki region that consists of Osaka, Kyoto and Kobe did not record high rates of growth. Moreover, regions outside the three metropolitan areas did not record fast growth.

8.2.2.4. The Growing Areas and the Declining Areas

Examining the 154 JFUAs individually reveals the characteristics of the faster growing JFUAs. These JFUAs are classified into two types. The first contains those JFUAs with regional core cities which were prefectural capital cities. Cities such as Sapporo, Fukuoka and Hiroshima recorded higher growth in both absolute and relative terms. The three metropolitan areas recorded huge rates of population growth but these areas did not show the highest level of population growth in relative terms. Another type of fast growing JFUAs included those

medium-sized JFUAs located close to the largest JFUAs. Narita and Atsugi JFUAs are good examples. They are neighbouring the Ku-Areas of Tokyo-to JFUA, the largest JFUA. These two JFUAs had the highest growth rates of any other JFUAs. In addition, it can be generalised that the JFUAs with prefectural capital cities recorded higher rates of population growth than those without a prefectural capital city. This tendency was observed throughout the twenty-year period examined in this thesis.

It was found that the JFUAs near the metropolitan areas, especially Tokyo, showed concentration and population growth, although the JFUAs in this region did not show drastic changes over the two decades. This is the opposite pattern observed in the regions without such metropolitan areas. It was also found that the prefectural capital cities showed centralisation of the core city. As mentioned in Chapter 4, most JFUAs recorded population growth overall in the two decades. In addition, the population growth pattern showed centralisation into the core.

On the other hand, some JFUAs recorded population decrease during this period, 9 JFUAs in the 1970s and 30 JFUAs in the 1980s. These declining JFUAs had two main characteristics. The first was that relatively small JFUAs suffered population loss, especially in the 1970s. Secondly and more importantly, old industrial centres showed population decline. These areas suffered low population growth or population loss from the core cities. They did not show decentralisation or relative concentration but an absolute population loss, especially in the 1980s. These JFUA core cities depended on specific industries such as steel and shipbuilding, i.e. declining industries. Therefore, the area tended to decline when its main industry started to deteriorate.

8.2.3. The Japanese Urban Settlement System - From the View Point of the City Size Distribution

Chapter 5 examined the size distribution of the Japanese urban settlement system to understand the changing settlement pattern at the national level and compared this to the results of studies of other settlement systems. This chapter also looked at the influence on the results of different sample taking of settlements; (1) two different spatial definitions; administrative and functional, (2) various thresholds defined by different settlement size, and (3) various thresholds defined by different number of settlements.

This analysis confirmed firstly that there was a difference in the results based on analysing the functional urban region and administratively defined areas. The Pareto exponent estimated on the series of functional urban regions showed a value very close to the theoretical value, 1 associated with the so-called 'urban rank-size rule'. On the other hand, the analysis based on the administrative units showed much larger values. Secondly, it was confirmed that the different thresholds of settlement size affected the estimate of the Pareto exponent. Thirdly, it was also confirmed that the number of settlements included in the measured sample affected the estimate of the Pareto exponent. Theoretically, the Pareto exponent of the city size distribution should not be affected by the different criteria for sample selection but it is, in fact, clearly affected by such changes.

In Chapter 5, the validity of the 'urban rank-size rule' was also examined with various samples of the Japanese settlement system by testing three hypotheses that must be satisfied at the same time. There were only three cases that satisfied this most stringent definition of the 'urban rank-size rule'. The majority of cases did not satisfy the hypotheses.

The evolution in the structure of the Japanese settlement system in the long term was examined applying the methods of Parr, 1985. This showed the various

aspects of the changing pattern of the Japanese settlement system based on the administrative definition between 1970 and 1990. Different threshold sizes of settlement showed the different pattern of the Japanese settlement system. If a small size such as 2,500 was applied as the threshold size, Japan showed concentration into large settlements during the period as measured by the increase of the Pareto exponent. On the other hand, if 300,000 was used as the threshold size of the settlement, the Japanese settlement system showed a deconcentration from large cities. These various tests produced similar results to those of Guérin-Pace (1995) who examined the evolution of the French settlement system over the last 150 years.

On the other hand, the analysis based on the JFUA definition presented a stable result. The different thresholds did not significantly affect the estimates of the settlement pattern. According to the analysis based on the JFUA definition, the Japanese settlement system had experienced concentration into larger settlements during two decades. From the above results, the advantages of the settlement analysis based on the functional urban region were demonstrated.

8.2.4. Centralisation or Decentralisation? - Inside JFUAs and the Relationship between the Growth Pattern and Industrial Structure

Chapter 6 examined the characteristics of the Japanese urban settlement system by classifying the 154 JFUAs into eight urban development stages. The urban development stages are defined by the population change and the relationship between the rates of population change in the urban core and the ring. From examining each JFUA with this classification, several findings show the characteristics of the Japanese urban changes.

In the 1970s, most JFUAs recorded population growth, and it was found that the number of JFUAs that fell into stages of centralisation was high during this

period. This is not like the pattern of the US and UK settlement systems but like that of the southern European counties observed by Hall and Hay (1980) and van den Berg et al. (1982). In the 1980s, the pattern of centralisation moved slightly to decentralisation in Japan. This Japanese pattern of urban development again contrasts with that of the UK settlement system (Hall and Hay, 1980; van den Berg et al., 1982; Cheshire and Hay, 1989).

Although the pattern of the urban development stages was different between Japan and the UK, the background of the phenomena in Japan and European countries can be treated as similar in that, the industrial structure and the types of urban function play an important role in settlement change. The first is that the prominence of the service sector has effects on the patterns of settlement change. The second is that the management and administrative function also has effects on settlement changes. In Japan, JFUAs with prefectural capital cities provided a good example. They have, at least, political functions for the prefectures. The service sector in prefectural capital cities is better developed than in the non-prefectural capital JFUA core cities. In addition, prefectural capital cities showed a higher proportion of employment engaged in the management and administration sector than that of the non-prefectural capital JFUA core cities. On the other hand, the old industrial centres that relied on old style industry such as steel and shipbuilding did not show a high proportion of employment in the service sector. These characteristics help understanding the different pattern of urban stages in JFUAs with prefectural capital cities and those without a prefectural capital city (Section 6.4.4). The former shows relatively sequential shift in which most of them stayed in the concentration stages. On the other hand, the latter group showed irregular movement of the urban stages and some of them suffered a population loss.

8.2.5. Japanese Policy and Evaluation

After various analyses of the changes in the Japanese settlement system, the relationship between national policy and the pattern settlement was examined in Chapter 7. How has the government viewed the evolving settlement pattern? What policies has national government adopted and what impact have they had? To answer these questions, the development of national policy for regional development was examined and some target areas were examined to assess the effects. To understand the Japanese policy for settlement development, it is useful to examine the aims of the four Comprehensive National Development Plans. To sum up the characteristics of the plans, we find the following:

The first two development plans concentrated on raising the rate of growth of the national economy and regional growth was not treated as the first priority. The second finding was that the third Comprehensive National Development Plan was mainly focused on regional growth but a concrete policy did not exist. Moreover changing national economic circumstances did not allow this policy to be implemented and national government policies were modified. The fourth plan, the latest plan at present, admits to the unipolar concentration into the Tokyo area, but although this was perceived as a problem the policy did not address it effectively. In short, national policy did not seem to achieve more balanced growth of the nation.

To examine the target areas of the Japanese policies, the following three topics were evaluated; (1) the changing pattern of the three metropolitan areas, (2) the effects of the 1960s policy on the target areas and (3) the effects of the 1980s policy. Overall, it could be said that national government did not pay enough attention to regional development in order to correct regional inequality.

To examine the population change in the metropolitan areas, some consolidated areas were established to approximate the government's definition of

metropolitan areas. From this operation, these three metropolitan areas were designated as the Japanese Consolidated Metropolitan Areas (J-CMA) by grouping JFUAs. From the examination of the population change in these areas, the Tokyo area showed a fast growth pattern. On the other hand, the second largest Kansai area did not grow as fast as the Tokyo area. The Nagoya area grew at a rate between that of the Tokyo area and the Kansai area.

In addition, internal migration patterns for the three metropolitan areas were examined in Chapter 2. This was not based on the J-CMAs but the results are helpful to understand the settlement change. It was found that the internal migration pattern associated with the concentration pattern of the 1980s was different from that prior to 1980. Before 1970, the three metropolitan areas recorded massive population inflows from outside and shared a common 'absorbing' pattern. In the 1980s, only the Tokyo metropolitan areas absorbed massive population migration from outside. The other two metropolitan areas did not reveal such a pattern. Thus, this unipolar concentration into the Tokyo Areas was observed as a unique phenomenon during that period.

The second approach to evaluating the role of policy in settlement change looked at the effect of the 1960s policies, the New Industrial Cities (NICs) and the Spatial Areas for Industrial Consolidation (SAICs). These were designated for fostering regional economic development, and partly helping the national economic growth. To examine the effects on the target areas, some JFUAs that covered similar areas to those of NICs and SAICs were examined in terms of their population change. The population of these JFUAs did not grow faster than the other areas, especially in the 1980s. This result confirmed previous studies, e.g. Ito and Takahashi (1985).

The last topic examined the effects of the Technopolis programme, a famous Japanese industrial policy of the 1980s. This policy aimed at regional economic growth based on regional character. JFUAs that were related to the Technopolis

were not observed to grow faster than other areas during the 1980s. On the other hand, a different relationship was found, that is the distance between the target areas and the Tokyo metropolitan area played a significant role in the degree of development.

8.3. Some Contributions of This Research

This section examines the contribution of this thesis from three points of view; (1) the importance of showing the process of defining the functional urban regions of Japan; (2) the conclusions of different analysis based on the different definitions; and (3) the results of the settlement studies of Japan during the last two decades, compared to those for other countries.

8.3.1. Importance of Defining the Functional Urban Regions of Japan

This thesis analyses the Japanese urban settlement system. Perhaps the most important result is to show the importance of basing any analysis – particularly any comparative analysis - on functional urban regions of Japan, based on the JFUA definition.

Previous researchers who examined the Japanese settlement system paid comparatively little attention to the choice of basic spatial units. Some studies were based on the smallest local authorities, i.e. *shi-cho-son* divisions, or prefectures (Yorimitsu, 1987; Kuroda, 1990). When Yorimitsu (1987) discussed the Japanese urbanisation pattern of the last 50 years, he used the prefectures as a basic spatial unit. Kuroda (1990) used municipalities to investigate the Japanese urban structure. The conclusions of these studies, however, may be conditioned by their definition of

the units to analyse as this thesis has shown results are so sensitive to any change to the different spatial units. To avoid these complexities, the simple and reliable definition of the Japanese settlement system would be required.

This requirement for a systematic definition also arose from the context of international studies of settlement systems. In the US and European countries, studies of settlement systems have been based on functional urban regions (Berry, 1973, 1976; Hall and Hay, 1980; van den Berg et al., 1982; Cheshire and Hay, 1986, 1989; Champion et al., 1987; Champion ed., 1989; Champion, 1992; Cheshire, 1995). To investigate the changes in the Japanese settlement system on a basis that would permit comparison with the US and European studies, it was essential to have a comparable basic definition of urban regions. In this sense, most previous Japanese settlement studies are unsuitable.

To define the functional urban regions of the Japanese settlement system, firstly, it was necessary to examine the previous definitions of the functional urban regions in order to gain an understanding of the background and clarify the purpose of the definition. Therefore, this thesis compared the various definitions of the functional urban regions that were developed for three different areas of the world, Japan, the US and Europe.

The Japanese government and researchers had already attempted to define the functional urban regions in order to examine the real change of the Japanese settlements. However, there were two questions; (1) 'how were the criteria defined?' and (2) 'why were indexes used for the criteria?' This has always been unclear and it is necessary to understand the background of the decision making and data collecting process, because Japanese statistical collection has been variable. As mentioned in Chapters 2 and 5, the Japanese administrative boundaries are changeable. Therefore, updates of the definition will be required for long-term analysis. In this sense, the previous definitions of the Japanese functional urban regions are difficult to use and update because some criteria they used were not

clearly stated. In addition, the background changes in data are difficult to access for non-Japanese readers.

To clarify the core concept of the functional urban regions, the cases of other countries should be examined and the original idea of the functional urban regions applied to other countries should be understood. In addition, it is a useful exercise because we will know the relevance of the definition and know how to update the terms. In this sense, the US definition is important because the Standard Metropolitan Area (SMA) was the first official definition of functionally defined urban regions. This definition has evolved to the Standard Metropolitan Statistical Area (SMSA) between 1958 and 1980 and the Metropolitan Statistical Area (MSA) since the 1980 Census.

It was also useful to examine the development of the UK settlement system and the definitions that have evolved there. The main reason of examining the development of the UK definitions is that the functional urban regions of the UK settlement were established with reference to the US definitions and modified according to the unique circumstances of the UK settlement system. This means that the core concept of the definition can be clarified by checking the UK definitions. In other words, we can define what the core concept of the functional regions is, and learn how to substitute certain indexes with other indexes.

In the Japanese settlement system, the definition used should be different from the US and UK settlement systems. This is natural because each country collects data based on its own circumstances and traditions. By comparing these three countries, there are two advantages. The first one is to clarify the core concept of the functional urban region so allowing the adaptation of the concept for the Japanese settlement system. In addition, the characteristics of the Japanese settlement system would be clear for non-Japanese readers. Therefore, the functional urban regions of the Japanese settlement system should be examined under a new and original definition, that is the JFUA.

8.3.2. Meaning of the Comparative Analyses with the Different Urban Definitions of Japan

A particular contribution of this thesis is that it compares results obtained using various definitions of the spatial units; administrative boundaries and the functional urban regions. This highlights how dependent results are on the definition of urban area on which they are based. The potential difference between different definitions of the urban areas was already noted by some researchers such as Hall and Hay (1980), Rosen and Resnick (1980), and Parr (1985). These studies recommended the usage of the functional urban regions as the basic spatial units and many researchers have examined urban settlement systems based on the functional urban regions (Hall and Hay, 1980; Spence et al., 1982; Cheshire and Hay, 1986, 1989; Cheshire, 1995). However, most previous studies do not use the functional definition due to lack of data.

The main purpose of this study was to analyse the Japanese settlement system using the functional urban region as the basic spatial unit. It is still necessary to compare results based on administrative boundaries as administrative units are still so frequently used. Therefore, this thesis can be partly treated as an evaluation of urban definitions for the study of urban settlement systems. Results based on administrative units are summarised in Chapters 2 and 5, and those based on functional definitions can be found from Chapter 3 onwards.

By comparing these two results, the characteristics of functional urban regions can be clarified. It was found that analysis based on the JFUA definition showed a different aspect from that based on the administrative boundaries. The apparent relationship between settlement size and growth rate is a good example. As summarised in section 8.2.3, the results are different. The analysis based on the administrative boundaries showed that the medium-sized settlements grew fastest.

The analysis based on the JFUA definition showed that the larger settlements grew faster than the smaller ones. These results are important if we are to understand – even objectively measure - counterurbanisation. When Tsuya and Kuroda (1989) examined the changes of the Japanese settlement system in the context of counterurbanisation, their analysis was conducted on a prefectural basis because its use is widely accepted and data so readily available. However, settlement change should not be analysed on a prefectural basis because analysis of counterurbanisation in the US and UK have been based on functionally urban regions and such functionally defined areas appear to relate to urban areas in a more systematic and consistent way.

Chapter 5 shows another good example of the complexity of the settlement analysis. When the Japanese settlement system was examined on the basis of administrative boundaries, the results were different from the real settlement change that was taking place during the period of deconcentration from the largest cities. On the other hand, the analysis based on the functional urban regions showed that the Japanese settlement system exhibited a concentration towards larger settlements. Such comparisons have not been undertaken in any previous Japanese settlement studies.

8.3.3. Meanings of the Settlement Studies of the Japanese Settlement System 1970-1990

It is important to consider the target periods of this thesis. Since Glickman (1979), it has been difficult to find comprehensive Japanese settlement studies. As mentioned above, some settlement studies have been conducted but they have been minor efforts, and thus, the coverage was limited. In this aspect, this thesis will have comprehensively covered Japanese settlement studies between 1970 and 1990, and

it will be a useful reference guide with regard to changes in the Japanese settlements during the target period.

Studies since Glickman (1979) have had several defects. Firstly, most are not focused on the whole of Japan. In other words, most studies examined some limited areas. Thus many papers are just case studies because they are focused on some selected area, such as the metropolitan areas of Tokyo, or other specific regions. Therefore, it is difficult to understand the changes in all of the Japanese regions. In addition, even though some studies have tried to examine the whole area of Japan, most have not paid attention to the definitional problems of the spatial units of settlements as shown above. Therefore, some findings cannot be compared to the western studies nor even with each other since frequently different definitions were used and, as was noted above, many results are highly sensitive to a particular definition.

Furthermore, those settlement studies based on functional urban regions have not focused on the pattern and characteristics of the change or development. Kawashima's studies focused on comparing population in 1990 with his own future forecast not patterns of population change in the 1970s and the 1980s. Yamada and Tokuoka (1991) and Tokuoka (1995) examined the stages of development of the Japanese settlement between 1965 and 1985. However, they examined the characteristics only briefly. They concluded that the Japanese settlement system did not change so much during the two decades and only some areas recorded population decline, i.e. the ones with old industrial centres. However, they did not focus on the characteristics of the growing centres and regional characteristics were not examined in depth.

From this study, it can be confirmed that the patterns of Japanese urban development have not been the same as those in the US and UK but closer to those of Southern European countries, such as Italy. This means that Japan has shown a concentration into larger settlements, and the urban population has shown growth.

However, the background of these changes observed in the US and European settlement system (Frey, 1993; Cheshire, 1995) is observable in the changing economic structure of Japan since 1970.

8.4. Limitations of This Thesis

In the previous section, the advantages and contributions of this thesis were discussed. However, the analysis of this thesis has some limitations, which in large measure result from the availability and quality of the data available.

The first limitation of this thesis is the data collection for particular topics. In examining internal migration in Japan, it was only possible to access the data based on prefectures. Therefore, this topic could not be examined based on the JFUA basis settlements and the findings that were observed in Chapter 2 have to stand alone.

The second limitation is due to a less than complete coverage of the total national territory. This thesis examines the urban settlement of Japan, based on the JFUA definition. As outlined in Chapter 3, the JFUA definition focused on the urban settlements and, therefore, this definition does not cover the whole area of Japan. Of course, the JFUA covers over 80% of the national population and the definition helps to understand the pattern of the total Japanese settlement system and its evolution.

The third limitation is caused by the changing Japanese administrative boundaries. As discussed in Chapters 2 and 5, the Japanese boundaries are changeable, and therefore, it is almost impossible to analyse the settlement system based on the same spatial units for any extended period. In addition, since the 1990 Census, some Japanese boundaries have already changed, and further modification for any update of this analysis will be required. Therefore, it is difficult to examine

the settlement system based on the fixed functional urban regions although these problems also arise in the context of studies in the UK and European counties. As with the studies in other countries some approximations have to be made to provide consistent estimates for constant boundaries over longer periods of time.

In addition to these three limitations, this study did not examine the changing workforce population in the JFUAs. In this study, areas of the JFUA definition are fixed, making the data access difficult. According to the 1990 Census, total population data between 1970 and 1990 using 1990 boundaries is available from the special issue of "Commuting Population". This data set has the advantage of having re-estimated the basic population data to 1990 boundaries. However, they have the disadvantage of distinguishing commuting workers from the total number of commuters including commuting students. In other words, only the population of workforce and students is available. Because of the restrictions on the access to and availability of the Japanese census, data input has had to be done manually. This situation has not changed since Glickman (1979).

8.5. Some Ideas for Further Research

The first development that is possible is an update of the definition for the latest data. Within a few years, the data set of the 2000 Population Census of Japan will be out. The JFUA definition should be modified in order to be applied to the 2000 boundaries accommodate to their changes. This is because the published data is based on the administrative boundaries and some boundaries are difficult to define. In this case, the approach should be similar to Yamada and Tokuoka (1991). In their work, as mentioned in Chapter 4, they updated their own definition of functional urban regions for every ten years. This is inconvenient for

comparative studies such as this thesis, but is necessary in order to understand the overall patterns of a rapidly changing settlement system.

It would also be useful to add to the definition of urban regions definitions of the non-metropolitan areas of Japan. This is to cover the whole area of Japan by functionally defined regions. In this thesis, non-metropolitan areas were not paid attention to because the growth of metropolitan areas was its main purpose. However, it will be useful to define the non-metropolitan areas to understand the settlement system completely. The UK settlement system, for example, is defined not only in terms of urban areas but also in terms of rural areas, and to cover the whole landmass of Japan, similar steps should be taken.

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