IMPLICATION OF POPULATION AGING ON ECONOMIC GROWTH AND SAVING

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PERPUSTAKAAN
UNIVERSITI MALAYSIA SABAH

THESIS SUBMITTED IN FULFILLMENT FOR THE DEGREE OF MASTER OF SCIENCE

FACULTY OF SCIENCE AND NATURAL RESOURCES
UNIVERSITI MALAYSIA SABAH

2014

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DECLARATION

I declare that this project of study is my own product except quotations, equations, summaries and references that are which have been duly acknowledged.

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DEGREE : **MASTER OF SCIENCE (MATHEMATICS WITH ECONOMICS)**

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ACKNOWLEDGEMENT

I wish to express my deepest appreciation and gratitude to my supervisor, Associate Professor Dr. Ho Chong Mun, who has been always patient and tolerant to advice, guide and supervise me throughout my journey of obtaining a master degree. His continuous and supportive encouragement provided me the necessary impetus to complete the research.

I would like to express my gratitude to Universiti Malaysia Sabah which provided me scholarship under the Teaching Assistance Special Allowance for MyMaster Scholarship Recipient. This helps me to lighten my financial burden and allow me to focus in pursuing my studies.

I gratefully acknowledge Japan Foundation for inviting me to participate in Japan-East Asia Network of Exchange for Student and Youths (JENESYS) special invitation programme. This gives me opportunities to study and doing research in Japan.

Most special and grateful thanks to my family and friends for their helps and motivation.

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ABSTRACT

Based on United Nation projections, world population structure have tendency to move toward the population aging structure. Population aging means increase in median age of population. Reason behind this demographic transition is because of the combination effect from low fertility and longer longevity. Population aging is said would induce several problems to a country in term of theirs macroeconomic, labour market and social security. However, researcher believed impact of aging society may vary depend on economic policies implemented. Effective policies implemented can help in offsetting the effect of population aging. Most of the early studied have utilized panel data in their analysis. Nevertheless, the results can only provide a general conclusion. Some of the population aging effect on individual country may not be well explained. In addition, previous empirical result uncovers the possibility of the existence of nonlinear relationship. Hence, both linear and nonlinear causality test are employed in this thesis to examine the causal relationship among old-age dependency ratio and work to retirement ratio on economic growth as well as on saving. The countries involved in this analysis include Japan, Germany, China, Malaysia and Singapore. Findings suggested that economic policies implemented do affect the impact of the population aging. Japan seems to have better policies in dealing with the aging society. Result also show that adjustment on retirement age gives significant effect on economic growth and saving. Besides, few cases show the existence of nonlinear causal relationship. Therefore, nonlinear relationship should also be considered to avoid bias result.

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ABSTRAK

IMPLIKASI PENUAAN POPULASI KEPADA PERTUMBUHAN EKONOMI DAN SIMPANAN

Berdasarkan unjuran Amerika, struktur populasi dunia berkecenderungan untuk beralih ke struktur populasi penuaan. Penuaan populasi bermakna peningkatan umur median populasi. Peralihan demografi ini adalah disebabkan oleh kesan gabungan daripada kadar kelahiran yang rendah dan jangka hayat yang lebih panjang. Penuaan populasi dikatakan akan menyebabkan beberapa masalah kepada negara dari segi makroekonomi, pasaran buruh dan keselamatan sosial. Walau bagaimanapun, penyelidik percaya bahawa kesan penuaan masyarakat mungkin berbeza-beza bergantung kepada dasar ekonomi yang dilaksanakan. Perlaksanaan dasar-dasar yang berkesan dapat membantu mengimbangi kesan penuaan populasi. Kebanyakan kajian yang lepas telah mengaplikasikan data panel dalam analisis mereka. Walau bagaimanapun, keputusan tersebut hanya dapat memberikan satu kesimpulan yang umum. Sesetengah kesan penuaan populasi terhadap negara induk tidak dapat dijelaskan dengan baik. Di samping itu, hasil empirikal sebelum ini mendedahkan kemungkinan kewujudan hubungan taklinear. Oleh itu, kedua-dua ujian penyebab linear dan taklinear digunakan dalam tesis ini untuk mengkaji hubungan sebab dan akibat di antara nisbah tanggungan tua dan nisbah kerja kepada persaraan atas pertumbuhan ekonomi serta simpanan. Negara-negara yang terlibat dalam analisis ini termasuk Jepun, Jerman, China, Malaysia dan Singapura. Keputusan menunjukkan bahawa dasar-dasar ekonomi yang dilaksanakan sesungguhnya mempengaruhi kesan penuaan populasi. Jepun seolah-olah mempunyai dasar-dasar yang lebih baik berhubung dengan penuaan masyarakat. Keputusan juga menunjukkan bahawa pelarasan umur persaraan member kesan yang ketara kepada pertumbuhan ekonomi dan simpanan. Selain itu, beberapa kes menunjukkan kewujudan hubungan sebab dan akibat yang taklinear. Oleh itu, hubungan taklinear juga perlu dipertimbangkan untuk mengelakkan keputusan yang kurang tepat.

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CHAPTER 1

FOREWORD

1.1 Introduction

The topic regarding on the relationship between the population structure and the economic growth have been well debated among the researchers and policy makers. The demographic transition may cause significant impacts on one country in term of their economy and social. Bloom and Canning (2004) argue that one of the important variables in determine the performance of economy in a country is age structure of a population. The rapid growth in economy during the 1965-1990 periods which known as "economic miracle" was contributed by the demographic transition that happened in the East Asia (Bloom and Williamson, 1998; Bloom *et al.*, 2000; Bloom and Canning, 2004).

In general, there are four stages of the population structure or also known as the Population Pyramid. In the first stages, the pattern of fertility rate and mortality rate are stable which known as the Stable Pyramid. The second stage is known as Expansive Pyramid where there are high fertility rate and mortality rate. Beside the life expectancy in this stage is also low. There are high percentage of and young people and low percentage of elder in this stage. The third stage is called Stationary Pyramid. Both fertility rate and mortality rate are low in this stage. However, it has high proportion of the children. Fourth stage is known as Constrictive Pyramid. This stage is mainly similar to the third stage, yet this stage has lower percentage of younger people and higher percentage of elder which is different compare to the Stationary Pyramid. In this stage, it also has longer longevity. The population structure for most of the countries currently is in the third stage. However, most of them have started to move into the fourth stage. Some of the countries such as European countries and Japan have already moved in fourth stage. The fourth stage of the population structure is also known as the Population Aging.

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As the demographic transition causes a change in population age structure, this might have some adjustment in the structural of a country's economic and its social policy based on the median voter theorem. Every age group will have their own needs and preferences. Thus, the age group with relatively large number will be politically stronger in adopting certain policies that are beneficial to them.

1.2 Population Aging

Population aging can be referring as a raise in the average age of population. The combination affect from the decline in fertility rate and improvement in the health and longevity have lead to this demographic structure. The declining in fertility in recent decades has lead to a phenomenon where the relative number of the children becomes lesser. Moreover, the great improvements in health care and life styles choices have lead to increase in life expectancy of elders without the major illness. Thus, the number of the elderly is growing rapidly. These properties have reflected the fourth population pyramid properties, Constrictive Pyramid. Another factor lead to increase in the relative number of elderly is due to the baby booms that happened after the World War II. With the effect of high fertility rate and low child mortality rate during that time, large group of the boomers have moving towards the age of 60 and above.

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Based on the United Nations projections, the population of the world with aged 60 and above will achieve 2 billion by 2050. Figure 1.1 shows the world population size by age group. The estimations presented in Figure 1.1 are based on the medium fertility scenario. The growth of the children population appears to be static over the year. However, there is a large increment in the elderly population. The elderly population is expected to more growth rapidly in the future. This implies that the demographic structure in world have the tendency to move toward the population aging structure.

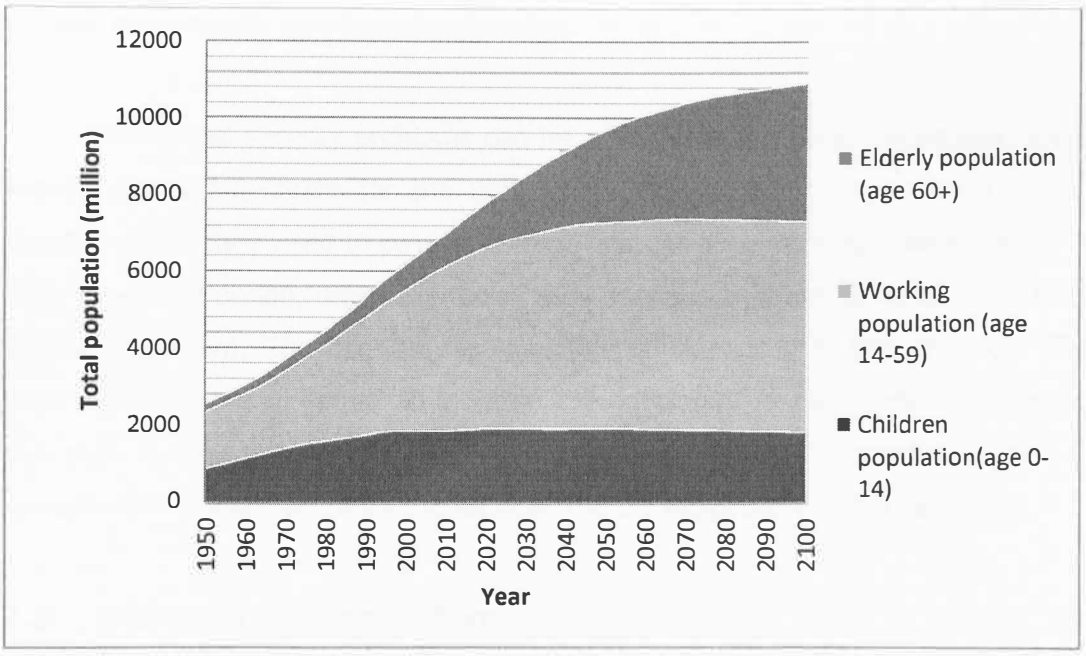

Figure 1.1: World population size by age group.

Source: United Nation (2011)

Population aging has introduce several problems to a country in term of theirs macroeconomic, labour market and social security. In term of macroeconomic, population aging might cause a slowdown in the economy growth due to the lower labour force participation and decline in the saving rate (Bloom *et al.*, 2010). Since the relative number of the young people is lower and relative number of elder is higher. This indicates that more elder will moved out from the labour force after their retirement and less young people moved into the labour force. This might lead to a shortage in the labour force then induce the decline in the productivity. Beside, elders tend to save less since they have less income and mainly rely on the social pensions. Thus, this will lead to decline in the saving rate.

In addition to cause a shortage in labour market, population aging is also causing an increase of competition in the labour market. Some of the elderly might found out that theirs saving is not enough to support their retirement life, thus they will look for another source of income by re-entering the labour market. In this time, the elderly labour will need to compete with other labour-force such as young labour, female workers and immigrants (Hamada and Kato, 2007). Some of the firm might have feeling that the elderly have less productivity. Beside that, they need to

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provide more health care incentive to elder.

The social security problems can be referring to the pension systems, social insurance and healthcare for the elder. The pension systems will face a critical situation when they need to pay out a large amount of pension to a large cohort of elder in a short period, especially those baby boomers that are going to reach their age of retirement. The pension system might collapse due to this situation. The government may even need to increase the subsidiary in the pension system to overcome it. Government may also need to increase the health care subsidiary and provides more financial support to elder as the life expectancy is increasing.

1.3 Definition of Common Term

There are a lot of indicator that can be used to represent population aging such as share of elderly population, percentage of the elder population, median age and dependency ratio. However, dependency ratio is chosen as the indicator of population aging in this study. This is because the dependency consist both effect from the change in fertility rate and longevity. Beside, the dependency ratio also helps in measuring the economic burden of productive part in the society. Definition of Old-age dependency ratio, child dependency ratio, total dependency ratio, life expectancy and work to retirement ratio will be given. The definition of these terms can have small variation depending on its research. Thus, a specified definition for all these terms in this thesis will also be provided.

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1.3.1 Old-age Dependency Ratio

Old-age dependency ratio is the ratio of the elderly to labour force. Increase in the old-age dependency ratio means increase in the burden of the workforce to maintain the social security of elder dependents. The definition of the ratio may vary depend on the research.

In general definition, the labour force is defined as age group of 15 to 64, while the elderly group is defined as age group of 65 and above. However, in this thesis, the workforce is defined as age group of 15 to 59 since most of the country official retirement age is around age of 60. Some of the individual might also have

early retirement. The elderly group will be taking from age 60 and above. The formula of old age dependency ratio will be given as below:

$$Old\ age\ dependency\ ratio = \frac{number\ of\ age\ group\ 60\ and\ above}{number\ of\ workforce, age\ group\ of\ 15-59} \quad (1.1)$$

1.3.2 Child Dependency Ratio

Child dependency ratio is the ratio of the children to labour force. Raise in the child dependency ratio imply the increase in the burden of the workforce to maintain the social security of children dependents. The definition of this ratio may also vary depend on the research.

In this thesis, the labour force is defined as age group of 15 to 64 and the children group is defined as age group of 15 and below. The formula of child dependency ratio expressed as:

$$Child\ dependency\ ratio = \frac{number\ of\ age\ group\ 15\ and\ below}{number\ of\ workforce, age\ group\ of\ 15-59} \quad (1.2)$$

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1.3.3 Total Dependency Ratio

Total dependency ratio is the ratio of the total dependents to labour force. The total dependents mean the total of the children dependents and the elderly. This can be used to measure the burden of the labour force. The formula of total dependency ratio given as:

$$Total\ dependency\ ratio = \frac{number\ of\ age\ group\ 15\ and\ below\ and\ \ age\ group\ 60\ and\ above}{number\ of\ workforce, age\ group\ of\ 15-59} \quad (1.3)$$

1.3.4 Life Expectancy

Life expectancy is the measure of average number of remaining life in term of years at a given age. Sometimes, this term can be mixed up with the term "longevity". Longevity is referred to the length of life.

The life expectancy can be varying over the given age. Life expectancy will increase with the age as an individual have survive through the age where high rate of death occur. If during particular age period have high rate of death, then the life expectancy at the age before the period will be low. However, the life expectancy will rise up if an individual can survive through the period. The life expectancy is very sensitive to the infant mortality rates.

Generally, public health, medical care and life styles of an individual will be taken account into life expectancy calculations. To improve its accuracy, gender, genetics and many other related variables will be taking into the calculation. Overall, the life expectancy is increasing every year due to the improvement in health care. In this thesis, the life expectancy at birth or life expectancy at age zero will be used in the analysis.

1.3.5 Work to Retirement Ratio

Work to retirement ratio is the ratio of working years to number of retirement life. Work to retirement ratio is a term that commonly used in the field of insurance and pension. However, it not commonly used in the demographic analysis. Increase in work to retirement ratio imply an individual have longer working life but shorter retirement life.

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This term is introduced in this thesis to replace the term of life expectancy used in analysis. In this thesis, the working years are count started from age of 15 to the official retirement age. The retirement life is calculated start from age of retirement to the life expectancy. The formula can be specified as:

$$Work\ to\ retirement\ ratio = \frac{number\ of\ working\ years}{number\ of\ life\ after\ retirement} \tag{1.4}$$

1.4 Overview of Demographic Changes and Future Trends

The United Nations Population Division has make projection on the future population trends for all the countries. The projections data used in the thesis are based on the medium fertility scenario. The demographic change and trends of Japan, Germany, China, Malaysia and Singapore will be given.

Japan and Germany was chosen as target countries in this thesis is because of these two countries had moved into population aging structure. Based on the United Nations (2011), the median age of the population in Japan and Germany were one of the highest in the world which is 44.7 and 44.3 years respectively. China is chosen because of its one child policy which makes it have more rapid change in the demographic structure and move into population aging faster compare to other country. Malaysia and Singapore are used as case studies as the demographic trend show they are moving towards the population aging structure. Besides, Malaysia and Singapore are neighbouring countries.

1.4.1 Japan

Figure 1.2 shows that the Japan population has rise from 82 million to 126 million in past 60 years and reached its peak on 2009. The population is started to fall in 2010 and projected to fall gradually.

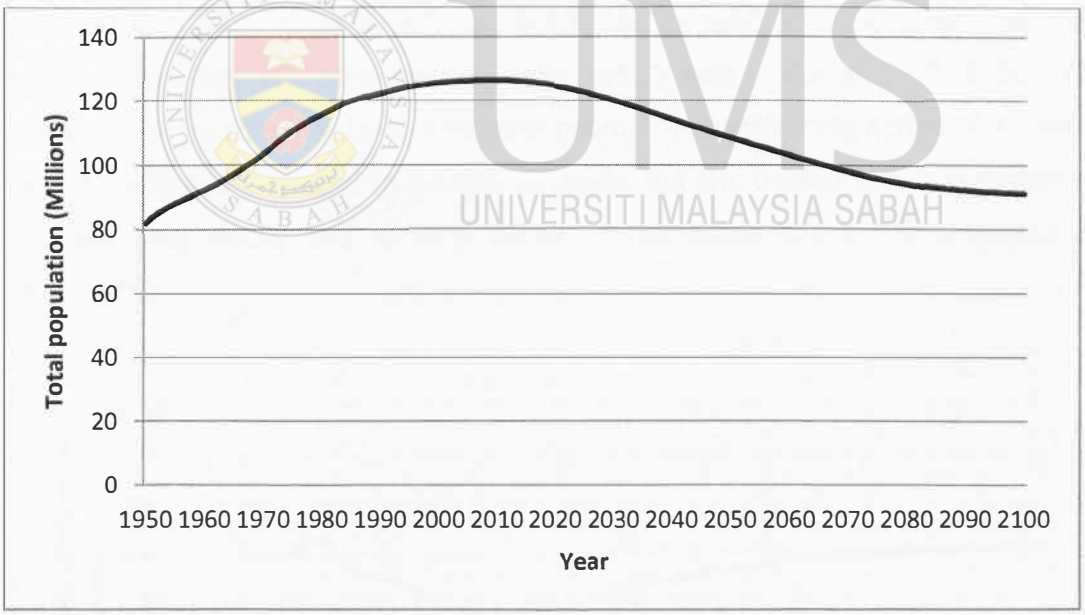

Figure 1.2: Total population size in Japan.

Source : United Nation (2011)

The life expectancy in Japan keeps increasing and is expected to achieve 90 at 2080 (See Figure 1.3). The life expectancy is increase rapidly from 1960 to 1990 and the growth rate started to slowdown afterward.

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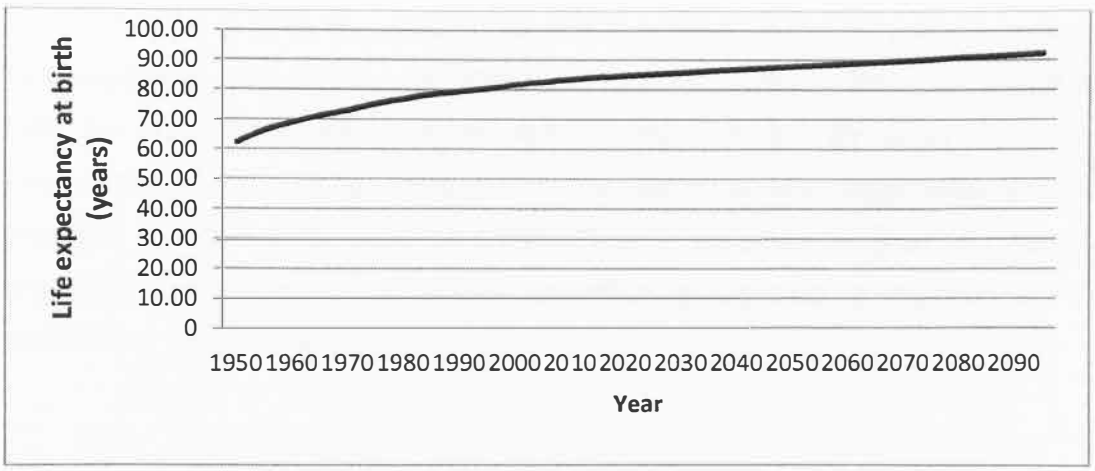

Figure 1.3: Life expectancy in Japan.

Source : United Nation (2011)

From the figure 1.4, the fertility rate have fall below 2 after 1975 and it continue to decline until recent year. There is an increase in fertility rate in 1960 and reached a small peak on around year 1970. This can be explained by the fact that the first batch of baby boomers which born around 1948 have reached their marriage age and this have induce a high fertility rate in the early of 1970s. This scenario can be referring to second baby boom. The fertility rate achieved it lowest rate in 2000 and it started to bounce up again. But the fertility rate is expected to increase very slowly and remains below 2 until 2080; when it is projected to achieved 2.

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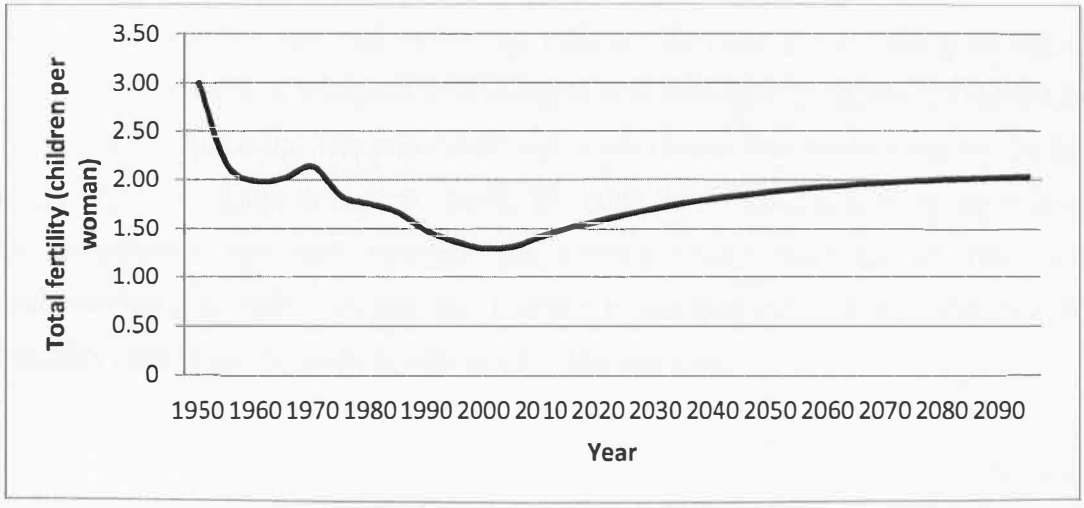

Figure 1.4: Total fertility rate in Japan.

Source : United Nation (2011)

Figure 1.5 show the percentage of the population age 60 and above over total population. This can also be referring as the Japan's population aging statistics. With the combination effect of low fertility rate and high life expectancy, the percentage of the elderly population is increasing rapidly since 1950 and is expected to achieve its peak on 2060. Then it expected to start decreasing gradually. The percentage of elderly population is expected to maintain at 40 percent and above after 2020.

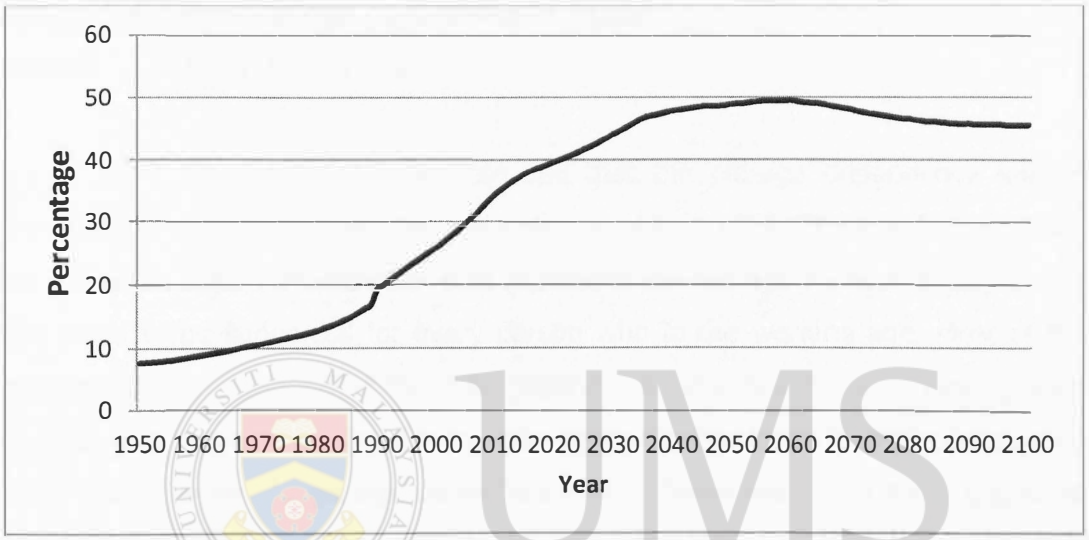

Figure 1.5: Percentage of age 60 and above over total population in Japan.

Source : United Nation (2011)

The working age population has reached its peak since 1996 (see figure 1.6). The workforce is declining until recently and expected to decline continuously without any bounce up. The population aging has causes the labour forces in Japan to continue to decline in next 80 years. Although some policies such as extending the retirement age and increase the female labour participation rate are implemented but Japan may still face problem in the long-run in labour shortage as the total population of Japan is also decline continuously.

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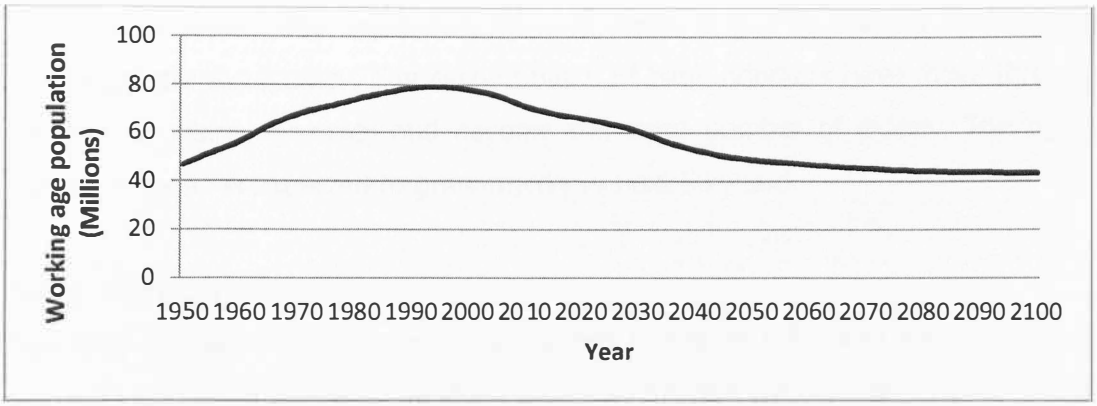

Figure 1.6: Working age population in Japan.

Source : United Nation (2011)

From the Figures 1.7, we can see that the old-age dependency ratio is increasing and gets over the child dependency ratio in 1990. These indicators could be use as an important indicator that represent the average number of dependent that need to be supported for every person who in the working age. Most of the past research found out that the child dependency ratio would always have greater impacts to the economic growth and this might due to the child dependency ratio always stay above the old-age dependency ratio. Therefore it has more impact to the economic growth. Since now the old-age dependency ratio is above the child dependency ratio, we expected that the old-age dependency ratio would started to have more significant effect on the economic growth.

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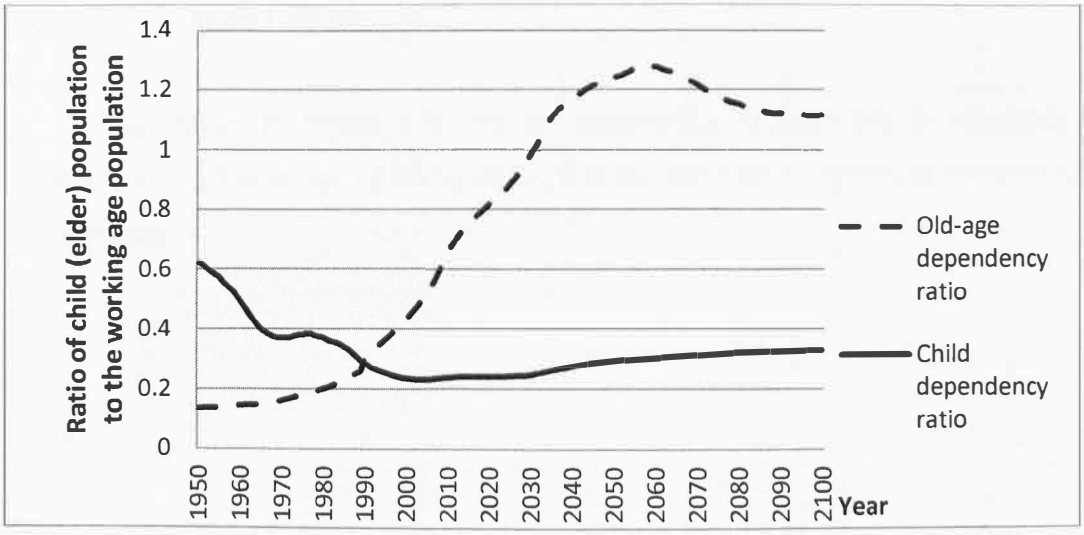

Figure 1.7: Child dependency ratio and old-age dependency ratio in Japan.

Source : United Nation (2011)

In summary, the population aging in Japan is due to the low fertility rate and longer life expectancy. The second batch of baby boomers have move through the age structure dynamics and become the large number of elderly. The aging society in Japan is expected to grow rapidly in next 50 years.

1.4.2 Germany

The total population in Germany is presented in Figure 1.8. Form the Figure 1.8, Germany population seem to be likely similar to the pattern in Japan. However, the magnitude of changes in the Germany is much smaller compare to Japan. The population is expected to achieve it stable point around 70 millions.

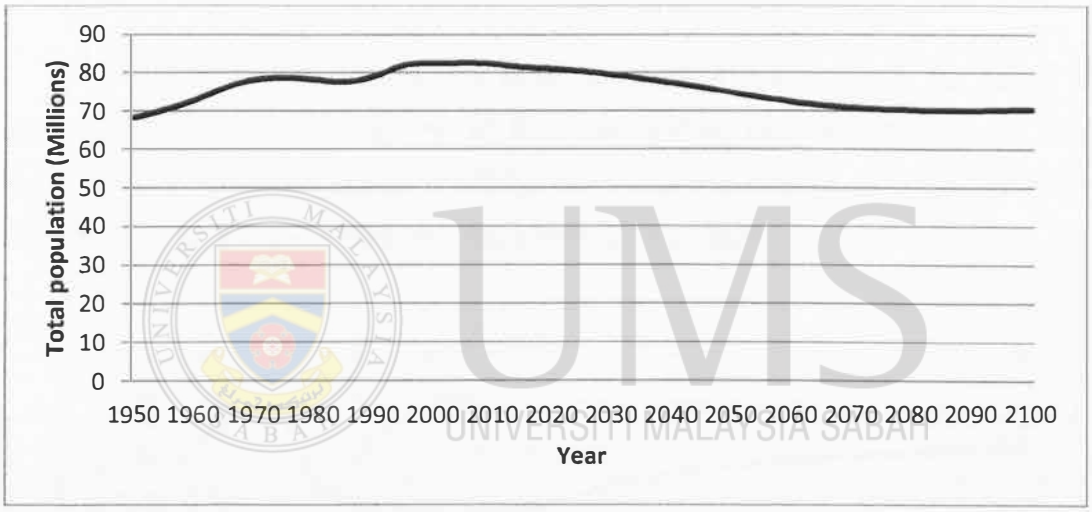

Figure 1.8: Total population size in Germany.

Source : United Nation (2011)

As shown in Figure 1.9, the life expectancy in Germany is expected to increase and achieve age of 90 by 2100. The life expectancy seems to increase in a straight line.

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