Part I Preliminaries

Chapter 1 Population, Structural Change, and Demographic Dividend

The purpose of this chapter is threefold.

First is to demonstrate the processes by which demographic dividend is manifest. Second is to confirm that changes in population structure differ according to regions in the world. Third is to show the regional classifications used in this research project, as well as their characteristics.

The structure of the chapter is as follows. In Section 1.1, demographic dividend will be confirmed using growth accounting. In Section 1.2, it will be shown that the benefits of demographic dividend can be split into two categories. In Section 1.3, the different timings with which demographic dividend may be expected to appear will be shown, using UN regional divisions. In Section 1.4, the groupings used in this research project will be explained, and the demographic changes in each observed.

Note that, for the purposes of this research project, 0 to 19 years is termed the "juvenile population", 20 to 59 years the "working-age population", and 60 years and over the "elderly population". Moreover, the working-age population is further divided into the classifications 20 to 39 years (young working-age population) and 40 to 59 years (senior working-age population), and the elderly population to 60 to 70 years (younger elderly population) and 80 years and over (senior elderly population)[1].

1. 1 Process of the expression of demographic dividend

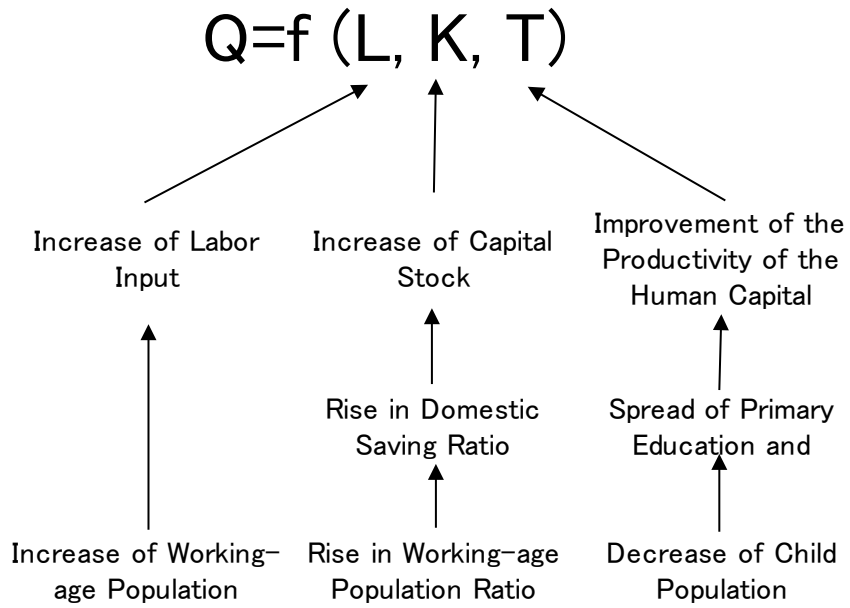
Conventional empirical analysis of demographic dividend has mainly been in the form of quantitative evaluation of the increase rates or ratios of increase in the working-age population, as well as a variety of other indices. However, there have been few studies that clearly indicate which types of policy are effective in order to enjoy the benefits of

[1] The reasons for creating sub-divisions of the working-age population are as follows. First, the young working-age population is considered to be the mainstay of labor intensive industry, as well as child-rearing. Second, the senior working-age population is considered to be the one that comprises of a highly productive workforce that utilizes its knowledge and experience, and is also a generation that begins to save for old age. Furthermore, the reason for sub-dividing the elderly is that a clear distinction may be expected in terms of the burden of care for each.

demographic dividend, and which are not.

Here, we will make use of a growth accounting formula to consider the influences that demographic changes exert upon labor input, capital stock, and total factor productivity. Growth accounting (production factor) is used to explain the size of an economy (Q) by the changes in the three factors of labor input (L), capital stock (K), and total factor productivity (T) (Figure 1.1).

Figure 1.1: Growth Accounting and Demographic Dividend



Source: Author

1.1.1 Impact on labor input

The first element of the formula in Figure 1.1 is labor input, which is the product of the work force and working hours.

Strictly speaking, labor input is expressed as the product of the labor force and working hours, and over the long term is strongly affected by labor force population trends. Therefore, in general, the higher the increase rate of the working population, the higher the labor input rate is believed to be.

Though falling birthrates eventually lead to decline in the working-age

population, increases in the working-age population will be greater than decreases for initial stage in developing countries[2], so the working-age population continues to increase. In other words, until its working-age population switches to decline, a country's potential to increase its labor input grows. In particular, once the baby boom generation reaches working-population age, the increase rate of working-age population is at its highest.

At the same time, as an increase in the working-age population promotes economic growth by virtue of increasing the labor input, decreases in the rate of increase restrict economic growth. Decline in the working-age population is being debated as an inhibitor of growth in the industrialized countries.

Of course, in the developing countries, an increase in the working-age population does not always result in an increase in labor force input (Oizumi 2011)[3]. The level of provision of the labor market, the stage of development of the industrial structure and the country's employment policies, all exert influence. In other words, the issues are whether a country's labor force can be absorbed, and whether the benefits of economic growth can be distributed evenly among the workers.

1.1.2 Impact on capital stock

The second element of the formula in Figure 1.1 is capital stock. This refers to the accumulation of investment (capital accumulation) that contributes to production, such as machinery, factories, harbors, electrical power, railroads and roads. The more capital stock a country has, the greater the potential for economic growth. Capital accumulation is formed by the investment activity of each year.

Changes in the level of capital stock are equivalent to subtracting the value of depreciation from the value of increased investment in a given period. To increase capital stock, the requisite is that capital is secured in excess of the amount of depreciation.

Today, with the advance of globalization, the required capital can be procured from overseas, but in the case of developing countries, an important policy measure is how the capital can be raised domestically. The reason is that these countries often do not have systems developed to handle incoming foreign capital, and that they have few

[2] The increase portion is the population that transitions from the juvenile population to the working-age population, and the decrease portion is that population that transitions from the working-age population to the elderly population.

[3] Many theories of demographic dividend assume full employment. However, among the developing countries, there are many where there is a large surplus population in agricultural communities, and the process whereby this surplus is absorbed by the labor market is underestimated. For example, see Oizumi (2011).

businesses that would attract foreign capital. It is believed that the degree to which capital stock can be increased in a developing country depends on that country's domestic savings ratio (Feldstein and Horioka 1980)[4].

However, the effective distribution of increased domestic savings into production activity, presumes a fully developed financial system. Particularly for developing countries, the development of banks and other financial institutions, and the development and provision of laws and systems in support of their work, as well as the maintenance of a stable macro-economy, are very important.

1.1.3 Impact on total factor productivity

The third element of the formula in Figure 1.1 is total factor productivity. In growth accounting, this is treated as a factor (residual) that cannot be explained by labor input or capital stock. This encompasses not only production engineering, but a wide range of infrastructure conditions, including educational systems for the development of human capital, efficient business management, laws and legal systems, ports and harbors, electrical power, roads and waterways.

As one example of how the population structure has brought about improved productivity, it may be pointed out that falling birthrates have contributed to a spread in primary education. For example, World Bank's *East Asia Miracle* points out that one factor behind Asia's high economic growth rates has been the spread of primary education, and that this in turn was realized by falling birthrates (World Bank 1993). In terms of improved productivity, changes in industrial structure (for example, the transition from a mainly agricultural economy to an industrial one) and the advance of urbanization have exerted influence.

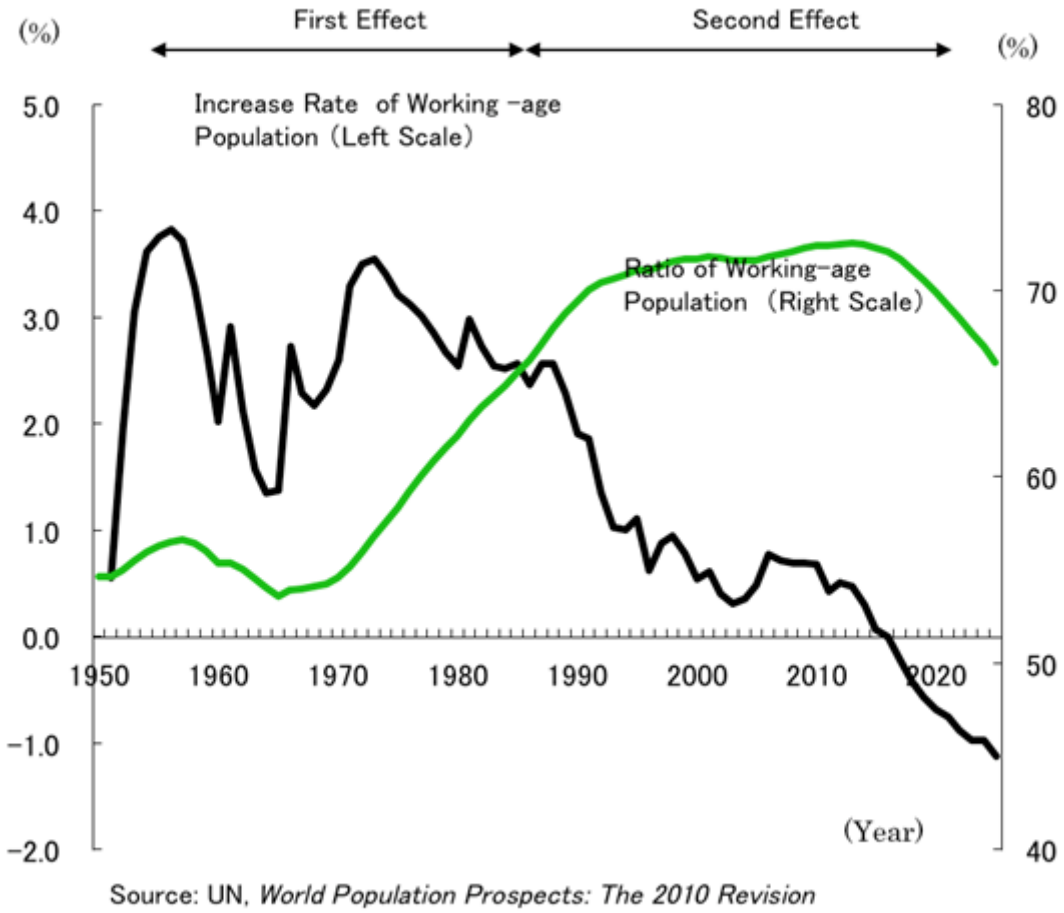
However, the maximization of the benefits of demographic dividend requires much more than the simple assurance of adequate provision for primary and secondary education. International competition becomes tougher year by year, and the maintenance of economic growth requires the spread of higher and university education, along with policy changes that will promote corporate research and development.

[4] There is known to be a positive correlation between savings rates and investment rates. This is known as the "Feldstein – Horikawa Puzzle", in which, even when international capital has been liberalized, uncertainty and a lack of information mean that domestic investment fundamentally depends upon domestic savings. Feldstein and Horioka (1980).

1.2 Two types of demographic dividend and their development strategies

Given that changes in the labor supply are affected by the rate of increase in the working-age population, and that changes in the domestic savings rate is affected by the working-age population ratio, the benefits of demographic dividend may divided into two classifications, as shown in Figure 1.2.

Figure 1.2: Two Effects of Demographic Dividend in Korea



Source: UN, *World Population Prospects: The 2010 Revision*

The first demographic dividend to make its appearance is the increased labor input resulting from an increase in the working-age population. In this paper, this is referred to as the “first demographic dividend”.

In order to benefit fully from the first demographic dividend, it is necessary to have the labor market and labor policies in place that will enable the increasing labor force accompanies with the rapid increase in the working-age population to be absorbed, and the key is to promote the existence of labor-intensive industries such as textiles, clothing and food processing.

However, there are a variety of different situations (initial conditions) in each country at the time when the first demographic dividend begins. The initial conditions include elements such as per capita income levels, main industry, employment structure, education systems and hygiene conditions, and infrastructure provision levels of electrical power, roads and ports. The better these initial conditions are, the stronger the benefits of the first demographic dividend a country can expect to enjoy.

Therefore, in countries where the demographic dividend begins while developing levels are still low, some kind of policy will be required to offset the disadvantages of the initial conditions. In particular, at this time, domestic savings rates are often at a low level because the working-age population ratio is low. In other words, the degree to which funds can be secured to promote the fostering of labor-intensive industries is an important point.

For example, in the case of South Korea and Taiwan, when the baby boom generation began to enter the labor market, both adopted an export oriented industrialization approach with promoting labor intensive industries, It is important that, prior to the period of demographic dividend, infrastructure development had been fostered and supported by financial aid from overseas, which continued throughout the period when these countries were enjoying the benefits of the first demographic dividend, so that investment by foreign companies helped to offset the lack of capital.

If, in this way, a rapidly growing labor force can be provided with ample employment opportunity, then as the working age population ratio rises, the domestic savings rate may also be expected to rise. The effect of this rise in the savings rate is the “second demographic dividend”. The effective utilization of this capital generates room to stimulate the development of capital intensive industries such as iron and steel and petroleum, enabling a change in the industrial structure from a labor intensive one to a capital intensive one.

For example, in the case of S. Korea and Taiwan, the infrastructure to be able to take advantage of the second demographic dividend was already in place. Labor-intensive industries had been fully developed, and they had been able to develop the heavy industries to produce the necessary raw materials and intermediate materials

(posterior industrialization). In the 1970s, S. Korea began to implement policies aimed at nurturing heavy industries in the six sectors of iron and steel, shipbuilding, electronic and electrical equipment, machinery, non-ferrous metals, and petrochemicals. Taiwan also began a program to foster the "10 strategic industries", comprising investment in three industries (petroleum, iron and steel, shipbuilding) and seven infrastructure construction projects in support of these three. Other hand the development of their financial institutions and financial institutions to enable the effective distribution of domestic savings helped promote this growth.

Of course, even without full employment, the rise in the working-age population ratio will be accompanied by a rise in the domestic savings rate, but if the benefits of the first demographic dividend are not fully leveraged, there will be no infrastructure to nurture posterior industrialization, and the benefits of the second demographic dividend will not be able to be enjoyed fully.

One reason why many developing countries cannot benefit properly from demographic dividend appears to be that, in the early stages of the period of demographic dividend, there was a lack of employment opportunities that could absorb the increases in the working-age population, and an industrial base that would form the platform for industrial advancement had not been developed (Oizumi 2007)[5]. That the formation of an industrial structure that can take full advantage of the benefits of the first demographic dividend affects the second demographic dividend is an important lesson for the developing countries to learn.

In addition, viewed from the perspective of improved productivity, it can be seen that it is important to enhance hardware infrastructure provision that will support sustainable economic growth, to develop legal, accounting and other systems that will support business activities, and to enhance human capital through the improvement of education systems. To that end, needless to say, unremitting effort to improve technical ability at government, corporate and individual level is required. Governments need to work to improve the national levels of primary, secondary and higher education, while businesses need to invest in technological innovation. If technological levels can be raised, then as well as capital-intensive industries, technology-intensive industries, such as automobiles and electronics and electrical equipment, and creative service industries, will also grow. The fostering of these kinds of knowledge intensive industries, as well as service and added value industries, will form the base of support for sustainable growth

[5] It may be that, in East Asia also, China and Thailand were unable to enjoy the benefits of the first demographic dividend to the full. See Oizumi, (2007).

in the aging society that follows demographic dividend[6].

1.3 Demographic dividend periods by region, and new collaborative systems

It may be considered that the effects of demographic dividend are diluted by lower working-age population increase rates and ratios. However, demographic dividend is a new concept and there is no agreed view as to exactly when the period in which its benefits can be enjoyed appears.

In order to identify the periods during which the benefits of the two demographic dividends mentioned above, it is assumed to be as follows.

The first demographic dividend "begins" when the working-age population ratio converts to upward growth, and "ends" when the ratio begins to trend downwards. The second demographic dividend "begins" when the working-age population ratio reaches over 50% of the total population, and "ends" when the ratio dips below 50% of the total.

The two periods of demographic dividend can be shown by region based on UN definitions, as per Table 1.1. Incidentally, in the calculation of the periods for each region, the medium variants used by the UN, *World Population Prospects: The 2010 Revision* (United Nations 2011).

If we focus on the first demographic dividend period, we can see that, in the more developed regions, the period in which the benefits could be enjoyed ended in 2006. Currently, the less developed regions are in the middle of the period in which they can enjoy the benefits of demographic dividend, and it is possible that the least developed countries also may be able to enjoy these benefits.

Region by region, we can see that North America (2005), Europe (2010), and Oceania (2010) have reached the end of their respective periods of first demographic dividend, and Asia is expected to reach this in 2021. On the other hand, Latin America may be expected to see the effects of demographic dividend extend over a longer period, untill 2027, and Africa untill 2079.

With regard to the second demographic dividend, the table shows this situation as continuing from 1950 in the more developed regions, and in fact is it known that high levels of domestic savings have supported economic growth in the developed regions.

[6] The nurturing of knowledge intensive industries is not only a hedge against an aging society, but is also an essential issue for the sustainable growth of middle income economies such as China and the ASEAN countries, and is debated as part of the "middle income trap".

However, as the aging of society advances, the second demographic dividend is expected to last until 2028.

Table 1.1: Period of Demographic Dividend

	The First Effect		The Second Effect	
	Start	Goal	Start	Goal
World	1972	2017	1998	2062
More Developed Regions	1967	2006	-	2028
Less developed regions	1973	2023	2002	2072
Less developed regions, excluding least developed countries	1971	2021	1998	2065
Least Developed Countries	1984	2075	2037	-
Africa	1979	2079	2046	-
Asia	1972	2021	1995	2064
Europe	1956	2010	-	2032
Latin America and the Caribbean	1970	2027	2001	2059
Northern America	1966	2005	1975	2024
Oceania	1966	2010	1983	2041

Note: The First Effect : a period that Increase Rate of Working-age Population is Positive, The Second Period: a period that Ratios of Working-

Source: UN, *World Population Prospects : The 2010 Revision*

What is very interesting to note is that the less developed regions entered the period of enjoying the benefits of the second demographic dividend in 2002, and the "less developed regions excluding least developed countries" from 1998. Expressed another way, these regions are now able to enjoy the benefits of both first and second demographic dividends. In particular, the high levels of economic growth among East Asian countries may be said to have been supported by the second demographic dividend. Meanwhile, the least developed countries may not be able to enjoy the benefits of the second demographic dividend until 2037, and this will depend on the degree to which capital for growth can continue to be procured from overseas.

Similarly, viewed by region, with the exception of Africa, the period of the second demographic dividend has already started. That period will end soonest in North America in 2024, followed by Europe in 2032, Oceania in 2041, Latin American and the Caribbean in 2059, and latest in Asia in 2064. As for Africa, meanwhile, even if population estimates are extended until 2100, the working-age population will not exceed 50% of the total, and unless there is sufficient capital support for Africa, there is every possibility that the benefits of the first demographic dividend will be missed.

1.4 Groupings used in this research project

For the purposes of this research project, the following five age groupings have been used.

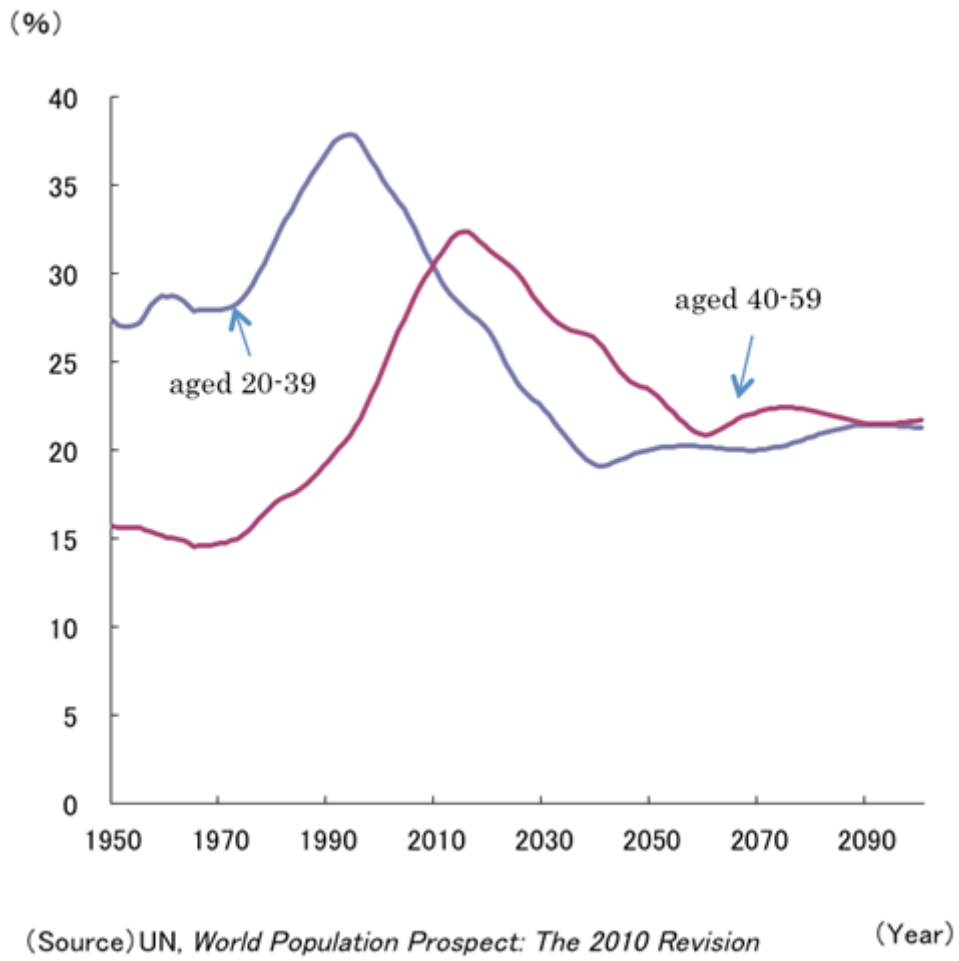
0 to 19 years is termed the "juvenile population", 20 to 59 years the "working-age population", and 60 years and over the "elderly population". The working-age population is further divided into the classifications 20 to 39 years (young working-age population) and 40 to 59 years (senior working-age population), and the elderly population to 60 to 70 years (younger elderly population) and 80 years and over (senior elderly population). In terms of the effects of the two demographic dividends shown above, as shown in Figure 1.3, the 20 to 39 years age group is the mainstay of the first demographic dividend, and the 40 to 59 years age group the second demographic dividend.

In this research project, for the convenience of simulation, the following groupings of countries and regions have been used, in consideration of the size of their economies.

1.4.1 Three basic groups

Firstly, as basic groups, countries and regions have been divided into the three groups of “Advanced Economies”, “East Asia” and “The rest of the world”.

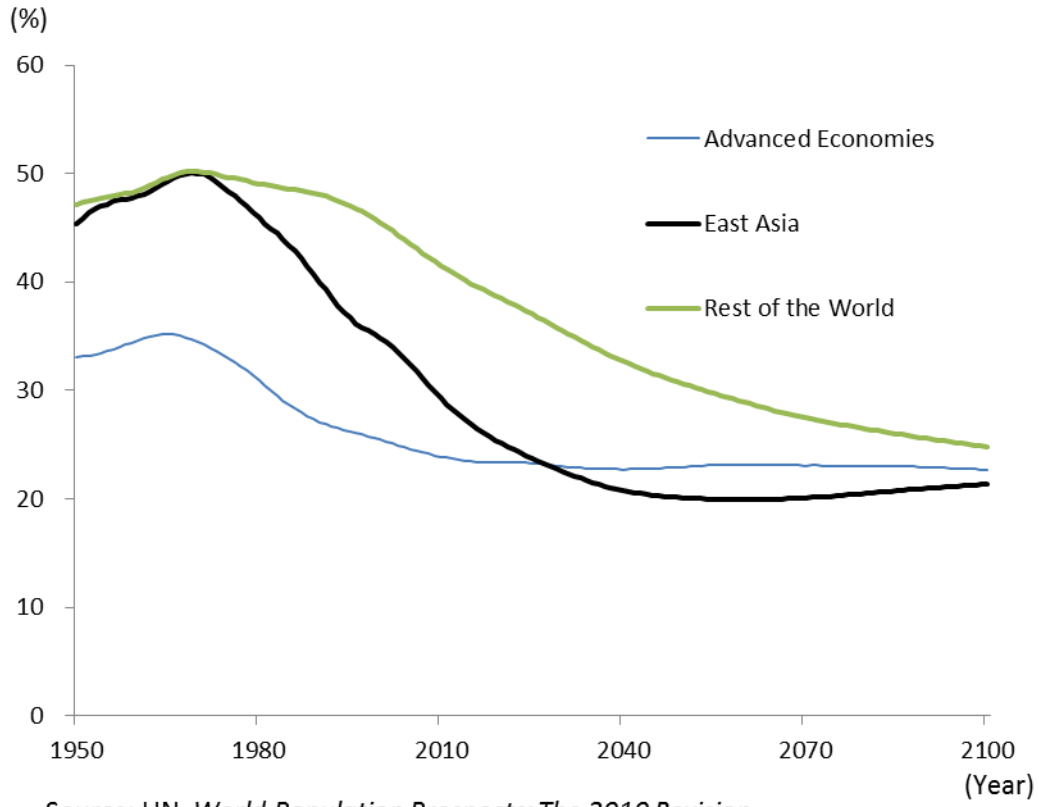
Figure 1.3: Ratio of Two Generations in Korea



The Advanced Economies group comprises the following 28 countries: Australia, New Zealand, Canada, United States of America, Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Ireland, Israel, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Slovenia, Spain,

Sweden, Switzerland and United Kingdom.

Figure 1.4: Ratio of Population Aged 0-19



Source: UN, *World Population Prospects: The 2010 Revision*

East Asia comprises: China, Hong Kong, Japan, Korea, Mongolia, Taiwan, Cambodia, Indonesia, Lao People's Democratic Republic, Malaysia, Philippines, Singapore, Thailand, Viet Nam and Rest of Southeast Asia.

The rest of the world comprises other countries.

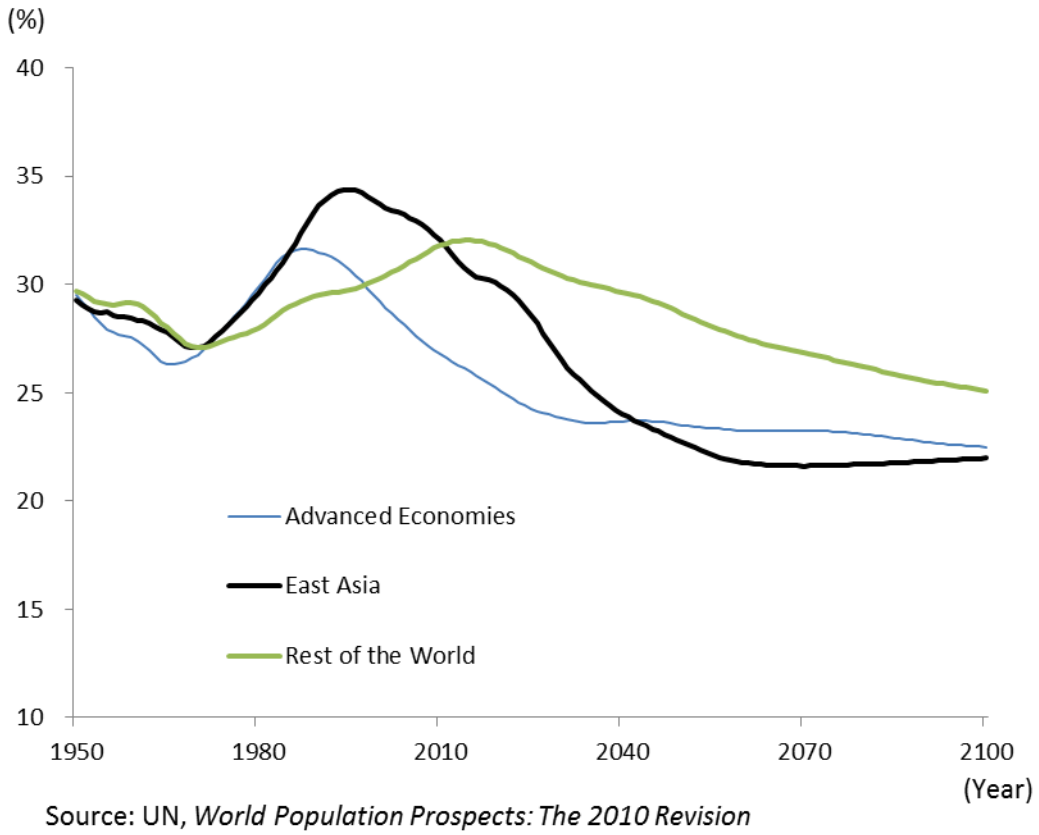
Here, the list of countries included in the advanced economies group is based on the countries and regions defined as “advanced” by IMF (2013), and East Asia and those countries for which population data cannot be obtained have been excluded from this group.

The East Asia group comprises the countries of North East Asia and South East Asia. Countries not belonging to either of these two groups have been put into the group of the rest of world. The economic sizes of each group are $34 trillion for the advanced

economies, $10.9 trillion for East Asia, and $11.3 trillion for other developing countries (Narayanan, Aguiar, and McDougall 2012)[7]. Population figures are 839 million for the advanced economies, 2.18 billion for East Asia, and 3.66 billion for other developing countries and regions.

Let us examine the demographic changes by age group in these three groups.

Figure 1.5: Ratio of Population Aged 20-39



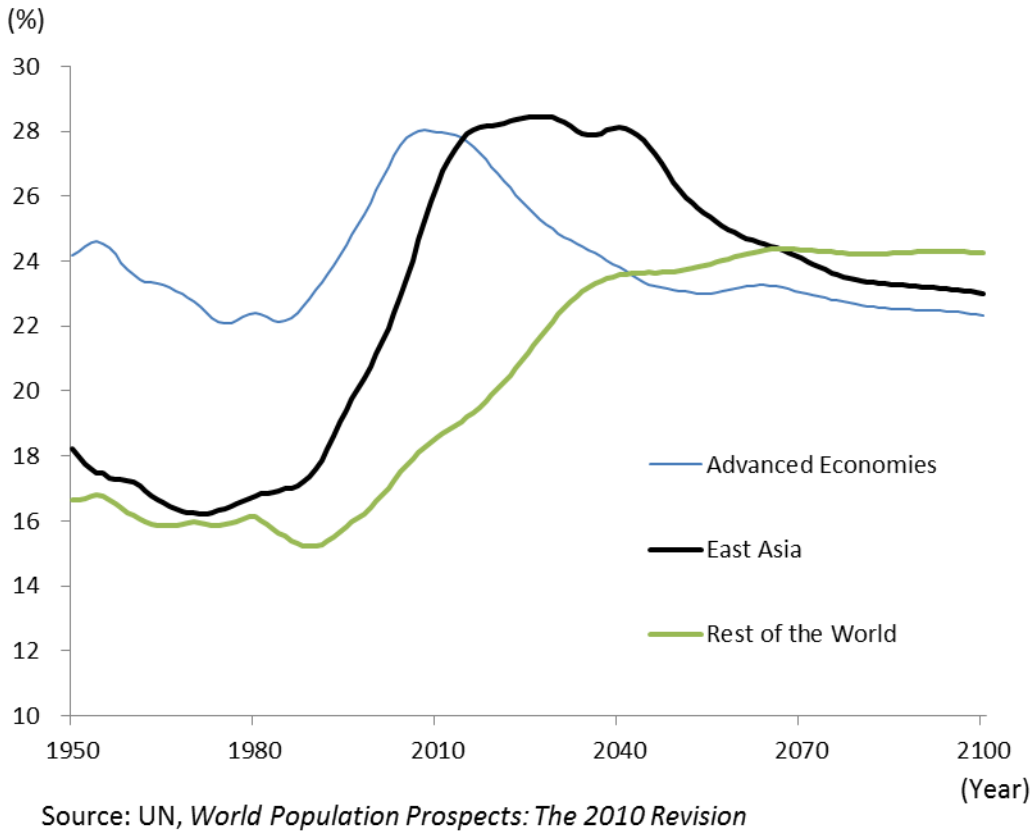
Source: UN, *World Population Prospects: The 2010 Revision*

Figure 1.4 shows the growth in the 0 - 19 years population ratio. In all regional groups this ratio has declined over time. The ratio is lowest in the advanced economies, followed by East Asia and the rest of the world. As of 2010, the ratios in each regional group were 23.9%, 29.2% and 41.5%, respectively. Looking forwards, East Asia's ratio is set to fall below the level of the advanced economies by 2030. The ratio in the rest of the

[7] Sum of GDP for 2007 according to GTAP (2012).

world will also decline significantly, falling below 30% by the late 2050s.

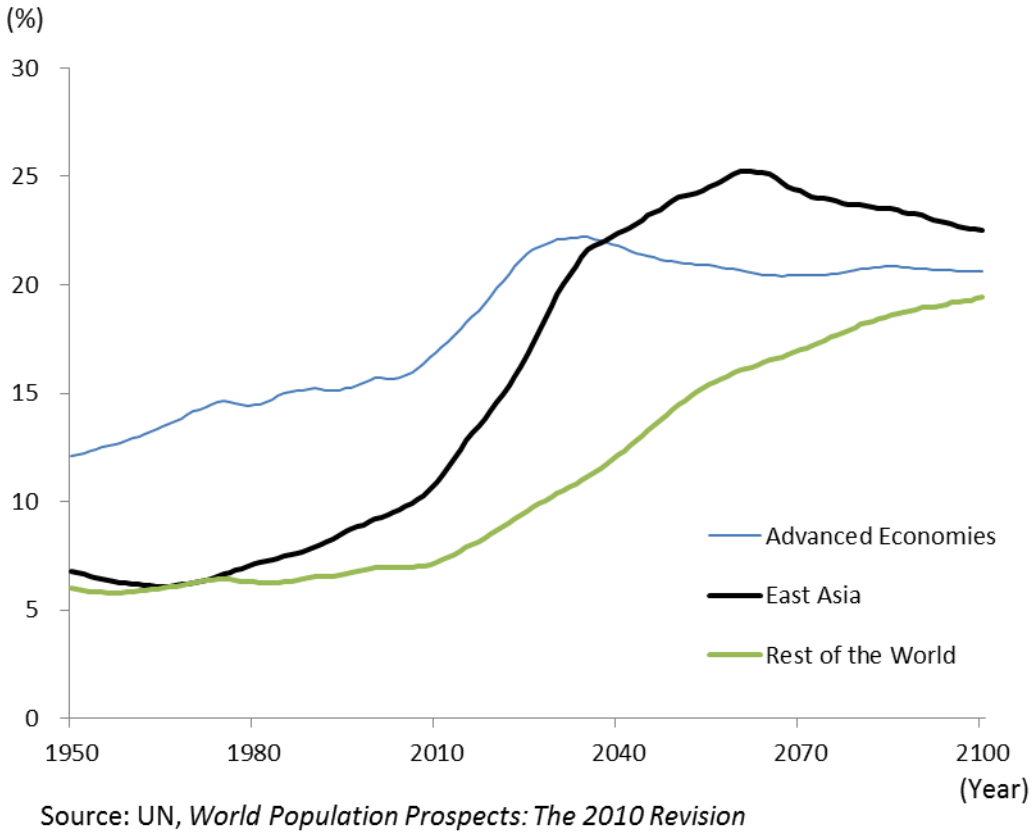
Figure 1.6: Ratio of Population Aged 40-59



Source: UN, *World Population Prospects: The 2010 Revision*

Figure 1.5 shows that, among the advanced economies, the population ratio of the 20 to 39 years age group peaked at 31.6% in 1987, and has been trending downwards since then. East Asia's ratio also peaked at 34.4% in 1996 and had been trending downwards ever since. For the rest of the world, the ratio is expected to peak in 2015 at 32.1%, and then begin to come down. However, this does not indicate that the young labor force has depleted drastically all over the world. A lack of sufficient employment in the developing countries means that it is common for an excess labor force to exist. Additionally, given that the speed of decline in the rest of the world is slower than that of East Asia, there is a strong possibility that the focus will shift away from East Asia as a labor-intensive production base and into the rest of the world.

Figure 1.7: Ratio of Population Aged 60-79



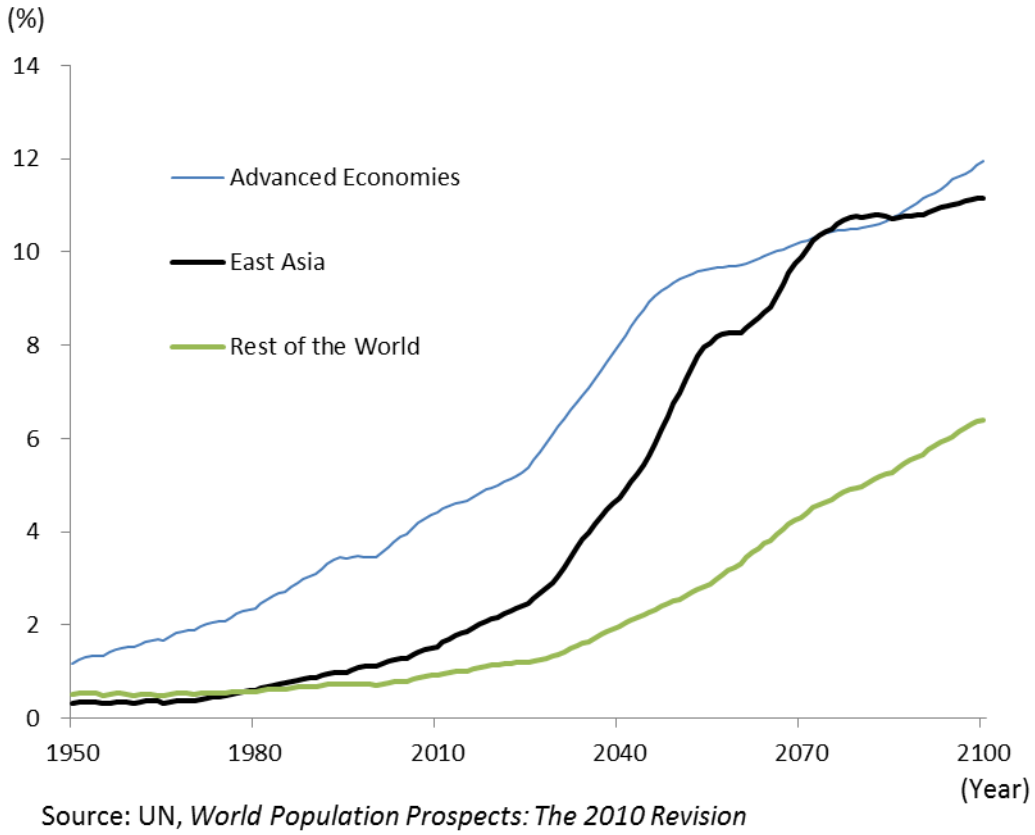
Source: UN, *World Population Prospects: The 2010 Revision*

Figure 1.6 shows growth in the population ratio of the 40 to 59 years group. In all regions, this ratio rose markedly from the 1980s. However, whereas the ratio in the advanced economies peaked at 28.0% in 2008, it is expected to rise at peak as 28.7% in 2027 in East Asia and remain around 28% in the 2030s. In other words, there is a strong possibility that savings rates in East Asia may continue at high level during the years to come, giving that region a potential future as a source of global capital. Meanwhile, in the rest of the world, this ratio was a low 17.7% in 2010, and will likely continue to rise moving forward, reaching a stable level at around 24% from the 2050s onward.

Figure 1.7 shows group in the population ratio of the 60 to 79 years age group. Hitherto, this ratio has been overwhelmingly highest in the advanced economies, 16.9% in 2010, against 10.9% in East Asia and 7.2% in the rest of the world. However, going forward, this ratio is expected to rise rapidly in East Asia and the rest of the world also. The ratio in East Asia will rise markedly, outstripping that of the advanced economies by 2038, and reaching as high as 25.2% by 2060. In the rest of the world, the ratio is also

expected to reach 14.0% by 2050, and peak at 19.4% by 2100, bringing it to within just 1.1% points of the the advanced economies.

Figure 1.8: Ratio of Population Aged 80 and Over



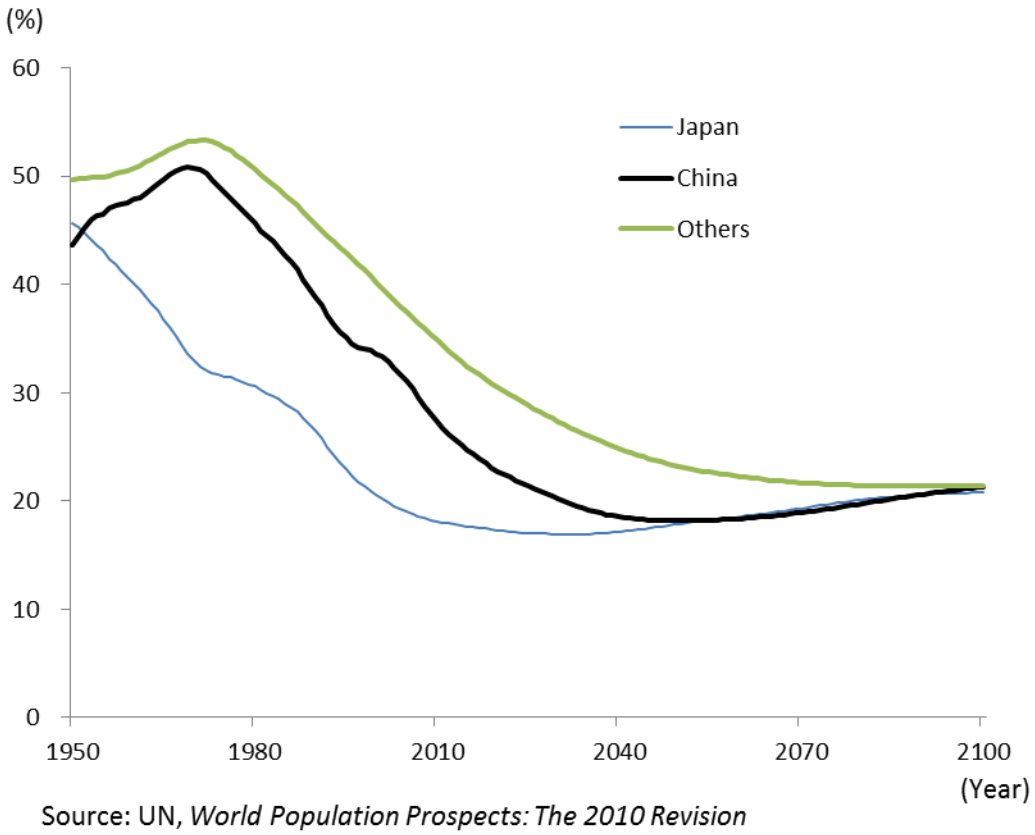
Source: UN, *World Population Prospects: The 2010 Revision*

Figure 1.8 shows the population ratio for the 80 years and over age group. In 2010, this ratio was low throughout the world, 4.4% in the advanced economies, 1.5% in East Asia, and 0.9% in the rest of the world. However, the rate will trend upwards in future in all groups, reaching 12.0% in the developed regions by 2100, 11.1% in East Asia, and 6.4% in the rest of the world. The population increase in this age group that requires long-term care, and the question of who will shoulder the burden are becoming serious issues.

1.4.2 Differences in changes in East Asia

For the purposes of this research project, the classification East Asia is further sub-divided into Japan, China and the rest of East Asia. Size of economy is $4.4 trillion for Japan, $3.5 trillion for China, and $3.0 trillion for the rest of East Asia, with populations 127 million, 1.34 billion, and 700 million, respectively.

Figure 1.9: Ratio of Population Aged 0-19



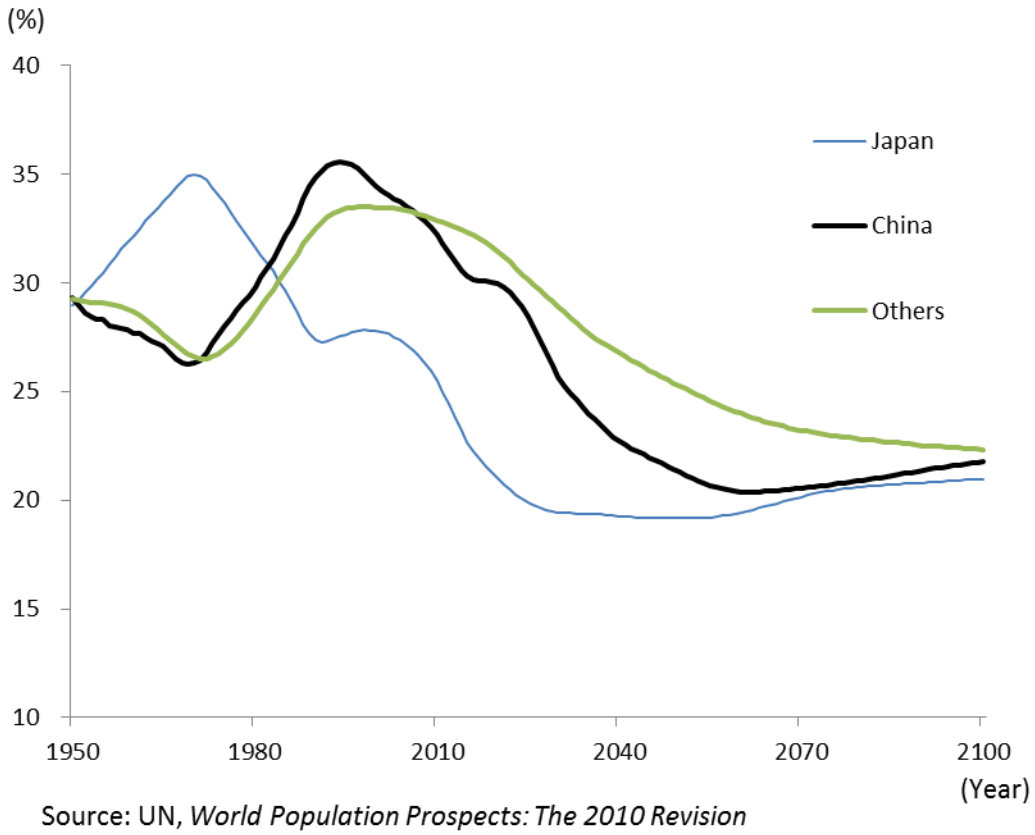
Source: UN, *World Population Prospects: The 2010 Revision*

Here, we will now examine the same demographic changes discussed above in terms of the differences between Japan, China, and the rest of East Asia.

Figure 1.9 shows the growth in the population ratio of the 0 to 19 years age group. This ratio was high in all regions in 1950. Subsequently, there was a strong tendency of decline, in the order Japan, China and then the rest of East Asia. In 2010 the ratios were 18.1%, 27.3%, and 34.9%, respectively. In the years to come, the difference will contract, with ratios of 17.9% for Japan, 18.2% for China, and 23.2% for the rest of East Asia expected in 2050, rising to 20.8% for Japan, 21.3% for China, and 21.3% for

the rest of East Asia by 2100.

Figure 1.10: Ratio of Population Aged 20-39



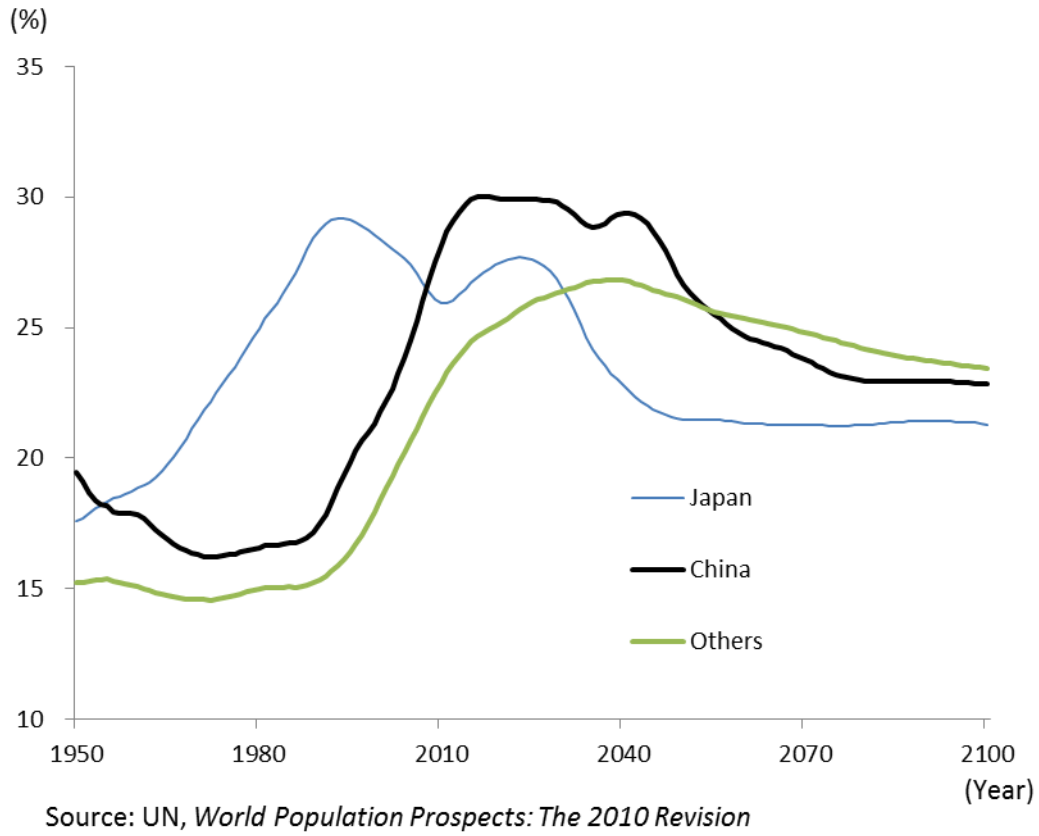
Source: UN, *World Population Prospects: The 2010 Revision*

Figure 1.10 shows the growth in the population ratio of the 20 to 39 years age group. This ratio rose quickly in Japan from 1950 onwards, peaking at 35.0% in 1970, and declining rapidly thereafter. On the other hand, the ratio rose rapidly in the 1970s in China and the rest of East Asia. However, it peaked in China in 1994 at 35.6%, and also peaked in the rest of East Asia at 33.5%, trending downwards thereafter. While the pace of decrease has been rapid in Japan and China, it has been more gentle in the rest of East Asia.

Figure 1.11 shows the growth in the population ratio of the 40 to 59 years age group. This ratio rose rapidly in Japan from 1950, reaching 29.2% in 1993 and gently declining thereafter. The ratio is expected to be around 27.7% by 2023, declining more markedly from then on. In China this ratio showed a marked increase from the mid-‘90s,

and will likely peak in the vicinity of 30% between 2010 and 2040. China's domestic savings rate is expected to exert an increasingly strong influence on the global economy. The ratio began to rise in the rest of East Asia from the mid 90s, and the increase was fairly rapid. The ratio reached 22.9% in 2010, and will likely reach 26.8% by 2038. While the ratio is expected to taper of from then on, the speed of decrease will be fairly gentle compared to China, and the ratio itself will exceed China's by 2054.

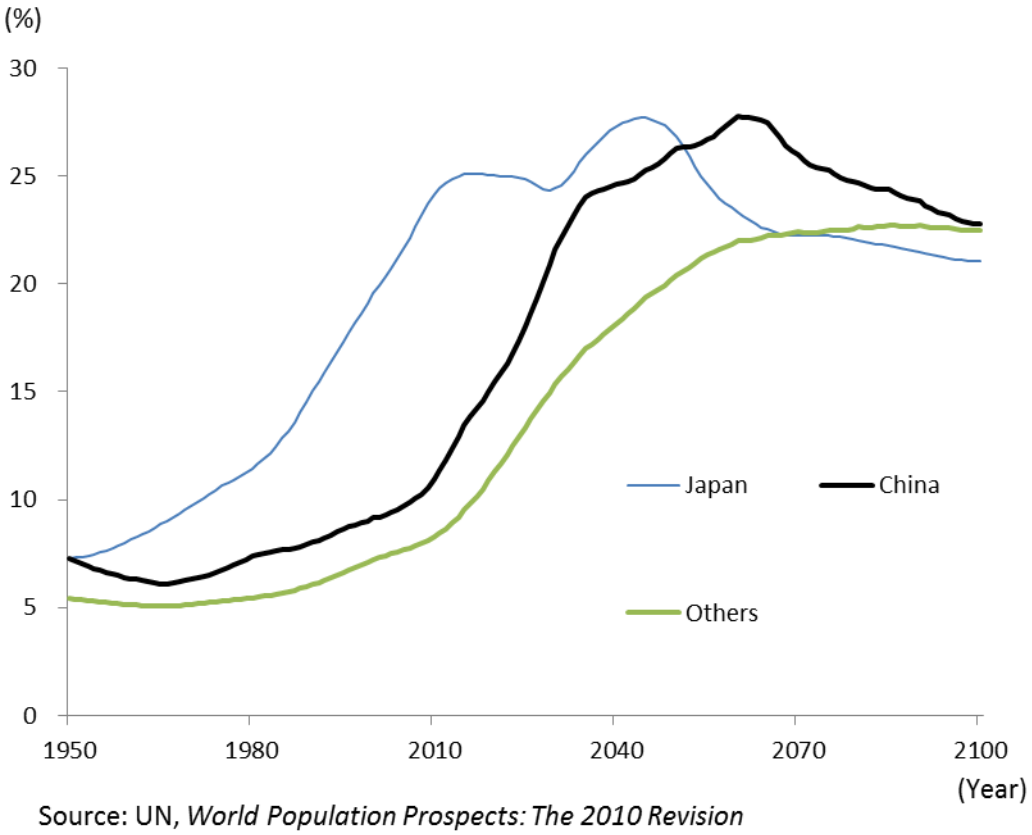
Figure 1.11: Ratio of Population Aged 40-59



Source: UN, *World Population Prospects: The 2010 Revision*

Figure 1.12 shows the growth in the population ratio of the 60 to 79 years age group. This ratio is rising rapidly in all regions. In 2010, the ratios exhibited significant gaps, with 24.1% for Japan, 11.0% for China, and 8.3% for the rest of East Asia. However, by 2050 it is expected that the ratios will be 26.8% for Japan, 26.3% for China, and 20.4% for the rest of Asia.

Figure 1.12: Ratio of Population Aged 60-79

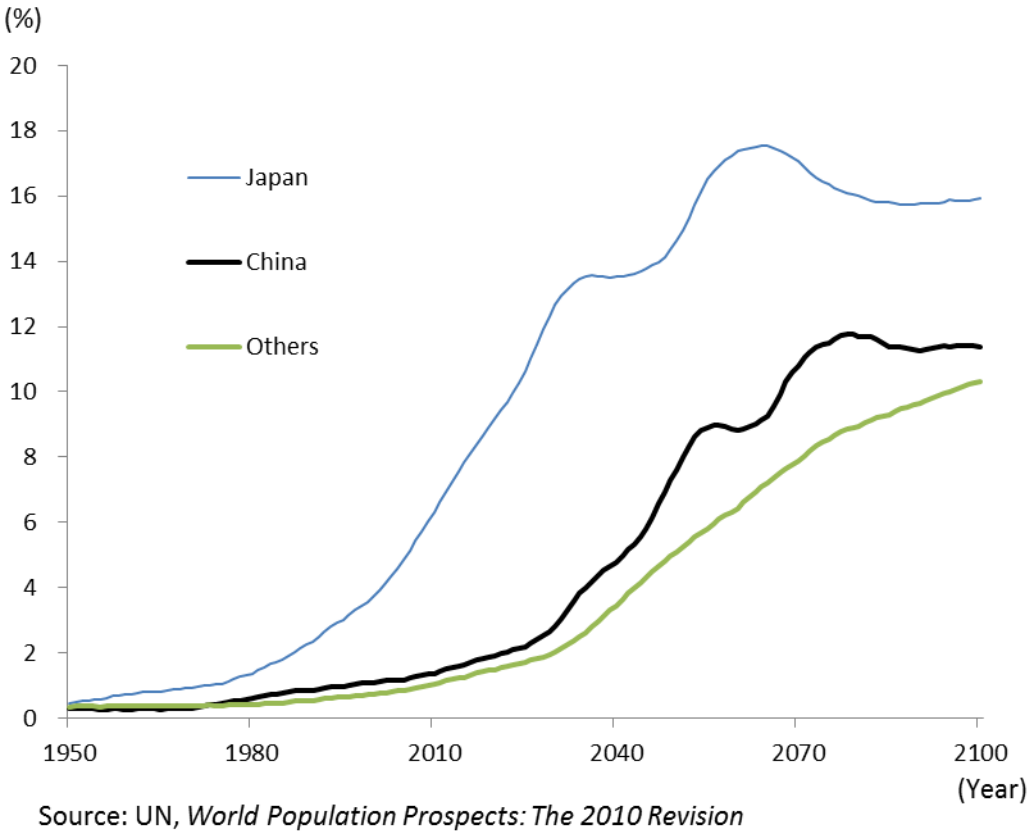


Source: UN, *World Population Prospects: The 2010 Revision*

Figure 1.13 shows the growth in the population ratio of the 80 years and over age group. This ratio is overwhelmingly highest in Japan. The ratio was 6.3% in 2010, compared to a very low 1.4% in China, and 1.0% in the rest of East Asia. While this relationship is not expected to change, the respective ratios in each region will rise, moving forward. Projections are for 14.6% for Japan in 2050, 7.6% for China, and 5.1% for the rest of East Asia. The ratios are expected to peak in Japan in 2065 at 17.5%, and in China in 2079 at 11.8%, trending downwards from then on, while that for the rest of East Asia will likely continue to rise, reaching 10.3% in 2100.

The simulations in this study will be based on these classifications.

Figure 1.13: Ratio of Population Aged 80 and Over



Source: UN, *World Population Prospects: The 2010 Revision*